



# Hydropower Sustainability Assessment Protocol

Official Assessment

Instituto Costarricense de Electricidad

Reventazón

Costa Rica

Project Stage: Implementation

Assessment Date: 03/07/2017 to 07/07/2017



Final

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**Client:** World Bank

**Lead Assessor:** Doug Smith, independent consultant (dsmith.environment@gmail.com)

**Co-assessors:** Helen Locher (independent consultant), Aida Khalil (International Hydropower Association), Margaret Trias (Golder)

**Project size:** 305.5 MW

**Cover page photo:** Aerial view of Proyecto Hidroeléctrico Reventazón as it goes online ('Central America's biggest hydroelectric project, goes online', Tico Times, 30 March 2016)

## Acronyms

ADI	Asociación de Desarrollo Integral
AID	Área de Influencia Directa
All	Área de Influencia Indirecta
ARESEP	Public Services Regulatory Authority
ASADA	Asociaciones administradoras de los Sistemas de Acueductos y Alcantarillados comunales
ASTM	originally American Society for Testing and Materials
BBOP	Business and Biodiversity Offsets Program
BMWP-CR	Biological Monitoring Working Party-Costa Rica
CAAL	Committee for Environmental and Labour Affairs
CABEI	Central American Bank for Economic Integration
CCSS	Caja Costarricense de Seguridad Social
CFRD	Concrete-Faced Rockfill Dams
CGP	General Coordination Group (Coordinación General de Proyecto)
CGSA	Center for Environmental Management Services (Centro de Servicios de Gestión Ambiental)
CITES	Convention on International Trade in Endangered Species
CME	Committee for Emergencies (Comité Municipal de Emergencias)
CNE	National Commission for Emergencies (Comisión Nacional de Prevención de Riesgos y Atención de Emergencias)
COMCURE	Comisión de Manejo y Ordenamiento de la Cuenca Alta Río Reventazón
CONAGEBIO	National Commission for the Management of Biodiversity
CONAI	National Commission on Indigenous Affairs (Comisión Nacional de Asuntos Indígenas)
CONAVI	National Roads Board (Consejo Nacional de Vialidad)
CREO	Comité de Recepción de Obras
EBAIS	Integrated Health Clinic (Equipo Básico de Atención Integral en Salud)
EsIA	Environmental Impact Assessment
EIB	European Investment Bank
EMP	Environmental Management Plan
EPC	Engineering, Procurement and Construction
ESAP	Environmental and Social Action Plan
FECON	Federación Ecologista
FONAFIFO	National Fund for Forest Financing (Fondo Nacional de Financiamiento Forestal)
GHG	Greenhouse Gases
GPS	Global Positioning System

GRI	Global Reporting Initiative
IAFA	Institute for Drug and Alcohol Rehabilitation
ICA	Índice de Calidad de Agua
ICE	Instituto Costarricense de Electricidad
ICFSF	Fluvial System Functional Quality Index (Índice de Calidad Funcional del Sistema Fluvial)
ICOLD	International Committee on Large Dams
IDB	Inter-American Development Bank
IDF	Inflow Design Flood
IE	Independent Engineer
IEA	International Energy Agency
IESMC	Independent Environmental and Social Monitoring Consultant
IFC	International Finance Corporation
IFIs	International Financial Institutions
IHA	International Hydropower Association
IMN	National Meteorological Institute
IMS	Integrated Management System
INCOFER	Costa Rican Railways Institution (Instituto Costarricense de Ferrocarriles)
INDER	Institution of Rural Development (Instituto de Desarrollo Rural)
INVU	National Institution for Living Conditions and Cities (Instituto Nacional de Vivienda y Urbanismo)
IPP	Independent Power Producer
ISO	International Standards Organisation
INTECO	National Standards Body of Costa Rica (Instituto de Normas Técnicas de Costa Rica)
LIDAR	Light Detection and Ranging
masl	Metres above sea level
MEP	Ministry of Public Education
MINAE	Ministry of Environment and Energy
MNCR	National Museum of Costa Rica (Museo Nacional de Costa Rica)
MOL	Maximum Operating Level
MW	Mega Watt
NML	Normal Minimum Level
NPV	Net Present Value
OHS	Occupational Health and Safety
PGA	Environmental Management Plan (Plan de Gestión Ambiental)
PHR	Reventazón Hydropower Project (Proyecto Hidroeléctrico Reventazón)
PMES	Environmental and Social Management Plans
POI-E	Institutional Enterprise Operating Plan



PPE	Personal Protective Equipment
PRMCV	Plan for the Restoration or Improvement of Living Conditions (Plan de Restitución o Mejora de las Condiciones de Vida)
PROCAME	Programa de Estudios en Calidad, Ambiente y Metrología
PRRCV	Plan for Resettlement and the Restoration of Living Conditions (Plan de Reasentamiento y Restitución de las Condiciones de Vida)
PS	Performance Standard
RFP	Requests for Proposal
RPT	Reventazón - Parismina – Tortuguero
SBBD	Barbilla Destierro Biological Sub-corridor (Sub-corridor Biológico Barbilla Destierro)
SETENA	National Technical Secretariat for the Environment (Secretaría Técnica Nacional Ambiental)
SIDA	Swedish Cooperation Agency for Development
SIEPAC	Central American Electrical Interconnection System
STDs	Sexually-transmitted Diseases
TDR	Time Domain Reflectometry
UGA	Environmental Management Unit (Unidad de Gestión Ambiental)
USA	Environmental Monitoring Unit (Unidad de Supervisión Ambiental)
USD	US Dollar
VECS	Valued Environmental Components

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## Executive Summary

This report presents the findings of an assessment of the Reventazón Hydroelectric Project (Planta Hidroeléctrica Reventazón, PHR) using the Implementation Stage tool of the Hydropower Sustainability Assessment Protocol. PHR is a 305.5 MW hydropower plant located on the Reventazón River which flows towards the Caribbean Sea. PHR has been implemented and will be operated by Instituto Costarricense de Electricidad (ICE). This assessment, and associated training and planning, was financed by the World Bank and undertaken by Golder, through the project “Application of the Hydropower Sustainability Assessment Protocol for the Reventazón Hydroelectric Project in Costa Rica”.

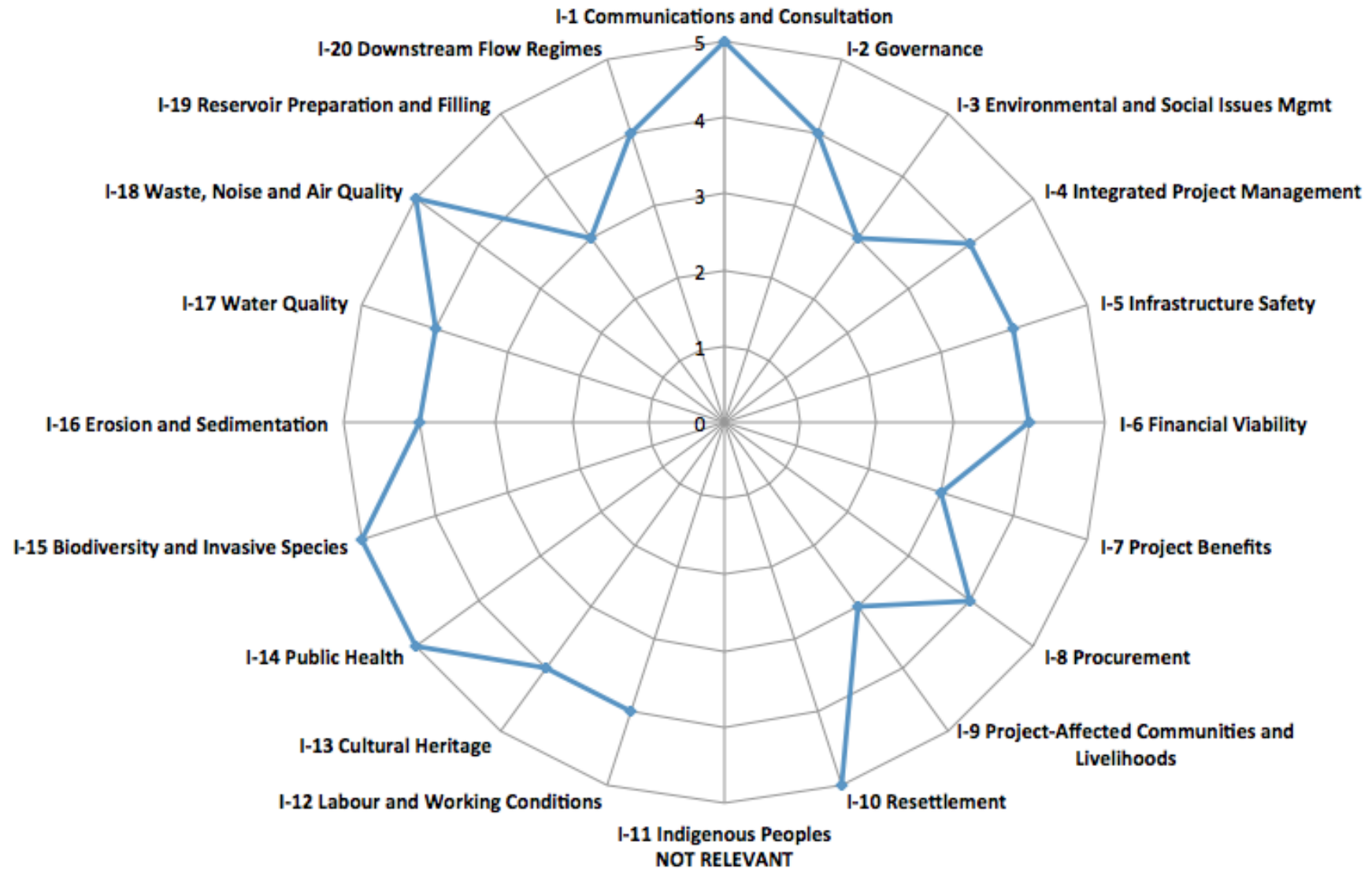
At the Introductory Workshop, ICE defined objectives for this assessment to (i) identify opportunities for improvements in the socio-environmental management of projects, (ii) improve planning and development of hydroelectric projects, and (iii) provide a training process to employees of the ICE Group. The assessment was carried out over June 2017 to August 2017, with an on-site assessment encompassing a visit to the project site and interviews with stakeholders conducted over 3<sup>rd</sup> to 7<sup>th</sup> July 2017. This assessment meets the requirements of an Official assessment, as set out in the Protocol Terms and Conditions. The scope of this assessment is the entire project, which encompasses responsibilities of all partners engaged in the project.

PHR, which has been financed by a group of Costa Rican and international financial institutions, will be the largest hydropower project in Central America. It has prompted improved sustainability performance (financial, environmental and social) in a number of areas, not least an ambitious “river offset” programme.

PHR meets or exceeds all basic good practice criteria on all 19 topics evaluated through this assessment.

PHR meets all proven best practice criteria on five topics (I-1 Communications and Consultation, I-10 Resettlement, I-14 Public Health, I-15 Biodiversity and Invasive Species, and I-18 Waste, Noise and Air Quality). Reasons why the project does not meet proven best practice criteria on other topics are varied but tend to relate to: delays in meeting all commitments and a series of non-conformances, processes to respond to risks and opportunities especially in social topics, and public disclosure of reports. On four topics (I-3 Environmental and Social Issues Management, I-7 Project Benefits, I-9 Project-affected Communities and Livelihoods, and I-19 Reservoir Preparation and Filling), PHR has two or more significant gaps against proven best practice, resulting in a score of 3. On ten topics (I-2 Governance, I-4 Integrated Project Management, I-5 Infrastructure Safety, I-6 Financial Viability, I-8 Procurement, I-12 Labour and Working Conditions, I-13 Cultural Heritage, I-16 Erosion and Sedimentation, I-17 Water Quality, and I-20 Downstream Flow Regimes), there is one significant gap against proven best practice, resulting in a score of 4. The findings are summarised in the sustainability profile and table of significant gaps shown on the following pages.

# Sustainability Profile



## Table of Significant Gaps

	Level 3: Significant Gaps against Basic Good Practice	Level 5: Significant Gaps against Proven Best Practice
<b>Assessment</b>	No significant gaps	<p>I-7 There is no evidence of an assessment of opportunities to increase the development contribution of the project through additional benefits or benefit-sharing, or of risks to the benefits provided to-date.</p> <p>I-17 PHR did not monitor or evaluate potential risks of concentrations of heavy metals in water, and potential bioaccumulation in fish.</p>
<b>Management</b>	No significant gaps	<p>I-3 There was no internationally-recognised environmental management system which is third party verified.</p> <p>I-3 There have been significant delays in development of the operation stage environmental management plan.</p> <p>I-6 The absence of well-considered contingency measures for environmental and social mitigation plans and commitments.</p> <p>I-7 There is no mechanism to respond to maintenance risks or to future opportunities to provide benefits and ensure that benefits are significant and sustained.*</p> <p>I-19 Public safety measures are not sufficient to prevent accidents and fatalities in the reservoir.</p> <p>I-20 The absence of analysis to show that the minimum flow can be guaranteed at all times, and the risk that adaptive response measures will not be effective in avoiding downstream biological or social impacts.</p>
<b>Stakeholder Engagement</b>	No significant gaps	<p>I-2 Reports on project performance in sustainability areas of high interest to all ICE stakeholders are not publicly available.</p> <p>I-9 Limited and slow feedback and responses to issues raised by affected people.</p>
<b>Stakeholder Support</b>	No significant gaps	No significant gaps
<b>Conformance/ Compliance</b>	No significant gaps	I-3 There are non-conformances with commitments in the EMP and ESAP

		<p>I-4 Delays in the completion of environmental and social commitments and in the handover to the operations group.</p> <p>I-5 Non-conformance with a commitment to install a warning and alarm system for regular operations.</p> <p>I-7 Non-conformance with the commitments set out in the agreement between ICE and Siquirres Municipality.</p> <p>I-12 A small number of non-compliances as shown in upheld PHR worker court claims against ICE.</p> <p>I-13 Non-conformance with a commitment to enter a formal agreement with INCOFER and to include railway heritage in the visitor centre.*</p> <p>I-16 There were recurrent non-conformances with regards to sediment and run-off management from several work sites, and ICE is not collecting data from all planned monitoring sampling points.</p> <p>I-19 There are delays in the implementation of the water hyacinth control programme and the development of the reservoir access and uses plan.</p>
<b>Outcomes</b>	No significant gaps	<p>I-8 There were no initiatives to develop the capacities of local suppliers and businesses.</p> <p>I-9 There is a risk that some affected households will not improve their livelihood or living standards, reduce their vulnerability, or be self-sufficient in the long-term.</p>

\* Also a gap on Outcomes

\*\* Also a gap on Conformance and Compliance

# Introduction

This report presents the findings of an assessment of the Reventazón Hydroelectric Project (Proyecto Hidroeléctrico Reventazón, PHR) using the Hydropower Sustainability Assessment Protocol. PHR is a 305 MW project in Limón Province of Costa Rica, currently in transition from implementation to operation.

## The Hydropower Sustainability Assessment Protocol

The Hydropower Sustainability Assessment Protocol ('the Protocol') is a framework to assess the performance of hydropower projects according to a defined set of sustainability topics, encompassing environmental, social, technical, and financial issues.

Developed by the International Hydropower Association (IHA) in partnership with a range of government, civil society and private sector stakeholders, the Protocol is a product of intensive and transparent dialogue concerning the selection of sustainability topics and the definition of good and best practice in each of these topics. Important reference documents that informed the development of the Protocol include the World Bank safeguards policies, the Performance Standards of the International Finance Corporation, and the report of the World Commission on Dams. To reflect the different stages of hydropower development, the Protocol includes four assessment tools that are designed to be used separately, corresponding to the Early Stage, Preparation, Implementation and Operation stages of a project.

Applying the Protocol delivers an evidence-based assessment of performance in each topic, with a set of scores providing an indication of performance in relation to basic good practice and proven best practice. The scoring system is as follows:

- 1 More than one significant gap against basic good practice;
- 2 One significant gap against basic good practice;
- 3 Meets basic good practice with more than one significant gap against proven best practice;
- 4 Meets basic good practice with one significant gap against proven best practice;
- 5 Meets basic good practice and proven best practice.

Assessments rely on objective evidence to support a score for each topic that is factual, reproducible, objective and verifiable. Key attributes of the Protocol are: (i) global applicability, i.e. it can be used on all types and sizes of hydropower projects, anywhere in the world; and (ii) consistency, i.e. the consistency of its application is carefully governed by a system of quality control encompassing accredited assessors, terms and conditions for use, and the Protocol Council.<sup>1</sup>

Scoring is an essential feature of the Protocol, providing an easily communicated and replicable assessment of the project's strengths, weaknesses and opportunities. The scoring system has been devised to ensure that a Protocol Assessment cannot provide an overall "pass" or "fail" mark for a project, nor can it be used to "certify" a project as sustainable. The Protocol provides an effective mechanism to continuously improve sustainability performance because results identify gaps that can be addressed, and the findings provide a consistent basis for dialogue with stakeholders.

## Assessment Objectives

ICE defined the following objectives for the assessment of the Reventazón project:

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<sup>1</sup> Full details of the Protocol and its governance, are available on [www.hydrosustainability.org](http://www.hydrosustainability.org).

1. Identify opportunities for the ICE Group to improve in the socio-environmental management of electricity generation projects, based on the application of the implementation tool of the Hydropower Sustainability Assessment Protocol to the Reventazón hydroelectric project;
2. Develop an action plan based on the assessment's results to address possible identified gaps. This will enhance improved planning and development mechanisms of the ICE Group's electricity generation ventures; and
3. Provide a training process to the employees of electricity generation in ICE Group, in the management and implementation of the Hydropower Sustainability Assessment Protocol for new electricity generation projects.

## Project Description

The Reventazón Hydroelectric Project (PHR) is a 305.5 MW project, implemented by Instituto Costarricense de Electricidad (ICE), Costa Rica's national electricity company. ICE began initial site access and preparation works in 2009, and constructed the project between 2010 and 2016, with the support of a range of financiers including the Inter-American Development Bank (IDB) and the International Finance Corporation (IFC). PHR is located on the Reventazón river in Limón Province, which flows eastwards, discharging into the Caribbean Sea, 50 km downstream of the project.

Table 1 below provides key information on the project. It is the largest hydropower project to be built in Central America, with four turbines of 73 MW capacity each. It diverts water from a 7 km<sup>2</sup> reservoir (created by a 130 m high dam) to the main 292 MW capacity powerhouse, via a diversion tunnel. The powerhouse returns waters to the river 4.2 km downstream of the dam. It is the most downstream of a cascade of hydropower projects on the Reventazón river, located downstream of ICE's Angostura, Cachí and Río Macho projects. It includes an additional small powerhouse, with a single 13.5 MW turbine, which provides a 15 m<sup>3</sup>/s environmental flow to the 4.2 km dewatered section of the river.

PHR is financed by a trust that has developed and will own the project until all debts are repaid. The trust is managed by Scotiabank, and it has received loan finance from a range of Costa Rican and international financial institutions (IFIs) following a financial agreement reached in 2013. The trust is financed by ICE's equity contribution of over USD 475 million, Costa Rican banks' loans of over USD 465 million, and IFIs' loans of over USD 435 million. Inter-American Development Bank (IDB) is the main IFI, and has led the lenders' environmental and social review and monitoring. The Trust appointed ICE to construct PHR through an Engineering, Procurement and Construction (EPC) contract. ICE will lease PHR during operation and will sell all the electricity generated.

ICE completed construction of PHR in September 2016 and began commercial operations in November 2016. During construction, ICE employed 2365 people from local communities, and 2135 from elsewhere in Costa Rica. At the time of this assessment, minor construction works were on-going at the site, and site clearance and rehabilitation was yet to be completed.

Secretaría Técnica Nacional Ambiental (SETENA, the National Environmental Technical Secretariat) is the environmental regulator of the project. SETENA issued an environmental licence for the project in 2009. At the time of this assessment, responsibility for social and environmental commitments was in transition between the ICE's Engineering and Construction business unit, and their Generation business unit.

A number of figures are presented below, in Figures 1 to 4, indicating the project location, layout, community locations, and the downstream area, respectively.



**Table 1. Key information on the Reventazón project**

Project name	Reventazón	
Country	Costa Rica	
Location	Limón Province	
Purpose	Power generation	
Capacity (MW)	305.5	
Annual average generation (GWh/year)	1 465	
Load factor (%)	0.52	
Developer	Instituto Costarricense de Electricidad (ICE) / Scotiabank Trust	
Financer(s)	Inter-American Development Bank (IDB), International Finance Corporation (IFC), Central American Bank for Economic Investment (CABEI), Banco Nacional de Costa Rica, Banco de Costa Rica, Banco Crédito Agrícola de Cartago, and Banco Popular y de Desarrollo Comunal	
Total cost (USD m)	1 379	
Type of dam	Concrete face rock dam	
Dam height (m)	130	
Width at crest (m)	535	
Reservoir area (km <sup>2</sup> )	7 km <sup>2</sup>	
Reservoir length (km)	8	
Units (number, type, MW)	Main powerhouse: 4 Francis turbines of 73 MW each. Ecological powerhouse: 1 turbine of 13.5 MW.	
Average net head (m)	131	
Headrace length (m)	1 700	
Headrace width (m)	9	
Headrace capacity (m <sup>3</sup> /s)	60	
Spillway capacity (m <sup>3</sup> /s)	11 000	
Spillway height (masl)	268.5	
Average flow at dam (m <sup>3</sup> /s)	152	
Environmental flows (m <sup>3</sup> /s)	Between dam and powerhouse: 15 Downstream of powerhouse: 40	
Road(s) (length, km)	41 km	
Transmission line(s)	10.9 km	
Volumes of material needed for construction	Dam fill	9 000 000 m <sup>3</sup>
	Concrete	737 000 m <sup>3</sup>

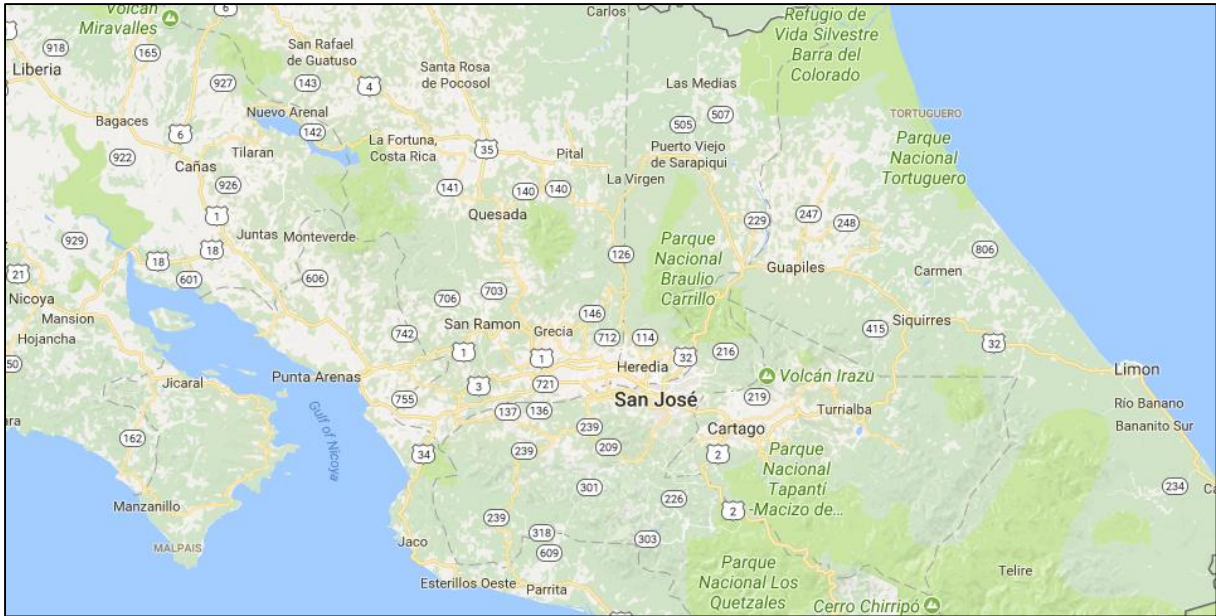


Figure 1. Location of Proyecto Hidroeléctrico Reventazón in Costa Rica

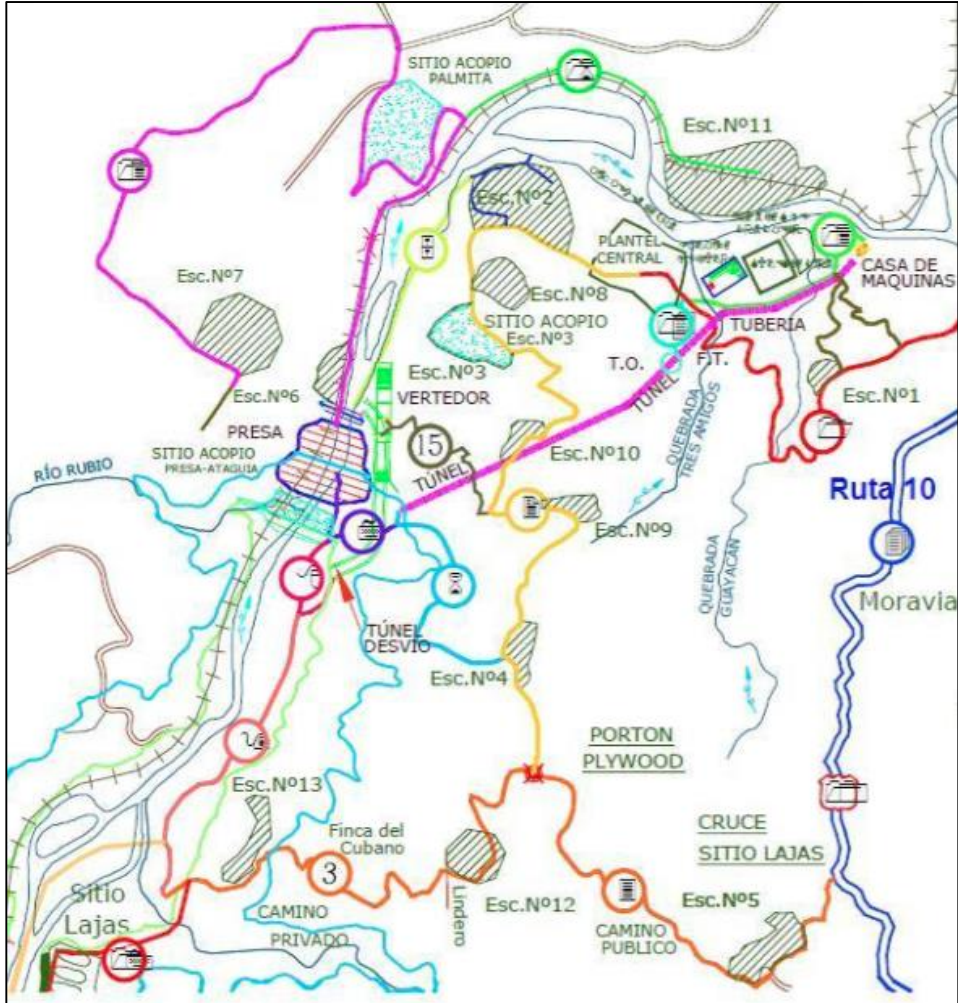


Figure 2. Layout of the main project components





## Assessment Process

The assessment was conducted using the Protocol's Implementation tool, which consists of 20 individual topics, addressing governance, technical, financial, social and environmental issues.

The assessment team was led by Doug Smith, and was mobilised by Golder under a contract to the World Bank (IBRD). The assignment encompassed training for ICE personnel and stakeholders, planning, the on-site assessment, and a post-assessment workshop of results.

Golder assembled a team of four accredited assessors, who conducted the on-site assessment over the dates of 3<sup>rd</sup> to 7<sup>th</sup> July 2017. Interviews with external stakeholders and ICE staff, and site inspections were carried out mainly during that week, with some further interviews with additional interviewees in subsequent weeks. Over 90 interviews were conducted and over 470 documents reviewed. A draft report was delivered to the World Bank and ICE by 11<sup>th</sup> August 2017 and amended in response to comments received.

This is an official assessment. All members of the assessment team are accredited by IHA, and the assessment was conducted with the full support of ICE, as demonstrated by their written support, provided in Appendix A.

Please note that while the Implementation tool is focused on the implementation stage, the intent of some of the topics and many scoring statements also encompass plans for the operation stage. In addition, analysis and plans made during project preparation may be relevant to the assessment and management criteria.

Mr Luis Pacheco, Gerente Electricidad, was the client for this assessment within ICE; Mr Miguel Víquez Camacho, Gestor Corporativo Ambiental, was ICE's focal point for the assessment, and he was assisted with coordination and planning by a support team drawn from the units involved in PHR (including Mr Sergio Bermúdez Muñoz, Mr Mauricio Morales, Ms Alexandra Saúrez, Mr Luis Diego Baltodano, Mr David Nuñez, Ms Samantha Camacho, Ms Yency Morales, and Mr Gustavo Calvo). There were some observers to the assessment process, in particular Ms Ruth Tiffer Sotomayor, Senior Environmental Specialist and Manager of the Technical Assistance, and Ms Karina Rodriguez, Environmental Specialist, of the World Bank.

## Assessment Experience

The assessment was organised effectively by ICE in a short timeframe. The assessment team would like to thank all involved for their dedication and commitment in coordinating the assessment effectively, and thank all interviewees including external interviewees for providing their time to respond to the assessors' enquiries. Particular thanks are due to Mr Miguel Víquez Camacho as the focal point, and to Mr Sergio Bermúdez Muñoz.

Interviews were held in San Jose, at the project site, in local communities (in the AID and downstream) and in Siquirres, through an intense 5-day assessment week. A number of additional interviews were held with international consultants and staff of international financiers by phone in the weeks following the assessment.

The vast majority of documentary evidence that was available is in Spanish, so two members (out of four) of the assessment team used online translation services to review the documentation. Interviews were conducted in Spanish, and two members of the assessment team used interpreters for assistance. The team would like to thank the interpreters, Illeana Castillo Vargas and Rosa Irene Schielzeth Fallas, for their indispensable and able assistance. The draft report was translated into Spanish and will be ICE's official document, to enable ICE to provide comments. Any revisions will then be made to the English version as well.

## Layout of this Report

This report consists of twenty sections numbered in direct correspondence with the twenty topics of the Protocol's Implementation tool. Four appendices are provided, including the written letter of support of the project developer (required for an official Protocol assessment), and detailing the items of visual, verbal and documentary evidence referred to under each topic.

For each topic, findings are provided according to the criteria used in the Protocol's methodology: Assessment, Management, Stakeholder Engagement, Stakeholder Support, Conformance and Compliance, and Outcomes. Findings are presented against a statement of 'basic good practice' and a statement of 'proven best practice' for each, with a 'Yes/No' indication of whether the scoring statement is met. A summary of the significant gaps against the scoring statement, the topic score and a brief summary are presented at the close of each topic section.

# 1 Communications and Consultation (I-1)

This topic addresses ongoing engagement with project stakeholders, both within the company as well as between the company and external stakeholders (e.g. affected communities, governments, key institutions, partners, contractors, catchment residents, etc). The intent is that stakeholders are identified and engaged in the issues of interest to them, and communication and consultation processes maintain good stakeholder relations throughout the project life.

## 1.1 Background Information

This topic addresses ongoing engagement with all project stakeholders on issues of interest to them, and the management of consultation and communication. Findings on stakeholder engagement under other topics focus on the issues related to those topics only.

Stakeholders in Proyecto Hidroeléctrico Reventazón (PHR) that are directly-affected (with substantial rights, risks or responsibilities) include: communities in the directly affected area (Área de Influencia Directa, AID) and indirectly affected downstream area; people within those communities and absentee households affected by land acquisition; the Siquirres municipality administration; district and local administrations (Asociación de Desarrollo Integral, ADI) and sector administrations within the AID; national government agencies or regulators with responsibilities PHR including MINAE (Ministerio de Ambiente y Energía / Ministry of Environment and Energy) and SETENA (Secretaría Técnica Nacional Ambiental / National Technical Secretariat for the Environment); contractors and service providers, including local contractors; partners in PHR's social and environmental programmes such as COMCURE, FONAFIFO or Panthera; and the range of lenders to the project and their advisers. Directly-affected stakeholders also encompass PHR employees during the construction and operation stages.

Other stakeholders (i.e. with an interest but without substantial rights, risks or responsibilities) are: upstream hydropower plants and the hydropower industry in Costa Rica; ICE employees elsewhere in Costa Rica; civil society organisations such as FECON (Federación Conservacionista Nacional); and consultants involved in project preparation or specific studies.

During PHR implementation, ICE deployed a communications team of 5 people, reporting to the project director.

## 1.2 Detailed Topic Evaluation

### 1.2.1 Assessment

#### **Analysis against basic good practice**

**Scoring statement:** *Communications and consultation requirements and approaches have been identified through an assessment process involving stakeholder mapping, supported by ongoing monitoring.*

ICE initially determined communications requirements and approaches during the EsIA process, preparing a detailed 100-page Environmental Communications Plan, which is annexed to the EsIA report. The plan provides general and specific objectives of the plan, and a media strategy, and for each of the feasibility/EsIA, construction and operation stages it provides: general and specific objectives, target audiences, media and tactics, internal stakeholders, local external stakeholders, national and international stakeholders, a schedule and operational plan, resources, budget, and monitoring and control. It also proposed an environmental education programme and crisis management measures. The plan involved comprehensive stakeholder mapping, with identification of the directly- and indirectly-affected communities, and categorisation of stakeholders into groups of internal



stakeholders, local external stakeholders, national and international stakeholders for each stage. Notably, it extends beyond affected communities to encompass national and international stakeholders including environmental groups, government officials, universities, academic institutions and civil society groups including those opposed to hydropower. Specific non-governmental organisations named include the Federación Conservacionista Nacional de Costa Rica (FECON), Latin American Network against Dams and for Rivers (REDLAR), and Green Guardians.

The Environmental Communications Plan provided a basis for communications but was adjusted as necessary, for example in the approaches used for internal communications and the deepening of communications with AID communities. ICE assessed consultation needs further through the preparation of a Plan for Information, Consultation and Participation of AID Communities in 2012. Communications activities were monitored on an ongoing basis through regular reporting of the communications team, and involvement of project leadership in communications activities.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, the stakeholder mapping takes broad considerations into account.*

Stakeholder mapping was broad from an early stage of project development. The communications plan attached to the EsIA identifies 11 groups of internal stakeholders, 10 groups of external, local stakeholders, and 8 groups of external national and international stakeholders. The plan presents a series of themes for these three broad groups of stakeholders and indicates whether the approach should be to inform, persuade or partner in each case. The themes (30 in number) encompass general information and specific interests such as crisis management, environmental management, processes of participation, uses of the reservoir, archaeology, and noise management, for example.

Criteria met: Yes

## 1.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Communications and consultation plans and processes, including an appropriate grievance mechanism, are in place to manage communications and engagement with stakeholders; these outline communication and consultation needs and approaches for various stakeholder groups and topics.*

ICE and PHR implemented a range of plans, procedures and processes for communications with stakeholders. Over-arching plans included the above Environmental Communications Plan, and the Plan for Information, Consultation and Participation of AID Communities, and these outlined numerous approaches, each tailored to stakeholder groups and topics. Communications was controlled through formal procedures concerning: communications planning (PHR-PR-2), security and registration of visitors during site tours/visits (PHR-COM-01), a crisis management method (PHR-COM-02) setting out steps to take and responsibilities for communications during a crisis event, mechanisms for employee's complaints and suggestions (PHR-COM-03), and a mechanism for following-up complaints of contractors' employees (A01-PHR-COM-03).

Measures that were put in place broadly followed the original plans. As summarised in the final report on communications, measures included:

- Internally: regular publications from 2011 to 2016 (Bitácora 1-page updates, weekly from 2001 to 2016; *La pizarra mural*, placed in 17 locations and updated monthly; three issues of a magazine *Between Margins / Entre márgenes*; *That's how we live / Así lo vivimos* publications associated with recreational events); and various awareness-raising materials on occupational safety and employee health;

- Externally: from 2011 to 2016, quarterly *Dardo* bulletin, targeting AID communities; *Porque Somos Vecinos/ Because we are neighbours*, leaflets published according to needs, in some cases complemented by an audiovisual or posters, on various AID issues (e.g. the process of land acquisition, plan for the restoration of living conditions, extension of the buffer area, and filling of the reservoir, etc); job fairs and an environmental education programme; management of the press through coordination with ICE's Communication and Corporate Identity Department, with a total of 69 official announcements from 2011 to 2016; official events (e.g. commencement of tunnelling , river diversion, commencing dam construction, inauguration of operations); and a programme of site tours.

In addition, the Communication and Corporate Identity Department of ICE delivered a communications strategy nationally and internationally, with the message “made by Costa Ricans for Costa Rica”. This included press releases (c.38 from June 2015 to September 2016, for example), site visits with national and international media, audiovisual productions and photographic material, and two supplements in the newspapers *La Nación* and *La República*. PHR was also mentioned widely on Facebook and Twitter, and coverage reached 162 international television networks around the world.

ICE maintained two grievance mechanisms, for community complaints and claims, and those of employees. The procedure for the management of community complaints and claims (PHR-GA-07) concerns all community stakeholders (AID, property owners, community representatives, NGO and public institutions), and sets out objectives, principles, responsibilities, resources, and a description of the process. The process is described as: dissemination of the mechanism to the population; determining eligibility of claims; registration; assessment; investigation, decision and announcement, and monitoring and follow-up. A key element in the mechanism was the 800- Reventazón telephone line, but complaints could be raised through any means.

The procedure for employee's complaints (PHR-COM-03) also sets out objectives, a policy statement, responsibilities, a description of the process, and dissemination of the mechanism. The process is similar but includes classification of the complaint or suggestion and categorisation of urgency (immediate, prompt, and standard). A 7800-telephone hotline and email was provided separately for employees to raise issues.

ICE has held formal “closure” meetings with each AID community to close the implementation stage approach to community relations. Plans for the operation stage, set out in the 2012 plan, are less clear but include: follow-up of implementation stage measures and proposals in the Environmental Management Plan (EMP); continuation of official channels of communication; follow-up to land acquisition and resettlement planning; monitoring and Implementation of the Reservoir Management Plan; personalized attention to groups of communities in the basin; follow-up on Local Development Training Program; and information centres. ICE is in the process of constructing a visitor centre near to the powerhouse.

In addition, ICE has made a presentation on project progress to the Siquirres municipality, provided regular progress reports to SETENA, and used social media and the local and national newspapers to publicise key events and milestones. ICE included a publication in national newspapers of its position in relation to a high profile court case for land compensation, using a paid advertising space.

ICE held a series of meetings with 16 communities and stakeholders in the Parismina offset programme, over 2013-2014. Ongoing communications for the offset programme are set out in a strategy, dated 2015, which includes a highly comprehensive identification of stakeholders. It is not clear whether communications with this broad range of stakeholders has proceeded as planned.

Criteria met: Yes

### **Analysis against proven best practice**

**Scoring statement:** *In addition, communication and consultation plans and processes show a high level of sensitivity to communication and consultation needs and approaches for various stakeholder groups and topics; and processes are in place to anticipate and respond to emerging risks and opportunities.*



ICE's communications were highly tailored to the communications needs and approaches suitable for different groups of stakeholders. For example: communications materials were focused on specific events such as reservoir filling or issues such as worker safety; an educational approach was used, taking account of different levels of technical understanding; the site visits were programmed for different types of external stakeholders; downstream communities were involved in preparations for reservoir filling and monitoring of flows during filling; and they used a manual for crisis communications.

PHR used the following processes to anticipate and respond to risks and opportunities for communications: regular reporting and meetings on communications activities, and associated reporting to SETENA and lenders; the grievance mechanisms described above; monitoring of the number of written media articles and television programs on the project since 2010, and analysis of whether they are positive or negative, focus and source; and direct responses to negative media coverage. In general, communications was seen as the responsibility of all PHR staff, not just the communications team, and a multi-disciplinary approach was taken, involving technical experts in communications, for example on reservoir filling. The PHR communications staff recognise that handover to the operation stage is a risk (and interviews in local communities during this assessment indicate that communications at that level have weakened since the departure of key social team staff). The final report on communications also provided an opportunity to identify lessons learned.

A notable opportunity in communications concerned environmental education. PHR has implemented an environmental education programme since 2010 with the objective of promoting responsible practices and a strategy to raise awareness of environmental protection and conservation. It was first aimed at the students and teachers of the schools in AID communities, and since 2012, extended to further schools, such as those in the Barbilla Destierro Biological Sub-Corridor (SBBD). A total of 23 primary and secondary schools of the Ministry of Public Education (MEP) were involved, reaching 57 teachers and over 2 000 pupils.

Criteria met: Yes

## 1.2.3 Stakeholder Engagement

### Analysis against basic good practice

**Scoring statement:** *The project implementation stage involves appropriately timed and scoped, and often two-way, engagement with directly affected stakeholders; engagement is undertaken in good faith; ongoing processes are in place for stakeholders to raise issues and get feedback.*

PHR implementation involved widespread engagement with all directly affected stakeholders. Interviews during this assessment amongst directly affected stakeholders – such as AID and downstream communities, SETENA, MINAE, Siquirres municipality, local contractors, and PHR employees – consistently indicated that engagement was appropriately timed and scoped, two-way and good faith, and (at least amongst institutions and suppliers) feedback was prompt. PHR established a range of ongoing processes for stakeholders to raise issues and get feedback, as discussed above and below. During this assessment, some interviewees in the local area were not aware of the 800- Reventazón hotline, but felt they could raise issues directly especially with the former PHR social team leader. ICE made about 70 official media releases over the construction period, mostly concerning accidents, simulation exercises, and key events such as river diversion, reservoir filling and commencement of generation. There were more positive news stories on PHR than negative throughout construction, but the number of positive and negative stories were more evenly balanced in 2011-2013, and there have been very few negative stories since 2014. ICE and PHR did not engage with other stakeholders such as dam-opposed civil society organisations, because they were not directly affected and they did not show any interest in the project, concentrating on other situations at the regional or national levels.

PHR placed most emphasis on communications with the 15 AID communities, maintaining relations through the PHR social team. They maintained direct communication to attend community requests, concerns and non-conformities, through ADIs, local committees, and producers' associations. Community meetings were held at

least every two months, to collect community concerns, report on the progress of the Project, and coordinate EMP actions. Minutes were taken according to a standard format. ICE prepared a closing report, which was formally signed by community representatives in 11 community meetings in 2017. Implementation stage community-level consultation was built on detailed consultation held during the project feasibility and EsIA stage, for example through the “Environmental Fair” and the 2008 “Protocolo de Responsabilidad Socioambiental” (Protocol of Social and Environmental Responsibility) brochure. Please refer to I-9 Project-affected Communities and Livelihoods for more details.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, engagement is inclusive and participatory; negotiations are undertaken in good faith; and feedback on how issues raised have been taken into consideration has been thorough and timely.*

Engagement with directly affected stakeholder, especially communities, was inclusive and participatory. A total of 466 meetings were held in AID communities during construction with the participation of 4854 people. During the EsIA, community meetings were held to discuss the EsIA, impacts and mitigation measures in four rounds, with a total of 35 meetings and 847 participants. Including consultation meetings on technical issues, a total of 156 participatory meetings and workshops were held, with participation of 1090 people. Meetings were held with downstream communities during the EsIA and later in construction prior to reservoir filling.

Feedback on how issues raised by directly affected stakeholders other than AID communities and landowners has been direct, thorough and timely. However, feedback on issues raised by people in AID communities including landowners has not always been thorough and timely. This is a significant gap, discussed under I-9 Project-affected Communities and Livelihoods.

Negotiations on the management of project impacts and the provision of benefits were conducted in good faith. Negotiations on the valuation of land to be acquired were undertaken in good faith. In principle, ICE follows what is required of ICE under the law – though in practice, it is a large state entity that affected households cannot easily negotiate with as equals.

Criteria met: Yes

## 1.2.4 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *Processes and objectives relating to communications and consultation have been and are on track to be met with no major non-compliances or non-conformances, and communications related commitments have been or are on track to be met.*

Processes, objectives and commitments set out in PHR’s communications plans were broadly met, especially in the case of AID communities, PHR employees, and other directly-affected stakeholders.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances*

There are no non-compliances or non-conformances. Communications with all affected landowners, not only those residing in the affected area, could have been more regular, and the lenders’ independent environmental and social monitoring consultants have also called for improved communications with this group, but communications with affected people is discussed under topic I-9 Project-affected Communities and Livelihoods.

Criteria met: Yes

## 1.2.5 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

There are no significant gaps against proven best practice.

0 significant gaps

## 1.3 Scoring Summary

ICE initially determined communications requirements and approaches during the EsIA process, preparing a detailed Environmental Communications Plan, which included broad mapping of stakeholders, including even international stakeholders and organisations opposed to hydropower. ICE assessed consultation needs further in the preparation of communications plans for directly affected communities.

Communications was managed through formal procedures, for example concerning communications planning and grievance mechanisms, and there were regular publications and awareness-raising materials, press releases, and an environmental education programme, for example. There were more positive news stories on PHR than negative throughout construction. PHR placed most emphasis on communications with communities in the directly affected area, maintaining inclusive and participatory consultation through a social team, conducting a total of 466 meetings during construction, and holding formal “closure” meetings at the close of construction. Plans have been set out for the operation stage in a number of areas. Communications activities were monitored on an ongoing basis through regular reporting of the communications team, providing a means to anticipate and respond to emerging risks and opportunities. ICE’s communications were tailored to the communications needs and approaches for different groups of stakeholders, and reach a broad range of stakeholders nationally and internationally.

Topic Score: 5

## 1.4 Relevant Evidence

<b>Interview:</b>	12, 14, 15, 22, 30, 41, 43, 45, 47, 49, 51, 74
<b>Document:</b>	11, 18, 122, 123, 149, 150, 163, 169, 197, 198, 199, 201, 204, 222, 234, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 265, 266, 268, 269, 270, 271, 273, 276, 369, 437, 438, 439, 440
<b>Photo:</b>	1-36

## 2 Governance (I-2)

This topic addresses corporate and external governance considerations for the operating hydropower facility. The intent is that the owner/operator has sound corporate business structures, policies and practices; addresses transparency, integrity and accountability issues; can manage external governance issues (e.g. institutional capacity shortfalls, political risks including transboundary issues, public sector corruption risks); and can ensure compliance.

### 2.1 Background Information

Instituto Costarricense de Electricidad (ICE, the Costa Rican Electricity Institution) is fully owned by the Costa Rican state and has the legal mandate to meet the electricity needs for the country's development, working autonomously of government, within its legal framework and duties. ICE is governed by a Board of Directors composed of seven members selected on professional competencies and corporate governance criteria, such as gender equity. The Board includes an internal audit committee and secretariat. ICE's executive management structure consists of the Executive President, the Corporate Manager of Administration and Finance, the Telecommunications Manager, and the Electricity Manager.

ICE's activities are guided by the National Development Plan 2015-2018, the National Energy Plan 2015-2030, the ICE Group Strategic Plan and the Integrated Expansion Plan. Costa Rica aims to increase the share of electricity generation from renewable sources from 88% in 2013 to 97% in 2018, and in 2017 reaching 100% generation from renewable sources with the entry of PHR. The 305.5 MW Reventazón Hydroelectric Project (PHR) is a key element of ICE's corporate strategy, as it is the largest renewable energy project to-date in Central America.

ICE is an autonomous institution and as such it is regulated by entities such as MINAE (the Ministry of Environment and Energy, which regulates public policies related to energy and environment, ARESEP (the Public Services Regulatory Authority who regulates tariffs for public services such as electricity tariffs, as well as electricity service delivery, and new concessions), the Comptroller General (who reviews budgets, contracts and spending for government organisations including ICE), and SIEPAC (the Central American Electrical Interconnection System) which connects the power grids of Panama, Costa Rica, Honduras, Nicaragua, El Salvador, and Guatemala.

Costa Rica comprises seven provinces, divided into 81 administrative districts (cantones) each directed by an elected mayor. A lower administrative level includes 423 districts. PHR is in the province of Limón, in the cantón of Siquirres. Costa Rica has a National Policy on Regional and Territorial Development applicable to this area.

### 2.2 Detailed Topic Evaluation

#### 2.2.1 Assessment

##### **Analysis against basic good practice**

**Scoring statement:** *Processes are in place to identify any ongoing or emerging political and public sector governance issues, and corporate governance requirements and issues, and to monitor if corporate governance measures are effective.*

Corporate governance requirements and issues are well understood by ICE. ICE's Corporate Governance Regulations 2010 set out criteria important to the business and establish best practice corporate governance as a reference. ICE's Corporate Governance Rules set out key roles and responsibilities, guiding laws, and powers

and duties of all key governance roles. ICE's mission and vision statements relate to modernisation, organisational renewal, increasing competition, leadership and innovation.

Processes to identify ongoing or emerging political and public sector governance issues, and monitor if corporate governance processes are effective, are well established through the governance structures of ICE. The Board meets regularly and informs itself of matters critical to ICE governance. The Executive President is supported by the Corporate Strategy and Development Division and the Corporate Legal Division. The Planning and Development unit within ICE's electricity business monitors policies, laws and developments, and registers are kept in a company-wide Integrated Management System (IMS). ICE had numerous meetings with key government agencies ahead of developing the EsIA for the PHR, and maintained relations with these organisations throughout project implementation.

With development of PHR, the involvement of international financial institutions helped identify a number of strengthening requirements (e.g. an independent internal monitoring unit for environmental and social compliance, and new policies and procedures), and prompted the introduction of monitoring and independent review frameworks.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, there are no significant opportunities for improvement in the assessment of political and public sector governance issues and corporate governance requirements and issues.*

ICE has a strong commitment to continuous improvement, and has assessed best practice in the areas of corporate governance. In 2015 KPMG undertook an independent evaluation of ICE's alignment with Best Corporate Governance Practices expressed in the Corporate Governance Regulations of the National Stock Exchange, relating to Board members and their responsibilities, the Audit Committee, Compensation Committee, internal controls, buying and selling shares, investor relations, and other Board processes. This report is attached to ICE's 2015 Institutional Memories document, which is available on the ICE website.

ICE is in the process of designing a framework of corporate governance, and plans to publish a new Corporate Governance Code by the ICE Board of Directors by the end of 2017.

ICE has a number of processes to build its understanding of, and embed, corporate level management systems, including the IMS which it launched in 2015. ICE is seeking certification for ISO 9001 (quality), ISO 14001 (environment), and ISO 18001 (safety) across the electricity business by 2020, and is moving towards ISO 26000 (corporate social responsibility) and annual sustainability reporting guided by Global Reporting Initiative (GRI) indicators. An Inter-American Development Bank (IDB) initiative to help modernise ICE's corporate governance is noted on IDB's website.

Criteria met: Yes

## 2.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Processes are in place to manage corporate, political and public sector risks, compliance, social and environmental responsibility, procurement of goods and services, grievance mechanisms, ethical business practices, and transparency; policies and processes are communicated internally and externally as appropriate; and independent review mechanisms are utilised to address sustainability issues in cases of project capacity shortfalls, high sensitivity of particular issues, or the need for enhanced credibility.*

ICE has numerous management processes to deliver on all corporate governance requirements. At the group level, ICE's Corporate Strategy and Development Division addresses organisational development, organisational

structures, corporate processes and corporate strategy. ICE's Institutional Enterprise Operating Plan (POI-E) is the corporate planning tool referencing the National Development Plan 2015-18, institutional policies, and the ICE Group Strategy 2014-18. The POI-E sets out objectives, actions, indicators and targets to be implemented in the short, medium and long term as well as the necessary financial resources, longer term priorities and processes, and monitoring and measurement methods to ensure effectiveness.

ICE's electricity business is guided by the Electricity Business Plan 2015-2018, which considers infrastructure, investment, the project portfolio, new business and commercial projections, economic and financial sustainability, human resource requirements, and environmental management. ICE's Electricity Business leads the IMS, which embeds all policies, processes, registers, etc. The IMS is guided by the IMS Policy, which commits the electricity business to manage efficiently and effectively its processes, meet customer needs, ensure quality, environmental protection, a safe working environment, risk management, continuous improvement and compliance. Whilst all policies and plans identified in these findings were not in place throughout PHR implementation (2009-2016), the following is the present status and it is assumed that all mentioned policies were in some degree of development and application during this period.

Processes relevant to the areas listed in this topic criterion are as follows:

- **Risk management.** ICE has numerous policies and processes relating to risk, throughout the business and at a range of levels. Important documents at the corporate level include the Institutional Risk Assessment Policy, the Methodology for the Evaluation of Institutional Risk, the Risk Matrix, and the Integrated Risk Management Policy and Business Continuity 2015. For PHR, risk identification and management measures are demonstrated by relevant sections of the Project Management Plan, and the PHR Procedure for Project Risk Management.
- **Compliance.** ICE's commitments to compliance are expressed in numerous corporate documents and embedded within key corporate policies. Compliance processes are evident through internal audits, regular reports to SETENA, regulatory inspections, obtaining licences and permits, and the IMS which includes compliance registers. Compliance is heavily emphasised on the Trust agreements for PHR and in all contracts, plans and reports for the project.
- **Social and environmental responsibility.** The ICE Electricity Business has its own environmental policy, as well as environmental guidelines clearly stating expectations of the business during project development, delivery and operation. ICE is guided by the IMS, which in a number of business areas is certified to ISO 14001 Environmental Management Systems. ICE also has a Green Procurement Policy. Specific measures for the PHR are addressed in I-3 Environmental and Social Issues Management.
- **Grievance mechanisms.** At the corporate level there is no policy on how grievances are managed, but there is a range of mechanisms for stakeholder contact. ICE's website offers a dedicated space for "Contact Us" on its main page, with sub-links relating to "Chat ICE", support phone numbers (10 separate ones for various focal areas, including for environmental complaints), written queries, shopfronts, fault reports, customer service complaints, and Frequently Asked Questions. For the PHR there were grievance processes for project-affected communities (see I-9 Project-affected Communities and Livelihoods), PHR contractors and suppliers (see I-8 Procurement), and PHR employees (see I-12 Labour and Working Conditions). Legal processes are available and are used in cases where issues are escalated.
- **Ethical business practices.** Integrity is one of ICE's three values, with practical implementation and promotion activities led by an ICE Values Committee. ICE's Code of Ethics (2002) is a statement of ICE expectations on responsible behaviour, including integrity, compliance, non-discrimination, and avoidance of drugs and alcohol. ICE's Declaration of Ethical Principles 2015 is a more in-depth statement of ICE's commitments, applicable to all workers of the ICE Group (including subsidiaries) and signed by each individual employee. Supporting public sector instruments include the Inter-American Convention against

Corruption, General Law of Public Administration, Internal Control Act, Public Procurement Act and its Regulations, and the Law against Corruption and Illicit Enrichment in the Public Function. At the project level, Annex D of the PHR Trust's Common Terms Agreement provides anti-corruption guidelines.

- **Transparency.** ICE has a well-developed external website, publishes an externally-audited Annual Financial Report, and publishes an annual "Institutional Memories" report. ICE does not presently publish an annual sustainability report with the content mapped against the GRI, but is working towards this and is undertaking internal evaluations of its GRI alignment. ICE has no written guidelines or defined commitments regarding transparency or stakeholder engagement, but follows all legal requirements and in cases exceeds these. ICE has an area on its website called Inter-institutional Transparency, but it has no policy, commitments or processes of the institution regarding transparency (here one finds, for example, links to the key roles, laws and regulations, and Institutional Memories reports).

All corporate policies and processes can be accessed by ICE staff on the intranet site, received via email, directly from the responsible staff persons for specific areas of the IMS, and through communications at team meetings as needed.

Communication of ICE policies and processes externally, depending on the context, may be through the internet, through procurement processes, and through processes of reaching agreements and developing contracts. ICE's website sets out the legal and governance framework under which it operates, the statements of vision, mission and values, and numerous corporate-level documents (e.g. the corporate strategy, and corporate governance rules and regulations). Some information on ICE policies is available in the Institutional Memories reports. Distinct policies for quality and environment are published in the electricity business area of the ICE website, under a link called "policies", which presents very brief one paragraph sets of statements for each.

Independent review for the purposes of the Protocol refers to expert review by someone not employed by the project and with no financial interests in profits made by the project or a direct interest. Whilst there is no document at the corporate level with commitments to use of independent review, a number of independent review mechanisms have been used in the PHR. Examples of areas in which the PHR has had independent reviews include: an Independent Engineer, an Independent Environmental and Social Monitoring Consultant (IESMC), an independent audit of occupational health and safety, independent expert advice on dam safety and dam seepage, and a biodiversity panel.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, contractors are required to meet or have consistent policies as the developer; procurement processes include anti-corruption measures as well as sustainability and anti-corruption criteria specified in pre-qualification screening; and processes are in place to anticipate and respond to emerging risks and opportunities.*

All contractors are required to meet ICE's policies. The PHR Construction Environmental Management Plan 2012 sets out an obligation of compliance with legal requirements for all staff including contractors. Standard clauses in Requests for Proposals and contracts express the obligations to meet legal requirements and ICE's policies, and address expectations regarding the environment, safety, labour and competencies. Bidders are required to sign Affidavits with clauses relating to compliance and anti-corruption. Laws, regulations and processes relevant to ICE's procurement are extensively documented in a manual containing both legal and internal regulations. All of these measures are described more fully in I-8 Procurement.

Processes in place to anticipate and respond to emerging risks and opportunities relating to corporate governance include monitoring of trends, stakeholder engagement, media monitoring, government agency meetings and liaison, delegations, and executive and Board meetings.

## 2.2.3 Stakeholder Engagement

### Analysis against basic good practice

**Scoring statement:** *The business interacts with a range of directly affected stakeholders to understand issues of interest to them; and the business makes significant project reports publicly available, and publicly reports on project performance, in some sustainability areas.*

At the corporate level, whilst ICE has no formalised policy or procedures, stakeholder engagement is a part of the electricity business' IMS.

ICE interacts with a range of directly affected stakeholders at the project-level, and has a good understanding of issues of interest to them. The ICE Procedure for Project Management requires development of a Communication Plan for each project, underpinned by stakeholder mapping. A Communications Plan was included in the PHR Environmental Impact Assessment (EsIA), and it details stakeholder interests following a range of stakeholder engagement activities, and communication channels. Further details on this plan are included in I-1 Communications and Consultation.

The project has made some significant project reports publicly available, notably the EsIA and Environmental Management Plan (EMP) and additional associated studies on the IDB website. The project has publicly reported on project performance in some sustainability areas, although this does not appear to be systematic or easily accessible. Regular progress reports submitted to SETENA are publicly available, but evidence of this could not be found online during this assessment.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, the business makes significant project reports publicly available and publicly reports on project performance in sustainability areas of high interest to its stakeholders.*

Significant project reports that are publicly available were noted above. However, none of them were made available by ICE on its website, and ICE's website does not provide links to them on IDB's website. ICE's website has a very small space on electricity projects including the PHR, but with only basic information about the project. PHR relevant reports are not easily apparent on the SETENA website, and a search for "Reventazón" on that website does not provide any results. ICE's Institutional Memories annual report provides little detail on the PHR and project performance in key sustainability areas. There is no regular PHR public reporting targeted at the general public and interested stakeholders in a manner that is easily accessible.

Whilst ICE does interact regularly with local project-affected communities, ICE has no pro-active and regular process for the PHR of liaising with a wider body of stakeholders according to a map of diverse interests, asking what they would like information on, and publishing regular project reports addressing those areas. Based on interviews and document review undertaken for this assessment, areas of high interest to PHR stakeholders included land acquisition and compensation, noise, dust, local employment, local economic opportunities, community safety, cultural heritage, water supply, cumulative impacts, road works and local transport, longer-term benefit sharing, and land rehabilitation. External stakeholder groups have shown an interest in the implications of the PHR on the jaguar migration corridor, rafting, biodiversity, environmental protection and regional economic development.

The lack of easily accessible public reports in project sustainability areas of high interest to the diversity of ICE stakeholders is a **significant gap** against proven best practice.

Criteria met: No



## 2.2.4 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *The project has no significant non-compliances.*

There is a long list of laws with which ICE and the PHR have to comply. These are listed in the EsIA, along with numerous permit requirements. In addition to these, significant compliance requirements for the PHR during project implementation are:

- Resolutions from SETENA, the environmental regulator;
- Terms of the PHR Engineer, Procure and Construct (EPC) contract;
- Terms of the Infrastructure Trust Agreement between Scotiabank and ICE (22 May 2013);
- Terms of the Scotiabank-Intercreditor Common Terms Agreement (20 December 2013); and
- Network approval for connection to the electricity grid.

ICE has developed the PHR in accordance with all legal requirements.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *The project has no non-compliances.*

At the time of this assessment there are still some outstanding deliverables but no significant legal non-compliances for the project. All compliance requirements have been closely tracked through a variety of processes during project implementation. There are a number of non-conformances with environmental and social commitments, discussed on I-3 Environmental and Social Issues Management. There have been a number of court cases seeking independent arbitration on disputes and claims, and some court cases have found against ICE, but in all aspects ICE has followed the applicable legal processes.

Criteria met: Yes

## 2.2.5 Outcomes

### Analysis against basic good practice

**Scoring statement:** *There are no significant unresolved corporate and external governance issues identified.*

As with any major development project, during construction of the PHR, a number of governance issues have arisen and been or are being addressed. These include:

- Compliance with regulatory and bank processes – final reports are being prepared;
- Gaps in legislative frameworks (e.g. environmental flows, dam safety, watershed management, cumulative impacts, and biodiversity offsets) – addressed by ICE following international guidance in liaison with government agencies;
- Significant legislative changes mid-project (e.g. waste management) – responded to (see I-18 Waste, Noise and Air Quality);
- Some protests at the project site – resolved;
- Local municipal authorities delivering on agreements – discussions have resumed with Siquirres Municipality (see I-7 Project Benefits);
- Corruption risks particularly in administrative contracts, such as with machinery – measures were implemented to protect against corruption risks, and inappropriate behaviours were dealt with (see I-8 Procurement);
- Adequacy of project-level policies and processes to deal with the scale of PHR and the issues arising – improvements implemented, guided by inputs from independent reviewers;

- Delays in a major international supplier delivering on contract milestones – ICE drew on support at the highest levels, right up to national diplomats, with no overall delays in the overall project schedule (see I-4 Integrated Project Management);
- Legal proceedings in relation to land acquisition, procurement, and employees – all cases have been or are going through court proceedings in accordance with Costa Rican laws;
- Tariff increases – ICE is progressing its case for increases with ARESEP as per standard processes; and
- Insurance for the dam rectification works – ICE has extensive insurance coverage and is progressing this issue through established processes.

At this stage in the project, all potential governance issues are resolved or have active processes towards their resolution. There is no reason to believe they will not be resolved, and there are no issues that represent significant impediments for PHR or ICE.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, there are no unresolved corporate and external governance issues identified.*

All governance requirements are progressing in accordance with established governance processes.

Criteria met: Yes

## 2.2.6 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

Reports on project performance in sustainability areas of high interest to all ICE stakeholders are not publicly available.

1 significant gap

## 2.3 Scoring Summary

ICE’s corporate governance framework is extensively documented and subject to a number of continuous improvement processes. Processes are in place regarding risk, compliance, ethics, grievances, and environmental and social responsibility. The project has no major non-compliances and all governance issues are being managed. Whilst much effort has been put into corporate stakeholder communications, there is no process of regular easily accessible public reporting on the PHR project in sustainability areas of interest to diverse stakeholders, which is a significant gap against proven best practice.

Topic Score: 4

## 2.4 Relevant Evidence

<b>Interview:</b>	42, 52, 64, 80
<b>Document:</b>	13, 14, 27, 72, 112-114, 118, 141, 147, 148, 164, 190, 191, 223, 243, 244, 246, 247-249, 257, 274
<b>Photo:</b>	-

## 3 Environmental and Social Issues Management

### (I-3)

This topic addresses the plans and processes for environmental and social issues management. The intent is that negative environmental and social impacts associated with the hydropower facility are managed; avoidance, minimisation, mitigation, compensation and enhancement measures are implemented; and environmental and social commitments are fulfilled.

### 3.1 Background Information

Costa Rica is considered a global leader for its environmental policies and achievements, around which it has built a national brand. It has been a pioneer of the Payments for Environmental Services program to promote forest and biodiversity conservation, which has successfully reversed deforestation. It has a number of initiatives to address climate change, such as establishment of a domestic carbon market and the Neutral Carbon Programme 2021.

The Ministry of Environment and Energy (MINAЕ) is the executive body responsible for environmental matters. Important institutions linked to MINAE include SINAC - National Systems of Conservation Areas, DGGM - Direction of Geology and Mines, SETENA - National Environmental Technical Secretariat, TAA - Administrative Environmental Tribunal, FONAFIFO - National Fund for Forest Financing, IMN - National Meteorological Institute, and CONAGEBIO - National Commission for the Management of Biodiversity.

Environmental Impact Assessment (EsIA) procedures in Costa Rica are the responsibility of SETENA, which is composed of a Plenary Commission, a General Secretary, and a Technical Administrative Unit. The Costa Rican EsIA system is based on the Costa Rican Constitution, the Environmental Organic Law 1995, and the General Regulation for the EsIA Procedures 2004.

The Reventazón Hydroelectric Project (PHR) has been through a number of design concepts. The first technical evaluation report in 1998 had a reservoir Full Supply Level of 380 masl, which was later modified to avoid physical displacement and flooding of important wetlands. Later prefeasibility analyses in 2003 identified eight options, five on the Reventazón River and three transferring water between the Reventazón and Pacuare rivers. The 2003 study recommended the PHR option at 275 masl be optimised, which was further lowered in the 2006 Progress Report on the Feasibility to a FSL of 265 masl due to geological and cost issues.

### 3.2 Detailed Topic Evaluation

#### 3.2.1 Assessment

#### Analysis against basic good practice

**Scoring statement:** *Environmental and social issues relevant to project implementation and operation have been identified through an assessment process, including evaluation of associated facilities, scoping of cumulative impacts, role and capacity of third parties, and impacts associated with primary suppliers, using appropriate expertise; and monitoring is being undertaken during the project implementation stage appropriate to the identified issues.*

ICE produced a full Environmental Impact Assessment (EsIA) in 2007 and submitted it to SETENA in 2008. ICE used its own and contracted expertise to produce this report, led by the Centre for Environmental Management Services (CSGA) in the Engineering and Construction service or the electricity business. Experts involved and their areas of specialty are listed in the EsIA executive summary, and professions include geology, hydrology, planning,

biology, archaeology, economics, sociology, forestry, geography, hydrogeology, seismology, history, law, engineering and communications. The EsIA covers the aspects expected, including physico-chemical (land, water quality, soils, geomorphology, groundwater, air, noise, natural hazards), biological (flora, fauna, aquatic and terrestrial ecosystems, protected areas, endangered species), and socio-economic (communities, cultural heritage, land uses, demographics, safety, community infrastructure, and landscapes). It identifies impacts and corresponding mitigation measures, and outlines an Environmental Management Plan (EMP).

The EsIA received SETENA approval to proceed in July 2009, subject to implementation of the EMP in chapter 12 of the EsIA. Construction started in July 2009 with site preparation works, and the PHR was declared a project of national interest in April 2010.

During the process of negotiating project finance, the Inter-American Development Bank (IDB) reviewed the EsIA and produced an Environmental and Social Management Report in May 2012. This review concluded that the EsIA was of good quality, with all the basic components expected and a sound baseline, but that there were some gaps with respect to IDB policies. The report concluded that the PHR's adverse environmental and social impacts, if left unmitigated, would be significant, with the key environmental and social impacts and risks including:

- loss of habitat connectivity due to the future reservoir impacting the Barbilla biodiversity corridor (Jaguar Corridor), a critical natural habitat;
- significant direct and cumulative impacts of project construction and operation on the Reventazón River's natural aquatic habitat;
- potential economic displacement of at least 16 households; and
- potential adverse impacts during project operation on the complex and ecologically sensitive Reventazón – Parismina – Tortuguero hydro-biological system.

The IDB commissioned additional studies and plans in two phases. The Phase 1 reports, finalised in February 2012, consisted of nine parts: A - Executive Summary; B - Water Quality; C – Sediments; D - Construction Management Plan; E - Biodiversity Management Plan; F - Proposed Biodiversity Project Compensation; G - Fish and Fish Habitat; H - Cumulative Effects; and I - Greenhouse Gas Emissions. A complementary social study was also drawn up by a separate group of consultants, the Social Management Plan 2012. The Phase 1 environmental studies outlined four areas for more detailed focus, addressed in Phase 2 reports finalised in March 2012: 1 – an adaptive management plan for the Reventazón-Parismina river confluence; 2 – a plan for the Barbilla Destierro biological corridor; 3 – a river offset plan for the Parismina River; and 4 – a plan for the PHR Environmental Monitoring Unit.

The 2008 EsIA included the associated facilities of the 1.8 km transmission line, and all internal roads. Community development infrastructure was also identified in the EsIA and EMP. Associated facilities such as schools, road works or health facilities required their own permits and approvals, e.g. from (as appropriate) the ministries responsible for education, public works and health.

The EsIA provided a brief section on cumulative impacts and identified a range of inter-related effects in regards to geology and land, water, flora and fauna, and economic and cultural aspects of the project. The lenders developed this further in their Phase 1 Part H Cumulative Effects report. The bank report established the following key Valued Environmental Components (VECs) and impacts of PHR construction and operation: basic services – increased demand for services; fish and biodiversity – alterations to terrestrial and aquatic habitat along with other land use changes; water quality – changes in water quality as a result of inputs including from changing land use; wetlands – impacts from changes in drainage patterns and flows from dam construction and agriculture; cultural resources – impacts as a result of construction and dam establishment; sediments – changes in sediment patterns due to land use and alteration of sediment deposition; and forest fragmentation – as above under fish and biodiversity.

ICE had a good understanding of the role and capacities of third parties (such as national government agencies, the municipal government and the lenders), particularly in the management of impacts and in provision of

support services. The EMP identifies relevant third parties by listing those responsible for delivery of each mitigation measure, as well as those involved (e.g. community representatives, local health committee, or specific agencies).

The EsIA included impacts associated with primary suppliers insofar as evaluating impacts from increased traffic. There was not a dedicated section on, for example, aggregate sources and their impacts. Any off-site extraction activities would require their own approvals in Costa Rica, so this is not considered to be a significant risk.

Numerous forms of environmental and social monitoring were undertaken during project implementation. The Construction Management Plan (IDB Phase 1 study, Part D) sets out monitoring requirements and responsibilities during project construction. Environmental and social monitoring requirements were delivered by the PHR Environmental Management Unit (Unidad de Gestión Ambiental).

The PHR Environmental Monitoring Unit (Unidad de Supervisión Ambiental) provided an important internal independent monitoring function. It was located within the Centre for Environmental Management Services (the area responsible for development of the EsIA), so in an area distinct from those involved in project implementation. Staff included two biologists, two environmental managers, a geographer, a civil engineer. Whilst there was no specific social expertise, social activities and commitments were also reviewed. This unit conducted regular inspections to ensure compliance with all commitments, reported breaches or issues to responsible parties, and issued monthly reports.

ICE submitted quarterly progress reports to SETENA, via the Environmental Regent. An Environmental Regent is a national requirement to be assigned by the proponent, and is responsible for looking after fulfilment of the environmental commitments. The Environmental Regent must maintain registers and inform SETENA on results of environmental monitoring of the project and its commitments.

A condition of project financing was to have an Independent Environmental and Social Monitoring Consultant (IESMC). The IESMC monitored compliance with environmental and social conditions established in the Project Environmental and Social Action Plan (ESAP) agreed with financiers, based on the IDB Safeguards and IFC Performance Standards. The IESMC has prepared monitoring reports four times per year since 2013, two reports per year on field verification visits and two per year on desktop reviews.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, monitoring of environmental and social issues during project implementation takes into account inter-relationships amongst issues, and both risks and opportunities that become evident during implementation.*

Inter-relationships were well considered in monitoring through formation of cross-disciplinary committees. Within the project team, the ICE Committee for Environmental and Labour Affairs (CAAL) monitored and analysed environmental and social risks and impacts, maintained records, recorded breaches, proposed corrective measures, alerted management and decision-makers, provided technical criteria for decision-making, and tracked and responded to community complaints including engaging the public in supervision and monitoring. The CAAL's particular focus area was on dust, noise and traffic which were the majority of the issues raised in community complaints. Another cross-disciplinary committee was formed for monitoring of reservoir filling, identifying and tracking all of the various aspects and risks, and meeting to discuss how to manage these.

Amongst other functions, the Environmental Monitoring Unit met with communities, held weekly meetings and undertook joint inspections with the Environmental Management Unit, and maintained communications with the PHR Occupational Health Unit to ensure that inter-relationships were identified and managed. For example, water quality monitoring informed the need for improved sediment barriers, and noise monitoring identified

impacts on neighbouring communities, prompting solutions addressing noise reduction at the source and protection for the most affected households.

Examples of how risks and opportunities were incorporated into monitoring are:

- Global Positioning System (GPS) devices were used in project vehicles to monitor public safety, such as speed limits near churches or schools; and
- The biological program studied traffic movements to inform placement of fauna transit areas;
- Automatic meters were used for water quality monitoring to get more immediate results so that it would not be necessary to wait for laboratory reports;
- People in neighbouring communities (Florida and El Coco) were issued with vehicle speed monitoring devices to engage them in ensuring community safety and build trust in monitoring results; and
- Community fears about tunnelling activities affecting local drainage were addressed by including community members in joint inspections.

Criteria met: Yes

## 3.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Processes are in place to ensure management of identified environmental and social issues utilising appropriate expertise (internal and external), and to meet any environmental and social commitments, relevant to the project implementation stage; plans are in place for the operation stage for ongoing environmental and social issues management; and the environmental and social impact assessment and key associated management plans are publicly disclosed.*

Processes to ensure environmental and social management were centred on delivery of commitments to SETENA and the lenders. Following the involvement of the lenders, the ability of ICE to deliver on commitments was significantly enhanced. ICE established a project-level environmental and social team (the Environmental Management Unit) with its own budget, staff, vehicles etc, as well as an independent supervision unit (the Environmental Monitoring Unit). The PHR Environmental Management Unit was structured with sub-units addressing the basin, biology, forests, socio-economics, archaeology, and impact mitigation. At its peak, this unit had staff of 130. Roles and responsibilities were well-established in the PHR Project Management Plan, the Construction Environmental and Social Management Plan (ESMP, contained in Section 6 of the IDB Phase 1 Report D), and in the Environmental Monitoring Unit plan (IDB Phase 2 Report 4).

The EMP in Chapter 12 of the 2008 EsIA has an extensive summary table of issues and measures to be taken. This table lists about 140 control measures, and includes responsible parties, third parties, timeframe, costs, link to relevant EsIA section, and indicators. Programs outlined in the EIS include biology, archaeology, forestry, waste, basin management, social and compensation.

Schedule 10 of the Common Terms Agreement between the Trust and the lenders provides the Environmental and Social Action Plan (ESAP) which captures all lender requirements additional to the EMP. Commitments are grouped under relevant IFC Performance Standards, and cross-referenced to IDB operational policies. The ESAP systematically sets out each issue, corresponding actions, evidence of completion, and completion timing. There are 46 commitments to be met in the ESAP.

The Construction ESMP sets out requirements and best practice guidelines on a range of topics, including:

- Environmental responsibilities during construction;
- Environmental compliance framework;
- Environmental and social specifications for works foremen and processes;
- Workforce and installation of camps and worksites;

- Decommissioning, revegetation and restoration of the project affected areas;
- Managing impacts during construction;
- A plan for waste management;
- Storage and handling of building materials;
- A maintenance plan;
- Protection and conservation of the flora and fauna;
- A security plan;
- Chance encounters of cultural property; and
- Health and community relations.

The Social Management Plan 2012 focuses more specifically on aspects of importance to communities. Full details are provided in I-9 Project-affected Communities and Livelihoods.

Further to these, environmental management plans were developed for particular focal areas in the construction process. The site supervisor was required to submit Environmental and Social Management Plans (PMES's) to ICE along with construction methods, schedules, equipment, labour management, etc. There were more than ten PMES plans, addressing roadworks, the powerhouse, the dam, tunnelling, etc.

Duties and responsibilities were established in the PHR Project Management Plan, the Construction Environmental Management Plan, and in the Environmental Monitoring Unit plan. Information management was managed through these planning documents establishing registers and reports and associated responsibilities. For example, the Construction EMP sets out a list of all reports, documents and records expected during the construction phase.

Whilst Operation stage plans are not yet finalised, ICE has given them considerable attention. The EsIA and EMP addressed the operations stage in a number of aspects, and the additional requirements of the lenders also address a number of operation stage considerations (downstream flows, biodiversity, etc). ICE has established an operations stage environmental and social team of about ten staff, some part-time, at the plant. ICE has also drafted an Operations Stage Environmental and Social Management Plan, currently under review by the lenders. ICE has developed detailed plans for ongoing operations, notably the adaptive management plan for downstream impacts; the Parismina offset programme, and programmes for catchment management.

Regarding public disclosure, the EsIA, EMP and all associated IDB reports are publicly disclosed on IDB's website, although not on ICE's website. Please refer to I-2 Governance, concerning a significant gap on public disclosure (on Stakeholder Engagement at the proven best practice level).

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, processes are in place to anticipate and respond to emerging risks and opportunities; and plans and processes are embedded within an internationally recognised environmental management system which is third party verified, such as ISO 14001.*

There are a number of processes to anticipate and respond to emerging environmental and social risks and opportunities. In particular, the Environmental Regent, the Environmental Monitoring Unit, and others had the power to stop construction work on the basis of environmental management problems. This unit took early action on non-conformities, and their inspection reports set out non-conformities, including documentation of the issue, corrective measures, responsible parties, time frames and follow-up. These were copied to all relevant responsible parties and the Environmental Monitoring Unit re-inspected to ensure delivery.

The plan for the Environmental Monitoring Unit (IDB Phase 2 Report 4) addressed this unit's role in how unforeseen risks would be addressed:

- For unforeseen impacts or incidents, the Environmental Monitoring Unit will work in coordination with the PHR Environmental Management Unit to find solutions to the problems encountered. The Head of the Environmental Monitoring Unit shall record in writing the solutions adopted and the ESMP and implementation guidelines should be updated accordingly.
- For unforeseen activities such as the need to build new roads, make new excavations, open new dumps, locate new sites extracting materials or areas of lending materials, etc., the PHR Environmental Management Unit in conjunction with the relevant construction engineer should submit to the Environmental Monitoring Unit for approval of locations of new sites, designs, and environmental management plans. The site supervisor or process owner should also have the required environmental permits and licenses to start new works.

An example of responding to an emerging risk related to bringing in 20 000 tonnes of steel from the port of Limón. The contractor schedule required delivery over a period of 3 weeks, but the traffic impacts were much greater than anticipated. ICE's procurement team worked with the environmental and community teams and the contractor to find a solution by which the period over which steel would be brought to site could be extended, thus significantly reducing the number of truck movements on the road each day.

Chapter 13 of the 2008 EsIA was called a contingency plan, but in practice it was more a natural hazards identification plan, e.g. with respect to identifying risks relating to landslides, seismicity, floods etc.

In addition, measures to anticipate and respond to risks were included in the plans required by the Lenders. The adaptive management plan for the Reventazón-Parismina river confluence (IDB Phase 2 Report 1) entirely concerns responding to emerging risks. The river offset plan (IDB Phase 2 Report 3) is a response to the risk that it will be impossible not to affect the river's aquatic ecology.

Some examples of management processes addressing opportunities include:

- One of the dump sites for waste was very large, and was used by SETENA as a model for waste management; and
- ICE developed and advanced a policy for green purchasing and extended producer responsibility, and implemented this in aspects of the PHR by including it in contract clauses, for example with regards to tyres, cement, fruit pulp and lubricating oils; and
- ICE is using the opportunity of development of the Operation stage EMP to redefine the Area of Direct Influence (AID), which will include downstream stakeholders and give them a higher weighting for attention than they had in the Construction stage EMP.

The ICE electricity business has an environmental policy and environmental guidelines dated 2016 and is continuously improving its environmental management systems within its broader Integrated Management System (IMS). However, these initiatives were not in place during most of the PHR construction period. PHR's plans and processes were not embedded in an environmental management system that was third-party verified according to an international standard such as ISO 14001. This is a **significant gap** against proven best practice.

Although processes to anticipate and respond to emerging risks and opportunities were in place during construction, ongoing processes are not in place for operation, because the transition to the operation stage and adoption of the ESMP for the operation stage is delayed. This also is a **significant gap** at the level of proven best practice. This issue was highlighted in the report of the IESMC of November 2015, flagging that the same observation had been made in previous reports and monitoring visits. Outstanding plans are still evident from the report dated June 2017.

Criteria met: No



## 3.2.3 Stakeholder Engagement

### Analysis against basic good practice

**Scoring statement:** *Ongoing processes are in place for stakeholders to raise issues and get feedback.*

ICE actively engaged with stakeholders in the process of developing the ESI, including 52 workshops and meetings with communities. Numerous measures were established to maintain communications with these communities, notably establishment of a community relations office in Moravia, Siquirres, appointment of community liaison officers, community meetings and public presentations, and a visitors' program to the project's construction site. Ongoing engagement has been guided by a Communities Engagement Plan. Further details on stakeholder engagement are set out in I-1 Communications and Consultation.

The PHR procedure to address stakeholder issues is the Mechanisms for Handling Complaints and Community Claims. This sets out the responsibilities, processes and commitments of ICE, including channels for receipt of concerns, classification of issues, tracking and follow-up, and responses. The social area of the Environmental Management Unit was responsible for tracking and attending to complaints. The Environmental Regent monitored the process of monitoring and implementation of care complaint and claims, and reported quarterly on these to SETENA. The IESMC also reviewed all complaints received and noted actions.

In Florida, the project developed a Technical Monitoring Committee involving project and community representatives, and partner organisations where relevant, to undertake joint inspections as needed on areas of concern.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, feedback on how issues raised have been taken into consideration has been thorough and timely.*

The processes set out in the relevant procedure were implemented. Regular reports document complaints received and the status. For example, the July-September 2014 quarterly report documents that 12 community complaints were received by different channels (raised in calls, meetings, community visits), nine were resolved and three were in the process of resolution. The 12 complaints were from 11 people, mostly from the villages of Florida and El Coco. It took an average of 3.5 days to give first attention to the complaint, and 11.8 days to provide final answers to complaints. Each complaint is listed individually. The CAAL was created to help speed up action on issues arising and complaints received, by including those responsible for implementing the actions when agreed by the committee. If a decision couldn't be taken, it was elevated to the PHR Director. Delegations were very clear.

However, ICE has not provided an overall summary of project performance in addressing complaints. Whilst issues raised are well tracked, a repeated view from communities is that ICE is slow to respond to and resolve complaints. Please refer to I-9 Project-affected Communities and Livelihoods for details.

Criteria met: Yes

## 3.2.4 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *Processes and objectives in the environmental and social management plans have been and are on track to be met with no major non-compliances or non-conformances, and environmental and social commitments have been or are on track to be met.*

There are numerous laws with which ICE needs to comply in PHR development, not only environmental laws but also those relating to waste, water, forestry, wildlife, heritage, soils, health, safety and biodiversity. These are detailed in the 2008 EsIA. In addition, numerous permits were required (e.g. for tree cutting, water use, archaeology, mining, health, sanitation, waste), listed as Annex VI of the Trust's Common Terms Agreement.

Major environmental and social commitments can be separated into those required by SETENA and those required by the lenders. For SETENA, the resolution for approval refers to the EMP (chapter 12 of the 2008 EsIA). For the lenders, the environmental and social commitments are set out in several attachments to the Trust's Common Terms Agreement: Annex F (Land Acquisition Plan); Schedule 7 (Information to be included in annual review of operations); Schedule 9 (Notices and Reports); and Schedule 10 (Environmental and Social Provisions). Schedule 10 contains the ESAP, as well as formats for annual and quarterly environmental and social monitoring and status reports to be provided to the lenders.

A protocol agreement was signed between ICE and all 15 affected communities, formalising ICE's commitment to comply with the mitigation measures in the EMP. ICE also signed a cooperation agreement with the municipal authorities of Siquirres to work together to promote integrated development of the municipality.

No formal non-compliances have been issued by SETENA. The lenders have noted non-conformances, but set further deadlines for delivery. The next field monitoring visit of the IESMC is planned for November 2017, at which stage the lenders will seek to formally close out environmental and social compliance issues during the construction phase and issue a compliance certificate.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

Not all environmental and social commitments have been met, with a number of outstanding issues identified in the ICE evaluation report of May 2017 and the June 2017 report of the IEMSC.

As of May 2017, of the 151 commitments tracked in the ICE evaluation report covering both SETENA and bank commitments, 121 are met, 19 are partially met, 10 are not met, and 2 are not relevant. Explanations are provided for the 29 non-conformances, in many cases proposing that alternative measures have sufficiently addressed the intent. However there has been no process of formalising these alternative measures to update commitments, and at the level of proven best practice this is a **significant gap**.

Criteria met: No

## 3.2.5 Outcomes

### Analysis against basic good practice

**Scoring statement:** *Negative environmental and social impacts of the project are avoided, minimised and mitigated with no significant gaps.*

A number of measures were implemented during development of the project concept to avoid and minimise potential environmental and social impacts, such as through likely impacts relating to population displacement and flooding. Measures identified through the 2008 EsIA and EMP, and the additional studies and plans developed with the involvement of the lenders, further strengthen the PHR in terms of avoiding, minimising and mitigating environmental and social impacts. IDB's independent review of the 2008 EsIA and EMP, and introduction of additional measures, were important to ensure the avoidance of any significant gaps.

The establishment and strengthening of the PHR Environmental Management Unit, the establishment of the internal but detached Environmental Monitoring Unit, the use of independent review through the IESMC, and

the establishment of the ICE electricity business environmental division for cross-project system development are all important factors in achieving good environmental and social outcomes.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, negative environmental and social impacts are avoided, minimised, mitigated and compensated with no identified gaps; and enhancements to pre-project environmental or social conditions or contributions to addressing issues beyond those impacts caused by the project are achieved or are on track to be achieved.*

The project was designed to ensure that there would be no identified gaps and that all residual impacts would be adequately compensated. The thoroughness of gap identification was achieved through the expert review of the lenders, and compensation measures were also significantly strengthened due to the lenders' involvement. The identification and management of cumulative impacts, including extending and strengthening the basin management plan and addressing the confluence of the Reventazón and Parismina rivers, are important measures to seek to address downstream issues. A key environmental compensation measure is the river offset. On the social side, compensation measures include the provision of improved infrastructure.

Whilst not all commitments are yet fully delivered or fully resolved, the lenders continue to closely supervise these and to ensure the quality, comprehensiveness and effectiveness of these. Decommissioning and restoration of construction sites, closure of grievances, and the closure of outstanding cases of compensation for land acquisition, will be an important component of this. Financial payments are still withheld by the lenders until all environmental and social commitments are demonstrated, and carry-over into the operational phase and ongoing commitments in the operations stage ESMP will be ensured as needed.

Enhancements to pre-project conditions have been or will be delivered through: a net biodiversity benefit delivered by the Parismina offset (please refer to I-15 Biodiversity and Invasive Species for details) and by the provision of new infrastructure in AID communities (but please refer to I-7 Project Benefits concerning questions on the sustainability of these enhancements).

Criteria met: Yes

## 3.2.6 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

There was no internationally recognised environmental management system which is third party verified during the PHR construction phase.

There have been significant delays in development of the operation stage environmental management plan.

There are non-conformances with commitments in the EMP and ESAP.

2 or more significant gaps

## 3.3 Scoring Summary

The PHR is a large and complex development with a number of direct, indirect and cumulative environmental and social impacts. Environmental and social impact avoidance and minimisation measures were realised through progressive revisions of the project concept. The project EsIA in 2008 identified and analysed

environmental and social impacts, and outlined 140 control measures with details of their implementation. The financing arrangements for the project, closed in 2013, lifted the level of evaluation, planning and resourcing to address environmental and social impacts by referring expectations against international safeguards and performance standards. The bank requirements added a further 46 environmental and social commitments with which ICE had to comply. Management, monitoring and supervision processes improved considerably, and the project has delivered well on almost all commitments. There are three significant gaps against proven best practice expectations: no internationally recognised environmental management system, significant delays in the operation stage environmental and social management plan, and non-conformances with a number of commitments.

**Topic Score: 3**

### 3.4 Relevant Evidence

<b>Interview:</b>	1, 5, 8, 21, 46, 64, 80, 86, 88, 90, 92
<b>Document:</b>	7, 8, 17, 18, 24, 90, 100, 101, 106, 108, 118, 134-137, 141, 147, 155, 161, 162, 174, 203-207, 220, 222, 227-233, 374-402
<b>Photo:</b>	13, 14, 37-47, 53, 64

## 4 Integrated Project Management (I-4)

This topic addresses the developer's capacity to coordinate and manage all project components, taking into account project construction and future operation activities at all project-affected areas. The intent is that the project meets milestones across all components, delays in any component can be managed, and one component does not progress at the expense of another.

### 4.1 Background Information

The construction of the Reventazón Hydroelectric Project (Proyecto Hidroeléctrico Reventazón, PHR) began in April 2010. Subsequently ICE formed a Special Purpose Vehicle, in the form of a fiduciary trust (the "Trust" or *Fideicomiso UNO P.H. Reventazón*) with Scotiabank to facilitate project financing. The original budget for the project was USD 1.379 billion, and the financing of the project was twofold:

- The Trust raised finance of USD 903.7 million from banks that lend to the private sector, including four national banks, IFC (International Finance Corporation) and IIC (Inter-American Investment Corporation, the private sector branch of the IDB, Inter-American Development bank); this financed part of the EPC turnkey contract and financing costs;
- ICE's investment in the Trust of USD 475.4 million, through its contribution to the EPC contract, using loans from IDB and BCIE (Banco Centroamericano de Integración Económica).

ICE was appointed by the Trust through an EPC Turnkey contract to construct the project. The main suppliers included SUMEC from China for the gates, Andritz for the hydro-electric equipment and Siemens for the transformers and sub-station.

The Trust had a very good relationship and communications with ICE in all aspects throughout the process. Scotiabank created a special project unit for ICE, and liaises with ICE in many areas. Scotiabank also liaises with the banks within the Trust.

### 4.2 Detailed Topic Evaluation

#### 4.2.1 Assessment

##### **Analysis against basic good practice**

**Scoring statement:** *Monitoring of project progress, milestones, budget and interface issues, and of the effectiveness of management of implementation stage plans including construction management, is being undertaken on a regular basis during project implementation.*

Project implementation at ICE is managed and coordinated by the General Coordination Group (Coordinación General de Proyecto or CGP) which falls under the "Engineering and Construction Business" at ICE. CGP is set-up to manage all ICE electricity sector projects. In order to allow it to efficiently adjust the amount of people working on projects at any given time, depending on project needs (more during implementation and then less as construction winds down) it is set up with a private company structure which differs from the rest of ICE and can therefore ramp up staff and also let staff go when no longer needed, with more flexibility and ease than the public entity ICE.

Each project has its own management structure with a dedicated Project Director and groups responsible for planning and controls, administration, occupational health and safety (OHS), purchasing, construction, engineering, communications, services, contracts, and environmental and social aspects. The Planning and Controls group at the project level monitors progress, milestones and costs very closely, and according to ICE

policies and procedures using a variety of tools such as Microsoft Project and SEGPRO software for tracking and analysis, which includes critical path analyses.

The EPC contract included the following milestones:

- (1) The completion of main tunnel excavation by 31 March 2014;
- (2) The start of the installation of draft tube for Unit 1 for 1 September 1, 2014;
- (3) Completion of fill of embankment dam, 13 October 2015;
- (4) Completion of the concrete face of the dam for 22 April 2016; and
- (5) Start of wet tests for 4 September 2016.

In addition, the EPC contract stipulates inspections requirements by the Independent Engineer (IE). The construction of the project was divided into work packages or project components such as: the dam, the spillway, the tunnels, the waste rock spoil areas, the intake, the powerhouse, the ecological flow power house, the concrete batch plant, the extraction of river bed material etc. Each work component had its own assigned engineering and technical staff, QC/QA staff, OHS “preventionists”, environmental and social representatives. Depending on the work component they may have more than one of each, for example the group responsible for the construction of the dam included 3 QC/QA specialists and 4 OHS “preventionists” per shift.

During implementation, the Planning and Control group would track and monitor all activity for all work components and follow-up on the implementation of corrective measures to address any deviation in schedule or costs. This was carried out in close collaboration with the various multidisciplinary teams on-site and discussed in detail at bi-weekly meetings on site that would last a full day. The meetings included a review of the risk matrix, OHS issues and incidents, environmental and social aspects and lessons learned. These meetings that were often attended by staff from San José also informed the larger ICE community and provided a forum for integrated discussions between work package teams and allows for the sharing of information, lessons learned and the standardization of social management by discussing how to resolve social issues and how to respond to grievances in a similar manner across the country.

An updated construction schedule is included in the Project Management Plan (Plan de Gestión de Proyecto, versión 4) and states that the Project schedule was updated twice with approvals in February 2012 and in November 2013.

Criteria met: Yes

### **Analysis against proven best practice**

**Scoring statement:** *In addition, monitoring of the overall project implementation takes into account inter-relationships amongst issues, and both risks and opportunities that become evident during implementation.*

Interrelationships amongst issues are picked up through dialogue amongst the multidisciplinary construction teams during the bi-weekly meetings. Every two months the Director of the CGP group attends in-situ meetings at the site and he regularly accesses updates on progress, costs, budget tracking, OHS statistics, inventories and human resources via SEGPRO which highlights any deviations and how they are being addressed.

Monitoring identifies both risks and opportunities. For example, improvements not initially envisaged included an additional channel for passing the ecological flow during reservoir filling and the paving of the roadway on the crest of dam. The IE stated that when they became involved not all design packages were closed and therefore there were opportunities for improvements that were eventually implemented by the project.

In spite of these events, the project was able to finish ahead of schedule with construction costs under budget. Success was attributed to very strict attention to the activities in the critical path, especially with the major suppliers (SUMEC, Andritz and Siemens). These three suppliers were a source of high risk, and ICE had to keep a lot of pressure on them.

Criteria met: Yes

## 4.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *An integrated project management plan and processes are in place that take into account all project components and activities with no significant gaps; and a construction management plan is in place that describes processes that contractors and others are required to follow to manage construction related activities and risks.*

The integrated project management plan is outlined in the Reventazón Project Management Plan (Plan de Gestión de Proyecto Reventazón). It includes detailed organisation charts, including one for environmental management, a detailed responsibilities matrix, a detailed work breakdown structure, the project schedule, the budget and financial planning for the Project. It also includes procedures for communications management, the management of risk and quality, processes and management of procurement, and tracking and monitoring tools to be used. These tracking and monitoring tools include reporting requirements, requirements and forms for minutes of meetings, integrated processes for scope changes, procedures for the hand-over and acceptance of products and lessons learned. The plan takes into account all project components and construction management activities with no significant gaps. It was created in May 2010 and has been updated and revised three times with modifications such as updates to the organisation chart, budget or risk matrix, or to incorporate changes in construction activities, the procurement plan, the communications plan.

Risks were identified by a group of 12 people, from the Project Directors group and one person from work components and support groups. Teams were formed and assigned to specific risks (for example financial risk was allocated to the planning and controls group) and critical risks were monitored very closely. The monitoring of risks and associated procedures are contained in a document titled Procedimiento Administrativo de Riesgos (Administrative Procedures for Risks).

Planning and Controls meetings occur every two weeks and go over each work package in terms of progress, milestones, costs and corrective measures as well as items in the risk matrix.

Examples of how contractors and others are required to follow plans and processes include the following:

- Siemens stated that all scope changes were handled very smoothly, they had a good working relationship with ICE, and that success was driven by (1) a contract manager (ICE) who knew exactly what the contract required, very good teamwork with ICE on site and teams were very accessible; (2) good relationships; (3) good documentation and transparency so everyone knew exactly what they were doing. In addition, they mentioned that ICE had very strict procedures around environment and safety; they were requested to use local workers and did. ICE requested Siemens to have skills develop, training in environment, safety, and all work permits. Siemens had to teach locals how to work, in cases, some were doing electrical, concrete etc. and they were always supervised by an engineer. This resulted in extra costs but they were insignificant and people were very committed and it was a very stable workforce.
- ICE support to the Union during the implementation phase: ICE's support to the union was logistical, not financial. ICE provided space for an office and liaised closely. The Union requested to go to the work fronts to talk to employees, so ICE gave appropriate permits. The Project helped the Union to get information on all systems and processes.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, the plan identifies a range of potential interface issues and sets out measures to manage interface and delay issues without impinging on overall project timetables and budgets; processes are in place to anticipate and respond to emerging risks and opportunities; and construction management plans ensure*

*that land disturbance and waste generation activities will be managed so that later rehabilitation activities can be undertaken efficiently and effectively.*

Interface issues are well identified and managed. These include the following examples:

- PHR had about ten directors or coordinators (environment, admin, construction, planning and controls etc.) and met every two weeks with each area represented. These meetings allowed space to examine potential interface issues. Some could be resolved at the work front. The coordinators present would agree on priorities which always had to do with the critical path and critical risk items. Planning and Controls would track and follow up on any remedial or mitigation measures that needed to be implemented;
- Different groups working in close proximity, e.g. archaeology teams working ahead of construction teams to conduct archaeological excavations and clear areas for construction, the dam site work group and the spillway work group working in close proximity, the waste rock spoil areas work group using the same internal road networks as other construction vehicles;
- Logistics involved in managing the fleet of buses, minivans and vehicles bringing 2200 workers to and from the site daily and ensuring every single worker is inspected by security guards upon arrival and before leaving. In addition, the logistics involved for provide food for the workers on a daily basis;
- Early warning system for floods and electrical storms and lightning strikes causing frequent work stoppage by the OHS team;
- Work at any of the work component sites could be stopped by the coordinator of that particular work site or by either of the QC/QA staff, the OHS “preventionists” or environmental staff on site at that particular time. Work could be stopped for a quality issue, a safety issue or a non-compliance with the ESMPs. For example, work was stopped on occasion due to the quality of materials (too wet, muddy) and needed to be addressed before continuing work;
- OHS and E&S were integral parts of the construction management process. The beginning of all construction work activities followed a protocol and required approval from the staff on-site responsible for OHS and E&S;
- Each work component site had its intermediate stockpiles of waste to manage and coordinate transportation of with the main waste management centre in El Plantel which in turn would coordinate with the certified waste management companies to arrange for transportation;
- Rehabilitation works on waste rock spoil areas used the compost obtained from the on-site composting plant.

Any issues that arose or could potentially cause an impact on schedule or budget were discussed during the bi-weekly meetings and budget and schedule tracking in SEGPRO was updated accordingly. In addition, annual audits and evaluations were carried out for all projects by ICE engineering and technical staff based in San José, to ensure best practices are applied to all projects in order to standardize quality across projects.

Examples illustrating how emerging risks and opportunities are identified and responded to include the following.

- ***Damage to the coffer dam during the flood of July 2012:*** the alternatives were either to wait one full year until the next dry season or modify the design of the coffer dam and construct it during the wet season which was completed in 6 months and therefore resulted in less of a delay in schedule;
- ***Archaeological finds causing the re-location of waste rock spoil areas:*** the project was flexible and was able to declare certain area off-limits for construction activities and find alternative locations for waste rock;
- ***Additional diversion channel for passing the ecological flow during reservoir filling:*** this improvement to Project design was recommended by the IE and implemented by PHR. Another improvement recommended by the IE was the paving of the roadway on the crest of the dam. This also was implemented by PHR;
- ***Collapse of governor and damage to Unit 1:*** this presented the opportunity for Andritz to hire ICE in order for ICE’s technical staff to repair the damaged Unit 1 and make changes to equipment for Units 2, 3, and 4



that were already on site to help in the installation, testing and commissioning process, allowing Andritz to complete remedial work on time within the established schedule;

- **Interface issue between supplier (MAGAZ) and communities:** A supplier's contract required goods to be delivered in 3 weeks which would require 40 truck movements per day. There were many complaints from the neighbouring communities. Dropping down the delivery of the goods to 10 trucks/day would extend time to approximately 4-6 months. Although not a problem to ICE in terms of critical path, but according to the contract, MAGAZ was only paid when the steel was at site. ICE helped resolve the issue by formally accepting goods at a port store area (so MAGAZ could get paid), sending ICE-funded security guards to guard the steel while it was stored there) and arranging for MAGAZ's bond to be extended. The PHR procurement team helped argue upwards within ICE to allow this solution for MAGAZ.

Concerning the management of land and waste and planning for later rehabilitation, the ESMP has specific programmes for the restoration of waste rock spoil areas and solid waste management (see I-18 Waste, Noise and Air Quality for further details).

Concerning management during the hand-over to the generation group, for each project, ICE has a committee called "CREO" (Comité de Recepción de Obras), with periodic meetings with colleagues from the generation group, and sub-committees on different components (civil, administration, environment, etc). This committee is responsible for making lists of outstanding items to be carried over by the generation group or completed prior to the formal hand-over. There are certain items remaining today; e.g. SUMEC has to provide as-built drawings in Spanish, not English or Chinese. An area of approximately 18 ha of construction camp has yet to be rehabilitated, there is a commitment to give some to the local municipality for an educational facility and currently some of the facilities and dorm rooms are being used by the local police force. Typically, idle equipment and some materials would be transferred to other projects, however there is no immediate need for the equipment and facilities and are being stored at El Plantal.

Criteria met: Yes

### 4.2.3 Conformance / Compliance

#### Analysis against basic good practice

**Scoring statement:** *Processes and objectives in the integrated project management plan and the construction management plan have been and are on track to be met with no major non-compliances or non-conformances.*

There have been a few variations to design, as noted in the examples given under the Management criterion, which have been recommended by the IE or the result of emerging risks during the implementation process. These have been addressed and implemented without any significant impact to construction costs or schedule. In each case, risks have been identified, mitigation measures have been implemented, and they did not cause any adverse effect on the overall project completion targets. For these reasons, no significant gap is assigned at the level of basic good practice.

Criteria met: Yes

#### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

The project has not yet completed the full hand-over to the operations or generation group. In addition, PHR has until November 2017 to complete some environmental benchmarks required under the lenders Environmental and Social Action Plan (ESAP), and they are on track to complete the required activities by that time. However, the management of some outstanding items is unclear and the ESMP for the operations phase does not fully address some of the pending commitments made during implementation (such as the construction of a landfill cell in Siquirres (see I-18) and site rehabilitation including the construction camp area). Delays in the completion

of environmental and social commitments and handover to the operations group are a **significant gap** against proven best practice.

Criteria met: No

## 4.2.4 Outcomes

### Analysis against basic good practice

**Scoring statement:** *The project is meeting overall budget and timing objectives and targets; interface issues are managed effectively; and construction risks are avoided, minimised and mitigated with no significant gaps.*

The initial budget for the project was USD 1.236 billion when ICE signed agreements with financial entities in 2011. AECOM conducted a full review of the work program, yields, and unit costs, and validated and guaranteed to the banks that the numbers were correct. There was a strong requirement for accountability and ICE has had a strong culture of accountability right from the start. The official budget subsequently agreed to with lenders is USD 1 379 billion (2013 USD) of which construction costs corresponded to USD 1 208 billion. The final costs ended up being USD 1 499 billion of which USD 1 192 billion were construction costs, therefore slightly under budget.

All the work components that were being monitored in detail behaved well, with deviations in cost or schedule that were within tolerances, with the following exceptions which caused variations with respect to the budgets agreed with the lenders:

- A flood in July 2012 washed out 60 % of the coffer dam,
- A land slip that occurred towards the end of 2012 in the spillway area that was already stabilized. A weak lens was encountered and required the excavation of an additional 1 million m<sup>3</sup>.
- The governor of Unit 1 collapsed during commissioning tests and caused damages to parts of the turbine and scroll case. Andritz took responsibility for the error in design and redesigned parts for Units 2, 3 and 4 that were commissioned in April 2016. Unit 1 needed significant work and was sent to Mexico for repairs. Instead of being commissioned in March 2016 as planned, it was commissioned in September 2016.

The project is currently operating. However a few pending items remain before the formal hand-over can be completed, for example, the ceding of land rights has not been completed yet, in relation to construction areas and camps. Property was declared of National Interest, allowing ICE to start using it, but PHR requires a court decision to put the property in ICE's name. The majority of lands are already under ICE's name, but about 20% are still in courts. The other issue which may delay the hand-over to the generation group is the remedial work to be carried out on the dam in March and April of 2018 (refer to I-5 Infrastructure Safety) which involves lowering the reservoir water levels to install post tensioned anchors and conduct repairs caused by underlying geology and not because of design or execution issues. The design of remedial work has been carried out in collaboration with the panel of experts.

The lenders have fully disbursed to the Trust, in 9 disbursements. Disbursements to ICE out of the Trust have been more frequent, in response to agreed benchmarks with progress reviewed by IDB/IFC independent engineering and environmental monitors. Where progress targets were not fully met, there have been partial disbursements in accordance with the independent monitors' advice. Some environmental benchmarks remain that must be met by November 2017 which will be associated with one final disbursement.

Interface issues are managed effectively, and construction risks have largely been avoided, minimised, and mitigated with no significant gaps.

Criteria met: Yes

## Analysis against proven best practice

**Scoring statement:** *In addition, interface issues are anticipated, and avoided or minimised; and construction risks are avoided, minimised, mitigated and compensated with no identified gaps.*

Interface issues are anticipated and avoided or minimised through the mechanisms described under the Management criterion. No significant interface issues have caused implications for the overall project delivery targets.

There are no identified gaps in the avoidance, minimisation, mitigation and compensation of construction risks. The risk matrix developed for the Project describes the wide range of risks and risk scenarios that may be encountered, and allocates responsibility for these. These include financial risks, hydrological and meteorological, seismological, social and behavioural (e.g. delays, labour issues), chance finds of archaeological artefacts, and general hazards. A major construction risk was encountered by way of a landslide on the right bank of the dam site, and a flood that damaged the coffer dam; the early warning system and other measures have been put in place to minimise this risk and to compensate the outcomes.

Of the 38 risks, only three materialised during the implementation of the Project, and one of them twice:

- Working in the river under extraordinary weather conditions (July 2012 flood);
- Fatality (electrocution) during Easter holidays resulting from bad communication and horseplay;
- Relationship with contractors: a small group of contractors blocked the entrance to the main construction camp for 8h. This occurred a second time a year later but with less support and lasted 6h.

Throughout the implementation of the project, risks were understood and the highest risks were closely monitored and measures were put in place to address major risks.

Criteria met: Yes

## 4.2.5 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

Delays in the completion of environmental and social commitments and in the handover to the operations group.

1 significant gap

## 4.3 Scoring Summary

ICE and PHR has demonstrated the capacity to coordinate and manage all project components and has met its overall project development milestones and completed ahead of schedule and slightly under construction budget.

Project progress was closely monitored with respect to time, cost and quality, and numerous reporting mechanisms with checks and balances were in place. Interface issues, risks and opportunities were anticipated, identified and well-managed, and there were a number of examples of risk avoidance and management as well as opportunities that arose during the implementation process that were acted upon.

The pending environmental benchmarks under the lenders' ESAP are on track to be completed by November 2016. However, some items related to the rehabilitation of the construction camp area, management of remaining waste streams, and the carry-over of unfulfilled commitments to the generation group are unclear or

are delayed. Delays in the completion of environmental and social commitments and handover to the operations group is a significant gap against proven best practice

Topic Score: 4

### 4.4 Relevant Evidence

<b>Interview:</b>	4, 10, 44, 53, 61, 68
<b>Document:</b>	7, 72, 148, 164, 170, 180, 193, 403
<b>Photo:</b>	42,44,48

## 5 Infrastructure Safety (I-5)

This topic addresses management of dam and other infrastructure safety during project implementation and operation. The intent is that life, property and the environment are protected from the consequences of dam failure and other infrastructure safety risks.

### 5.1 Background Information

There is no national dam safety legislation and there are no dam safety guidelines in Costa Rica. ICE, as the owner and operator of over 80% of the hydropower dams in the country, has developed their own internal guidelines (ICE, Norma Interna, 2007) which ICE supplements with international standards and guidelines such as ICOLD (International Commission on Large Dams), the United States Bureau of Reclamation, ASTM – originally American Society for Testing and Materials, and Spain's *Reglamento Técnico sobre Seguridad de Presas y Embalses* i.e. Technical Regulations on Dam and Reservoir Safety. Other national codes and regulations also apply, for example the national codes for slope stability, for foundations, for seismicity and others. ICE also has an “ad hoc” Dam Safety Committee that meets regularly to discuss the latest trends in dam safety and staff often attend and present papers at Dam Safety conferences.

Similar to other Caribbean watersheds in the region, the Reventazón River watershed is subject to high annual precipitation with an annual average of 3 317 mm at the dam site and up to 7 000 mm in the higher altitude reaches of the basin. The average flow for the period of record 1963-2005 is 151.9 m<sup>3</sup>/s, with the highest average monthly flows occurring in September and October. Communities in the downstream area and delta, and especially housing in the floodplain, can be affected by flooding. For example, the community of Hamburgo is affected by flooding with flows above 400-450 m<sup>3</sup>/s.

There are five operating hydropower projects located upstream. Three are ICE-operated: Angostura (177 MW), approximately 3 km upstream, which started operations in 2000; Cachí (100.8 MW) and Río Macho (140 MW), built in the 60's. Two are smaller IPP (independent power producer) projects: La Jolal and Torito international.

Infrastructure safety as it relates to occupational health and safety during the implementation stage is discussed in I-12 Labour and Working Conditions.

### 5.2 Detailed Topic Evaluation

#### 5.2.1 Assessment

##### Analysis against basic good practice

**Scoring statement:** *Dam and other infrastructure safety risks relevant to project implementation and operation have been identified through an assessment process; and safety monitoring is being undertaken during the project implementation stage appropriate to the identified issues.*

The Reventazón hydroelectric project's (PHR's) planning stage, pre-feasibility and feasibility level design and associated field studies, were conducted by ICE's Electricity Planning and Development Group and Engineering and Construction Group, which have many years of experience in all aspects of planning, design, construction and operation of hydropower plants. The Reventazón dam is the first CFRD (concrete faced rockfill dam) structure in Costa Rica and ICE followed ICOLD's Bulletin 141 recommendations for the design of CFRD dams and retained a panel of reputable external experts to help support the design. Consultants such as SRK from Chile carried out a dynamic analysis of the CFRD using a 3-D model in order to predict its behaviour during reservoir filling. In addition, a 1:100 scale physical model of the dam and spillway were built in ICE's hydraulics laboratory. The independent engineer (IE; Fichtner) hired on behalf of the lenders, independently vetted the design and

monitored progress during the construction process. In addition, factory inspections were carried out for major equipment.

The hydrology of the Reventazón River has been well studied, using flow records for 1963-2005. The selected inflow design flood (IDF) entering the reservoir was the 1:10 000 year flood with a 90% confidence interval ( $8592 \text{ m}^3/\text{s} + 2708 \text{ m}^3/\text{s} = 11\,300 \text{ m}^3/\text{s}$ ). The spillway is designed to carry a maximum of  $9\,300 \text{ m}^3/\text{s}$  which corresponds to the routed peak flow through the reservoir, and a low level outlet is designed to discharge  $600 \text{ m}^3/\text{s}$  to flush sediment.

The feasibility study describes the underlying dam foundation conditions, which includes a layer of loamy tuff which can potentially cause unfavourable hydrogeological conditions that can affect dam stability. To improve the foundation conditions, impermeable curtain grouting and drainage galleries were included in the design under the dam and the abutments.

ICE's Basic Engineering and Construction Studies Service Centre (one of 8 "Service Centres" within ICE's Engineering and Construction Business Group) carried out many of the basic studies for the design of the project and this office also participates in monitoring of the project during construction and operations. For example, ICE owns and operates Costa Rica's seismic monitoring network and has in-house seismic expertise that conducted the Seismic Risk Study for the project. ICE experts also designed the instrumentation of the dam to be able to monitor behaviour during reservoir filling and throughout the life of the dam. Instrumentation includes piezometers, topographic control points on the dam, spillway and slopes surrounding the structure, inclinometers, etc. Monitoring of instrumentation is done using DamPro software.

A dam break assessment was carried out simulating a failure of the Reventazón dam. Results of the analysis are kept internally, considered confidential and not shared with the public. The assessment includes various dam break scenarios with and without various floods and PMF (Probable Maximum Flood) and different breach parameters. The analysis is for the failure of the Reventazón dam only and does not include a cascade dam failure that considers the upstream dams.

Public safety and roads are considered in Chapter 11 of the EsIA due to the increased heavy vehicle traffic on community roads leading to an increase in exposure of the communities to risks and accidents.

Infrastructure safety monitoring is carried out throughout the implementation stage. This monitoring is well coordinated between the various work groups onsite and follows the Procedures for the Administration of Projects document (document number 20.00.001.2005) which describes roles and responsibilities for the phases of initiating, planning, executing, monitoring and quality control, and closing of project activities. Further details on quality control are provided under Management below. Monitoring was done continuously and relevant issues raised at weekly and bi-weekly meetings held by the planning and controls group and other meetings. Morning tailgate meetings reviewed daily activities, hazards and risks. Regular inspections are also carried out by the Engineering and Construction group based in San Jose, as well as by the panel of experts and the IE (Independent Engineer).

Specific risks monitored during the implementation of the project are described in the Final Report on Risk Management (*Gestión de Riesgos, Informe Final*). An example is meteorological risk, which was considered a high level risk that could result in delays and cost overruns, and was monitored closely, including electrical storms and lightning strikes. A July 2102 flood damaged the coffer dam, but the early warning system which advised of floods upstream allowed for workers and equipment to evacuate before the flood arrived on site. Another example is geological risks: land slips and seepage through components of the project were closely monitored as well as the quality of materials used for the construction of the structures which were monitored by the QC/QA members of the work component teams.

Criteria met: Yes

## Analysis against proven best practice

**Scoring statement:** *In addition, consideration of safety issues takes into account a broad range of scenarios and both risks and opportunities.*

A broad range of scenarios has been taken into account in consideration of safety issues for the project, tied in with assessments of risk. All of the major risks have been taken into consideration in the design of the project (e.g. such as hydrological, seismic, geological). There are numerous monitoring processes including cross-checks, such as: third party monitoring by the IE and external panel of dam experts, inspections at equipment manufacturing facilities, strict acceptance criteria once goods were delivered to site, and the work of the Planning and Controls Group.

ICE developed, owns and operates the only electrical storm and lightning detection network in the country. Together with the early warning system implemented along the Reventazón River (see Management), these systems allow warning of flood and electrical storms to be given to construction crews with sufficient time to stop work and evacuate workers at risk. Throughout the implementation phase the electrical storm and lightning early warning system available on OHS staff cell phones was able to alert workers of incoming electrical storms, and stop work until the risk subsided.

Opportunities to improve day-to-day community safety have been identified through the Environmental Management Unit's interaction with the communities, as discussed for traffic safety under Management below. ICE also designed an extensive network of instrumentation for the Project which was able to track the behaviour of the dam during the filling of the reservoir against the predictions made by of the 3-D model developed by SRK Chile. The instrumentation and monitoring of dam performance and associated infrastructure is considered by the IE and panel of experts to be state of the art.

Although ICE conducted a dam break analysis of the Reventazón dam, it is reported that it does not include cascade failure or the consequential failure of more than one dam. This is a gap, but is not considered significant as the volume of flows occurring with failure of any of the upstream dams is small compared to the flows considered in the dam break analysis (to be confirmed once study has been viewed).

Criteria met: Yes

## 5.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Processes are in place to address identified dam and other infrastructure safety issues, and to meet any safety related commitments, relevant to the project implementation stage, including providing for communication of public safety measures; a formal quality control program is in place for construction; safety management plans for the operation stage have developed in conjunction with relevant regulatory and local authorities; and emergency response plans include awareness and training programs and emergency response simulations.*

Plans and processes are in place to address dam and other infrastructure safety issues, such as the Quality Plans for each of the major work packages. The monitoring and inspections conducted by ICE staff, as well as review and advice by the external panel of experts, are in place to ensure that dam and infrastructure safety issues are identified and addressed during the implementation stage, and that they have also been considered for the operations stage.

ICE has formal processes for quality control and assurance throughout the implementation stage of the project that are well coordinated with the various work packages on site. The Quality Plan includes all processes oriented towards quality assurance and quality control as well as quality policies at the project level. The construction of the project was divided into work packages or components for example: powerhouse, dam, tunnel, spillway, intake, extraction of materials (river), concrete batch plant, and waste rock spoil areas (escombreras). Each work

package had an engineer, technical and support staff, quality control (QC) specialists (for example, for the dam, there were 3 QC specialists for each shift), an OHS/preventionist (for example at the dam there were 4 per shift) and an environmental representative to ensure compliance with the EMP).

Processes are in place to respond to identified and emerging geological risks which would lead to infrastructure failures. The following incidents occurred during the implementation phase and demonstrate the effectiveness of ICE's emergency plans and early warning systems as well as safety management planning:

- During the implementation stage of the project, a slope failure occurred in the spillway area, leading to significant increase in excavation and slope stability measures required for that area including the use of rock bolts and shotcreting. Workers were not injured when the incident occurred; and
- During the construction of the coffer dam in 2012, a flood event caused the coffer dam to fail. The early warning system was able to alert the construction site of the approaching flood and all workers and any mobile equipment were able to evacuate the area at risk.

ICE's engineers in cooperation with the experts will be implementing remedial works in March and April 2018 to address the following issues. Works will involve lowering the reservoir water level for a period of two months, installing post tensioned anchors to secure the spillway and relining the intake channel:

- Currently there is some seepage from one of the drainage galleries from one of the two diversion tunnels located on the left bank of the river;
- The left-most spillway bay has seepage between two concrete blocks, and the spillway joint may have opened up due to some slight settlement and the increased seepage through the dam may be caused by the underlying geological layer that is causing some hydrofracturing and pressure under the dam.

The early warning system for the lower Reventazón river basin has provided for communication to the public and stakeholders regarding flood risks during implementation, and will continue in operations. Water levels and flows are monitored upstream at the other ICE hydropower plants. The early warning system includes response or travel times for events triggered by floods or rainfall intensity. The document describing the early warning system refers to the installation of sirens in communities at risk along the river as well as using all national communication networks, and it includes evacuation routes that can be used by communities, and drills and simulations in cooperation with the emergency response authorities. Communications to surrounding communities regarding the reservoir filling were done by the environmental management unit and OHS staff (please see I-1 Communications and Consultation for more details). However, please refer to the significant gap concerning the commitment to alarms on I-20 Downstream Flow Regimes.

During implementation, the Reventazón project was the largest transport terminal of the region, with 59 buses, of which 35 were rented and 24 were owned by ICE, and 9 rented mini-buses to move a total of 2200 people morning and night during the peak workforce period. Most of the workforce is bussed in and out every day from the neighbouring communities. Prior to the construction phase, a number of measures were in place to address traffic safety and inform the public of them, for example:

- ICE re-paved and upgraded portions of the secondary road network (between Siquirres and the project site);
- ICE improved signage on roads (internal and external roads) in coordination with the Ministry of Public Works;
- ICE built sidewalks to the road from Florida to one of the waste rock soil areas (Escombrera 7), sidewalks in El Coco and other areas, increasing signage, and fences around school yards to prevent children from running out into the road;
- A participatory monitoring programme to ensure project, contractor, sub-contractor, and provider's vehicles did not speed on community roads, in which ICE gave speed guns to community members;
- GPS devices installed on all vehicles and systematic monitoring of their speed and location;



- A zero tolerance policy for working under the influence of alcohol or drugs and automatic dismissals for anybody who tested positive;
- All rented vehicles had mechanical inspections including brakes, lights, oil and all drivers of rented vehicles had safety induction; and
- Restricted access for the public to work areas indicated by fencing, signage and security gates.

All emergency preparedness and response procedures are detailed in the contingency or emergency plans that have been developed for specific components or period within the implementation phase, are well planned with responsibilities clearly identified, a few are listed as examples: Emergency Plan for Reservoir First filing, Emergency plan for first “wet” tests, Plan for disaster prevention, Early Warning System for Emergencies, and the emergency preparedness and response plan (“PADE”) for the operations phase.

Counterparts that participate in the coordination of emergency response and planning include the National Commission for Emergencies (“CNE” or Comisión Nacional de Prevención de Riesgos y Atención de Emergencias) which has a National Risk Management System and a National Plan for the Management of Risks as well as an internal committee that advises on hydrometeorology and rivers. Siquirres also has a Municipal Committee for Emergencies (“CME” or Comité Municipal de Emergencias) which plays a role in the implementation of efforts related to the organisation, preparation and response to emergency at the local level. Major responsibilities also lie with the local Red Cross, Fire Department and police force. The project’s emergency response plans include provisions for communications and awareness training to surrounding communities and people at risk (e.g. workers) as well as simulations which include external emergency response authorities and entities.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, processes are in place to anticipate and respond to emerging risks and opportunities; and public safety measures are widely communicated in a timely and accessible manner.*

On-going QC/QA, periodic inspections and bi-weekly Planning and Controls meetings ensure that project risks are identified and actions assigned as needed. Planning and Controls meetings occur every two weeks and go over all risks identified on the risk matrix and assess the need or follow-up on corrective measures put in place to address any of the materialised risks. Any materialized risks becomes a lessons learned. Meetings taking place every Thursday. There are numerous processes with checks and reviews to identify and respond to aspects of technical risk.

The early warning system in place in the basin for the upstream hydropower facilities has been extended to include Reventazón. The processes and details of the early warning system are reviewed by the local emergency response authorities and the communities are aware of procedures. Public safety measures regarding construction activities and roadwork, reservoir filling, as well as risks and emergencies, are well coordinated with the local authorities and police and emergency response teams and have been widely communicated. During implementation, emergency drills are carried out to ensure workers and management respond appropriately. However, public safety measures on the reservoir are not effective. This is a significant gap but is addressed on I-19 Reservoir Preparation and Filling.

Criteria met: Yes

## 5.2.3 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *Processes and objectives relating to safety have been and are on track to be met with no major non-compliances or non-conformances, and safety related commitments have been or are on track to be met.*

There is no formal dam safety legislation in Costa Rica; however, ICE has its own dam safety guidelines supplemented by widely used international standards that are applied to similar projects around the world. The management and coordination of the project ensures conformance with the established plans and processes that are in place. The IE and external experts that periodically conduct inspections confirm that state of the art methods have been used and that the quality of the construction was high.

All infrastructure safety commitments have been met (other than the commitment to install alarms – see below) and are on track to be met with the remediation works planned for 2018 on the spillway and dam.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

Ineffective public safety measures on the reservoir are discussed on I-19 Reservoir Preparation and Filling. There is a non-conformance with a commitment regarding a warning and alarm system immediately below the dam and powerhouse. The ESAP included a commitment to develop and implement a warning and alarm system to assure that downstream communities are notified when (a) regular operational or extraordinary but planned downstream flows are expected to abruptly increase, and (b) there are emergency releases or other emergency situations. The commitment stated that “this system must assure that downstream communities are trained and understand the different risk situation, understand what actions to take and what behaviours to avoid, and know who to contact in case of doubts or emergencies.” Although ICE has developed the early warning system for floods as described above, it does not concern regular operational or planned downstream releases, and it has not installed an alarm system to warn of increased flows. This is not considered as a significant gap against basic good practice as there are procedures to avoid abrupt increases in flow: CENCE’s operation protocol does not allow the entry into operation of more than one turbine simultaneously, and an operating procedure for the reservoir requires that there is no abrupt increase in spilling. However, there has been one fatality (a fisherman) in the critical section between the dam and powerhouse since operations began, reportedly due to sudden increases in flow (though the exact circumstances are not clear) and data on water levels downstream of the powerhouse (Estación Codo) show that levels do occasionally increase rapidly from around 1m to 2 m. Non-conformance with a commitment to install a warning and alarm system for regular operations is a **significant gap** against proven best practice.

Criteria met: No

## 5.2.4 Outcomes

### Analysis against basic good practice

**Scoring statement:** *Safety risks have been avoided, minimised and mitigated with no significant gaps.*

Major infrastructure safety risks from the perspective of dam and public safety, such as seismic, hydrological, geological and dam safety risks, have been taken into account during the design of project components and are being monitored and managed on an ongoing basis. The most significant infrastructure safety risks relating to dam safety have effective actions for avoidance, minimisation and mitigation of identified issues. There are no significant dam safety risks.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** Safety risks have been avoided, minimised and mitigated; and safety issues have been addressed beyond those risks caused by the project itself.

Safety risks have been avoided, minimised and mitigated, with the exception of the fatality mentioned above. The main safety issue that is beyond the risks caused by the project is flooding: the early warning system will provide improved communication of imminent flooding events to local communities, and the reservoir can be used to attenuate floods to some extent. In addition, the project measures for project traffic – training of workers who are local residents and participatory monitoring of traffic – may contribute to improved safety culture on roads, but is mainly intended as a mitigation measure. The use of the project ambulance in case of medical emergencies in the communities is a further example.

Criteria met: Yes

## 5.2.5 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no gaps against basic good practice

0 significant gaps

### Analysis of significant gaps against proven best practice

Non-conformance with a commitment to install a warning and alarm system for regular operations.

1 significant gap

## 5.3 Scoring Summary

Processes for testing, inspections and monitoring during project implementation are extensive, and include numerous forms of geological instrumentation, quality control and quality assurance processes, factory inspections for major equipment, IE and expert panel site inspections. Plans are in place for disaster management and emergency response. An early warning system is installed in the Reventazón river basin which includes five other hydropower facilities located upstream. Public safety measures regarding construction activities, road works, road hazards, and emergencies are coordinated with the local authorities, police and emergency response teams.

All basic good practice criteria are met. There are no gaps against proven basic practice other than the commitment to install alarms, and ineffective public safety measures on the reservoir, addressed on I-19 Reservoir Preparation and Filling. This results in a score of 4.

Topic Score: 4

## 5.4 Relevant Evidence

<b>Interview:</b>	2, 7, 35, 56, 79, 81, 83
<b>Document:</b>	2, 5, 12, 22, 32, 36, 37, 78, 109, 119, 126, 131, 139, 154, 186, 235, 237, 406
<b>Photo:</b>	49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70

## 6 Financial Viability (I-6)

This topic addresses project financial management, including funding of measures aimed at ensuring project sustainability, and the ability of the project to generate the required financial returns to meet project funding requirements. The intent is that the project is proceeding with a sound financial basis that covers all project funding requirements including social and environmental measures and commitments, financing for resettlement and livelihood enhancement, and delivery of project benefits to project-affected communities.

### 6.1 Background Information

Economic challenges presently faced by Costa Rica include a deteriorating fiscal situation and issues of inequality. ICE Group has been in a process of modernising and increasing efficiencies its business, including containing costs and operating expenses. ICE's statement of income and expenditure has shown some swings year-by-year, influenced by currency exchange rates, but it has maintained its earnings and debt indicators over the past 3 years. ICE Group's operating surplus in 2015 was around USD 32 million. ICE actively analyses and hedges contracts to mitigate currency exchange risks, and can access external financing. ICE is actively implementing processes to align with International Financial Reporting Standards.

A Special Purpose Vehicle, in the form of a fiduciary trust (the "Trust"), approved by the Controller General in September 2013, is the developer of the Reventazón Hydroelectric Project (PHR). The Trust was formed by ICE and Scotiabank, and represents six financial institutions. PHR funding consists of USD 475.4 million (34.5%) from ICE as equity, and loans totalling USD 903.7 million (65.5%) to the Trust from:

- Inter-American Development Bank (IDB), providing an A-Loan of USD 200 million and B-Loan of USD 135 million;
- International Finance Corporation (IFC), providing USD 100 million and
- Four Costa Rican banks with loans totalling USD 468.7 million (Banco de Costa Rica, Banco Nacional de Costa Rica, Banco Popular y de Desarrollo Communal, and Banco Crédito Agrícola de Cartago).

The Trust as Borrower, the six Senior Lenders, and The Bank of New York Mellon as Intercreditor Agent, signed a Common Terms Agreement on 20 December 2013. The Trust appointed ICE through an Engineering, Procurement and Construction (EPC) contract to develop PHR. After construction is complete, ICE will lease the plant from the Trust, and will be responsible for operation and maintenance under the lease. All electricity generated will be sold by ICE.

Under its constitution, ICE's financial policy is to use any profits that it makes from electricity sales to invest in national electrification plans and the promotion of industry that is dependent on electric power. The Government of Costa Rica cannot profit from ICE, and ICE is exempt from paying national and municipal taxes.

### 6.2 Detailed Topic Evaluation

#### 6.2.1 Assessment

##### **Analysis against basic good practice**

**Scoring statement:** *An assessment has been undertaken of project financial viability, including project costs and revenue streams, using recognised models and including risk assessment, scenario testing and sensitivity analyses; and monitoring of the financial situation during project implementation is being undertaken on a regular basis.*

Financial analyses have been undertaken at various stages in development of the PHR, including:

- Financial analysis presented in the 2008 EMP;
- Financial analysis presented in the 2009 Feasibility Report;
- A comprehensive review by IDB in 2011;
- ICE's review of project costs in 2013 following a major flood in 2012; and
- Financial modelling underpinning the Trust agreements signed in 2013.

The 2009 financial analysis compared investment flows and operating expenses against expected income flows. As there was no electricity market or contract energy sales, revenues were calculated using 2008 rates set by the regulator, ARESEP, for sale of high-voltage generation. Project cost estimates and the annual distribution of financial repayments were made by ICE's Department of Economic Engineering. This analysis showed an internal rate of return for PHR of 9.65%, higher than ICE's expected rate of return of 8.20%, and a Net Present Value (NPV) of USD 114.4 million. Sensitivity analyses were conducted to test changes in the electricity price, annual generation, and project development costs. Alternative financing scenarios were included in the scenario testing, with analyses considering the cost of financing, interest rate, and effects on profitability. Based on this financial analysis, the ICE Board of Directors approved the PHR in April 2010.

Financial monitoring during implementation was undertaken through a number of processes. The project control unit tracked costs and issued financial reports. Reporting requirements set out in the Trust's Common Terms Agreement include quarterly and annual financial statements and reports, and notices on a number of matters including project changes, litigations, defaults, compliance, budgets, costs, schedules, and reports of the Independent Engineer. The Independent Engineer reports were important to verify payments of milestones in the financial agreement. Independent financial audits were also conducted.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, project costs and revenue streams are fully detailed; and financial viability of the project has been analysed and optimised including extensive scenario testing, risk assessment and sensitivity analyses.*

Many of the costs used in the 2009 analysis were based on preliminary designs. Cost estimates were tightened and refined iteratively over the next few years and in particular leading up to the financial agreement with the lenders. Following agreement with the lenders, the budget for the project totalled USD 1 380 million. This included direct project construction costs contained within the EPC Contract (USD 1 168 million) as well as operating costs for the Trust (USD 5.2 million), financing costs (USD 156.6 million), and debt servicing (USD 49.0 million).

The financial model developed with the lenders includes a model of debt and lease service calculation, month-by-month during the construction period relevant to the agreement (2013-2016), and annually from 2017 to 2033. Assumptions about interest rates for the USD and for the Costa Rican colon are set out in the financial model, as they are linked to debt service calculations. Considerations in the modelling include all costs, fees and expenses, disbursement amounts, cash balances, debt/equity ratio, accumulated capital, accumulated debt, and interest rates.

With the iterative financial modelling and cost updates, and the rigorous review of the lenders, the processes of evaluating the project financial situation satisfy these proven best practice criteria. Risks are extensively considered in the Trust agreements.

Criteria met: Yes

## 6.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Measures are in place for financial management of project implementation; plans are in place for financial management of the future operating hydropower facility.*

Financial management during project implementation and operation is guided by the terms of the Trust's Common Terms Agreement, a 323-page contract establishing all aspects of the financial agreement between the Trust and the lenders. It states the disbursement and repayment schedule and procedures, and how a number of areas of risk will be managed (e.g. interest rate fluctuations, default in repayments, exchange rates, increased costs and expenses, taxes, cancellations by either party, bankruptcy, insolvency). Expectations regarding financial planning, budgeting and reporting are all clearly established. Expectations are also set out regarding a number of matters including insurances, labour, environmental and social matters compliance, governing law and enforcement.

The final itemised project construction budget is outlined (e.g. for the dam, main powerhouse, ecological powerhouse, land acquisition, environmental and social plans etc), with clarity on the contributions from ICE's equity contribution and Trust financing for each item. The repayment schedule during operation is set out year-by-year between 2017 and 2033 for payments to IDB for the A Loan and B Loan, to IFC, and to each of the four Costa Rican banks, in Annex E of the Common Terms Agreement and in the Trust's financial model.

Article V of the Common Terms Agreement sets out the lenders' requirements for financial management of the PHR. Financial management processes include but are not limited to: maintenance and tracking of a budget; delegations on financial decisions; installing and maintaining an accounting and control system; developing a management information system; implementing a system for financial controls; maintenance of financial records that give a fair and true view of the financial condition; submission of regular financial reports; conformity of financial reports with Accounting Standards; and appointment and use of independent financial auditors.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, financial management plans provide for well-considered contingency measures for all environmental and social mitigation plans and commitments; and processes are in place to anticipate and respond to emerging risks and opportunities.*

Whilst the technical aspects of the budget were examined in detail by the banks, and contingency assigned to each component based on an evaluation of risks and uncertainty, it is not evident that the same level of attention was paid to consideration of budget contingencies for implementation of the environmental and social management plan. During the due diligence assessment by the Lenders, the Independent Engineer tested if the amount for contingency on the engineering aspects met their requirements. For the environmental and social aspects, the focus for the Lenders was on scoping the programme and ensuring budget and human resource capacities to deliver a much more comprehensive and multi-faceted environmental and social program.

Actual environmental and social management costs to date have totaled around USD 41.2 million, which have significantly exceeded the budget of around USD 31.7 million. All costs for implementation of environmental and social management commitments during project construction would not be fully accounted for in expenditure to-date, as several outstanding items from the environmental and social management programme are still to be delivered. In examination of plans and reports for various environmental and social programmes, budgets were often presented as preliminary and time-limited (e.g. first 3 years). No contingency allocations are apparent. The absence of well-considered contingency measures for environmental and social mitigation plans and commitments is a **significant gap** against proven best practice.

Processes were in place to respond to emerging financial risks including extensive financial monitoring and reporting requirements and independent supervision. According to the EPC Contract, quarterly payments were made based on the actual progress expressed as achievement of payment milestones. The payment milestones and the earliest payment date were specified in the contract. The Independent Engineer verified progress and authorised payment or partial payment in accordance with the payment milestones.

Important processes that contributed to ICE's ability to contain the costs of construction included very close tracking of and managing to stay on the project critical path, creating a culture of accountability, the use of interdisciplinary committees, and a very hands-on approach by the Project Director meeting with all team managers regularly.

Any claim based on unforeseen difficulties is considered a part of ICE's equity contribution to the contract and does not affect the budget for the part covered by the lump-sum EPC contract. The EPC Contractor has designated an amount totaling USD 50 million for escalation and unforeseen within the internal project budget (shown as "Unallocated Expenses"). The Independent Engineer verifies the claims, to ensure they are substantiated and the corresponding value defined based on actual costs.

An important process that enabled ICE to respond to emerging financial opportunities was the financial modelling and scenario testing undertaken at the start of the project, including of potential financial arrangements. This work enabled ICE to clearly articulate its needs and look for these in negotiating financial arrangements. Negotiations for project finance commenced in 2010 and were closed in 2013, and a number of ICE objectives were successfully realised in the final financial structure, for example regarding participation of the private banks, timing to bring the project into operation, longevity of the loans, and involvement of the local banks.

Criteria met: No

## 6.2.3 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *Processes and objectives relating to financial management have been and are on track to be met with no major non-compliances or non-conformances, and funding commitments have been or are on track to be met.*

More than 50 contracts and agreements were established for PHR. The principal financial documents are: the Infrastructure Trust Agreement between the Scotiabank and ICE, signed 22 May 2013, that created the Trust; the Trust's Common Terms Agreement between Scotiabank, the six Senior Lenders and the Intercreditor Agent, signed 20 December 2013; and the EPC Contract to engineer, procure and construct PHR, between the Trust and ICE.

Other important documents which have financial aspects include but are not limited to: loan agreements with the lenders, equipment supply agreement, insurance and reinsurance policies, Interconnection Agreement, Operation Agreement, and leasing agreements for the PHR between the Trust and ICE.

Article V of the Trust's Common Terms Agreement sets out the loan covenants. These are the conditions that ICE must fulfil, and cover a diverse array of considerations both on conditions that must be met and conditions that should not arise. On the financial side, ICE must meet the financial management measures stated under the Management criterion, must maintain a cash balance of at least USD 2 million, and must meet a number of financial reporting requirements, for example.

All financial processes, commitments and obligations are met or are on track to be met.

Criteria met: Yes



## Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

There were some non-conformances in the financial indicators of the lenders in relation to earlier commissioning and due to a change in accounting standards. These are not considered significant non-conformances by the lenders. ICE maintained very good relations with the lenders, and if any issues were emerging would alert them to discuss how to proceed rather than waiting for a non-conformance to be identified. Other than matters that were discussed and agreed by all parties, there have been no non-compliances or non-conformances with regards to the financial agreements and commitments.

Criteria met: Yes

## 6.2.4 Outcomes

### Analysis against basic good practice

**Scoring statement:** *The project or the corporate entity to which it belongs can manage financial issues under a range of scenarios, can service its debt, and can pay for all plans and commitments including social and environmental.*

Scenarios and risks have been extensively tested by a large number of parties with a stake in the project over a period of years. The iterative financial modelling, scrutiny and testing of financial modelling and assumptions by the lenders, control of project costs, building of numerous safeguards into financial agreements, and careful planning all support a high degree of confidence in the financial viability of the project.

Some of the most significant risks are already in the past, notably the ability of ICE to obtain timely financing and the containment of project construction costs. ICE successfully delivered construction of the PHR under-budget in terms of the direct costs of construction plus engineering supervision and administration (USD 1,234 million in budget; USD 1,192 million actual). However, financial costs were USD 70 million higher than budgeted, at USD 281 million compared to USD 271 million.

Although all social and environmental programme delivery costs are not yet accounted for, there is still room in the construction budget to cover these, the Trust withholds an EPC Contract amount in reserve (USD 2 million) until these items are complete, and rolling programs will be built into and funded through the operation stage ESMP which is currently receiving close scrutiny by the lenders.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *The project can manage financial issues under a broad range of scenarios.*

Future risks regarding revenues might arise in relation to sufficient tariffs to cover PHR costs (ICE has made a case to ARESEP, the electricity regulator, which is in a process of evaluation) or in relation to climate change impacts affecting inflows to the reservoir (a national climate change study has been conducted and risks of impact to PHR's viability are very low). Operating costs are considered very low for projects such as PHR, and they carry a high degree of certainty. Extreme natural disasters such as earthquakes or volcanoes could arise but these go beyond the scope of this criterion. The lenders are satisfied that they have stressed all of the main variables in the financial model, and influential variables such as exchange rates, tariffs etc can be managed. The lenders extensively analysed the robustness of ICE as an institution, since they have to cover debt payments and operating costs. Valuation of financial risks of ICE was undertaken by individual lenders. Risks of ICE failing are extremely low, given that it is a semi-autonomous institution backed by the State. All analyses and safeguards indicate that the project can manage financial issues under a broad range of scenarios.

Criteria met: Yes



## 6.2.5 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

The absence of well-considered contingency measures for environmental and social mitigation plans and commitments.

1 significant gap

## 6.3 Scoring Summary

PHR has been developed with an innovative financial structure involving a Special Purpose Vehicle created in the form of a Trust. A number of financial analyses have been conducted, with progressively more detailed understanding of costs and terms of finance, leading to a conclusion of financial viability under a broad range of scenarios. Extensive requirements on financial management, monitoring, reporting and independent oversight were embedded in the project development. The project was developed with careful cost controls, and the direct costs of construction came in below budget. However the environmental and social management budget was exceeded and with hindsight would have benefited from greater detailing of costs and contingencies. There is one significant gap against proven best practice resulting in a score of 4.

Topic Score: 4

## 6.4 Relevant Evidence

<b>Interview:</b>	10, 33, 37, 48, 57, 84, 86, 91
<b>Document:</b>	36, 72, 192, 193, 244, 245, 250, 410-421
<b>Photo:</b>	3

## 7 Project Benefits (I-7)

This topic addresses the additional benefits that can arise from a hydropower project, and the sharing of benefits beyond one-time compensation payments or resettlement support for project-affected communities. The intent is that opportunities for additional benefits and benefit sharing are evaluated and implemented, in dialogue with affected communities, so that benefits are delivered to communities affected by the project.

### 7.1 Background Information

This topic focuses on benefit-sharing and additional benefits for affected communities. Impacts on affected communities including economic displacement are addressed in I-9 Project-affected Communities and Livelihoods, and issues related to physical displacement are addressed under topic I-10 Resettlement.

Affected communities include settlements located around main roads on both left and right banks of the reservoir and in the vicinity of the project site (in the Área de Influencia Directa, AID), downstream communities potentially affected by altered river flows and sedimentation dynamics in the downstream Reventazón and Parismina Rivers, and the town of Siquirres, potentially affected by in-migration by people seeking employment on the project.

### 7.2 Detailed Topic Evaluation

#### 7.2.1 Assessment

##### **Analysis against basic good practice**

**Scoring statement:** *Opportunities to increase the development contribution of the project through additional benefits and/or benefit sharing have been assessed. In the case that commitments to additional benefits or benefit sharing have been made, monitoring is being undertaken on delivery of these commitments.*

ICE did not separately assess opportunities to increase the development contribution of the project. However ICE identified, in the EsIA and the Social Management Plan (Plan de Gestión Social of 2012), measures to address impacts on affected communities that could provide on-going benefits, if maintained. Many of these were framed in the context of enabling AID communities to adjust to demographic and economic change. For example, the following measures were identified in the EsIA: paving of the main road on the left bank (Ruta 415); priority employment to AID residents, and especially San Joaquin residents; surfacing the road to San Joaquin; health, water supply and multi-purpose infrastructure in a range of communities; the provision of organizational and leadership skills; the extension of telephone services and electricity to AID communities; reservoir management to enhance use of the reservoir for tourism; and collaboration with the Municipality of Siquirres on waste management.

ICE reported regularly on the delivery of its commitments to community infrastructure in AID communities, as part of reporting to SETENA. In addition, the delivery of commitments was discussed in regular community meetings from 2009 to 2017 (a total of 456 meetings, attended by 4791 persons), and from December 2016 to March 2017, ICE held a series of meetings in AID communities to officially close their relations and to sign agreements on the delivery/closure of commitments.

Criteria met: Yes

##### **Analysis against proven best practice**

**Scoring statement:** *In addition, the assessment of delivery of project benefits takes into consideration both risks and opportunities.*

There is no evidence of an assessment of opportunities to increase the development contribution of the project through additional benefits or benefit-sharing, or of risks to the benefits provided to-date. An assessment might have identified maintenance as a key risk, and the opportunity to provide an ongoing benefit-sharing mechanism. This is a **significant gap** against proven best practice.

Criteria met: No

## 7.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Measures are in place to deliver commitments by the project to additional benefits or benefit sharing; and commitments to project benefits are publicly disclosed.*

ICE has delivered the following commitments, which will deliver ongoing benefits if maintained (this list does not include measures that concern mitigation of potential impacts only such as sidewalks and fencing for traffic-protection in Florida):

- Paving (asphalting) of Ruta 415 from Alegría to the plain beyond Bonilla, with sub-base, for 14.7 km;
- Paving of a 4.5 km road to San Joaquín;
- Improvement of the road to El Llano (3.3 km);
- Installation of a wider bridge over the Peje River between Florida and El Cruce;
- Two classrooms and an assembly room for Florida School, and a classroom in Pascua;
- EBAIS (Equipo Básico de Atención Integral en Salud, i.e. rural health clinics) to meet standards of CCSS (Caja Costarricense de Seguro Social in Florida, El Coco, and Santa Marta (extension));
- New water supply facilities in Florida, El Coco-Moravia, Pascua, Guayacán, Baja 52, Bonilla, and Lomas;
- 'Multi-purpose Rooms', i.e. community halls in Florida, El Coco, La Alegría, El Cruce, Bonilla, Santa Marta, Guayacán, and Baja 52 (improvements) and recreational facilities, including an all-weather pitch in Florida;
- A police station serving communities on the left bank, in La Alegría (100 m<sup>2</sup>);
- Residential telephone connections on the left margin from Lomas to Bonilla along Ruta 415, and on the right margin from Moravia to Guayacán; and
- Electricity connections according to community needs, i.e. a total of 19 cases on the left bank in Lomas, El Llano-Cazorla, and San Antonio.

ICE also provided a local capacity development programme for AID communities, though this tended to focus on people affected by land acquisition. Activities included strengthening productive activities (pasture, livestock), product development (cheese-making etc); and organisational strengthening (literacy, accounting, leadership, business management). In addition, ICE provided many affected people from the AID area with preferential employment during PHR construction, and ongoing employment in some cases. This has included on-the-job training, and some employees have been able to take employment facilitated by ICE following their demobilisation from PHR.

ICE used a procedure for the implementation and monitoring of community works (PHR-GA-06). This sets out criteria for prioritisation, scheduling, coordination with regulating authorities; land acquisition, design, permitting, construction and follow-up. It included responsibilities of ICE's environmental coordinator, community relations coordinator, and engineers, including their responsibilities for liaison with SETENA and other authorities (for example EBAIS construction requires coordination with the Ministry of Health, and water supplies with the respective ASADAs, i.e. Asociaciones administradoras de los Sistemas de Acueductos y Alcantarillados Comunes).

In addition, ICE and the Municipality of Siquirres made an agreement early in PHR implementation that encompasses the delivery of a range of benefits, including the development and implementation of an integrated waste management plan (with a landfill site). It also included support for the municipality to develop various

strategic plans such as a Human Local Development Plan, and a management plan for the micro-catchment of the Siquirres River. The latter plan exists on paper (dated 2015) but its status is unclear. Few of the plans in the agreement were put in place, as disagreement between the Siquirres council and its administration stalled progress. Separately, ICE delivered a gymnasium as a benefit to Siquirres town.

Commitments to project benefits were publicly disclosed through community meetings, in particular at an 'Environmental Fair' in 2012, at which ICE signed agreements, setting out commitments in the EMP, with community representatives. These commitments and agreements were documented in a publicly-disclosed 'Socio-Environmental Responsibility Protocol' document.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, processes are in place to anticipate and respond to emerging risks and opportunities.*

During implementation, ICE could respond to emerging risks and opportunities through the issues and suggestions raised by AID communities. For example, the San Joaquin community raised a complaint concerning inadequate drainage of the San Joaquin road, leading to erosion and the collapse of the road in one section, as seen during this assessment. This resulted in municipality plans to repair the road. In some cases, for example complaints regarding telephone connections, ICE's response has been slow. This issue of limited or slow responses to grievances raised is addressed on I-9 Project-affected Communities and Livelihoods.

However, there were or are no processes in place to anticipate and respond to emerging risks and opportunities, as follows:

- ICE did not replace the failed agreement between ICE and Siquirres Municipality with any other mechanism to respond to suggestions or requests for benefits outside of AID communities, for example from downstream communities; this is a significant gap, but is the same as discussed under Conformance/Compliance below;
- There are no processes to respond to the risk that facilities provided by ICE during project implementation will be maintained. This has already been seen with road maintenance issues with the San Joaquin road and Ruta 415 near Pasqua / Bonilla. Some government agencies have a poor reputation for maintenance (such as CONAVI, Consejo Nacional de Vialidad or the National Roads Board). ICE's finiquito (termination or settlement) documents describe the works completed in each case (an example was seen for the La Alegría multi-purpose hall) and may include mention of maintenance responsibilities but ICE was able to provide only one example of reference to maintenance in a finiquito document;
- There is no mechanism to respond to emerging opportunities to provide benefits for affected communities during the operation stage. As a state-owned entity, ICE is not able to provide a fixed proportion of revenues without a change in the law, but there is also no mechanism for providing occasional benefits.

The absence of a mechanism to respond to maintenance risks or future opportunities to provide benefits, and to ensure that benefits are significant and sustained, is a **significant gap** against proven best practice.

Criteria met: No

## 7.2.3 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *Processes and objectives relating to project benefits have been and are on track to be met with no major non-compliances or non-conformances, and any additional benefits or benefit sharing commitments have been or are on track to be met.*

Until recently, certain commitments had not been met (the police station and water supplies in Guayacán and Florida). However there are now no major outstanding non-conformances and no non-compliances.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

There is no evidence of any non-compliances with the law. Failure to deliver the commitments set out in the agreements between ICE and Siquirres Municipality, resulting from disagreement within Siquirres Municipality, is a non-conformance (and a **significant gap** against proven best practice). It is not considered a major conformance at the level of basic good practice as PHR impacts are limited in Siquirres Municipality outside of the AID.

Criteria met: No

## 7.2.4 Outcomes

### Analysis against basic good practice

**Scoring statement:** *Communities directly affected by the development of the hydropower project have received or are on track to receive benefits.*

AID communities, with the exception San Antonio, have received the benefits described above. Assuming these facilities are maintained, PHR will have contributed to ongoing development in AID communities.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, benefits are significant and the project has delivered or is on track to deliver significant and sustained benefits for communities affected by the project.*

Some of the benefits for AID communities are significant, such as the surfacing of roads, and the significant number of works supported in Florida. In other AID communities, benefits are relatively minor (for example a classroom in Pascua) and ICE did not support any infrastructure in one community, San Antonio. As discussed under Management above, there is no mechanism for ensuring the maintenance of the infrastructure supported during construction or to provide additional benefits in future. Some local stakeholders have raised the possibility of an ongoing 'royalty' benefit, which might enable Siquirres municipality to address high rates of unemployment (apparent since construction ceased) and to develop plans to attract foreign investors. The absence of a mechanism to respond to maintenance risks or future opportunities to provide benefits, and to ensure that benefits are significant and sustained, is a **significant gap** against proven best practice.

Criteria met: No

## 7.2.5 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

There is no assessment of opportunities to increase the development contribution of the project through additional benefits or benefit-sharing, or of risks to the benefits provided to-date.

There is no mechanism to respond to maintenance risks or to future opportunities to provide benefits and ensure that benefits are significant and sustained.

Non-conformance with the commitments set out in the agreement between ICE and Siquirres Municipality.

2 or more significant gaps

### 7.3 Scoring Summary

ICE initially identified measures to address impacts demographic and economic change amongst affected communities that, if maintained, could provide on-going benefits, in the EsIA and the Social Management Plan. The project delivered a range of social infrastructure projects such as roads, a bridge, water supplies, health clinic buildings, and school classrooms, and delivered a local capacity development programme. Some of the benefits for AID communities are significant, such as the surfacing of roads.

Commitments to project benefits were publicly disclosed through community meetings, in particular at an 'Environmental Fair' in 2012, and ICE reported regularly on the delivery of its commitments in regular community meetings.

However, there are three significant gaps against proven best practice, resulting in a score of 3. There was no assessment of opportunities to increase the development contribution of the project through additional benefits or benefit-sharing that considers risks and opportunities. Secondly there were and are no processes to respond to risks associated with the agreement with Siquirres Municipality, or risk of a lack of maintenance by other authorities, and no mechanism to continue to provide benefits during the operation stage. Because of this, there is a risk that benefits will not be significant and sustained. Thirdly limited implementation of the Siquirres Municipality agreement is a non-conformance.

Topic Score: 3

### 7.4 Relevant Evidence

<b>Interview:</b>	1, 14, 22, 41, 43, 47, 49, 74, 78
<b>Document:</b>	10, 15, 18, 118, 135, 153, 161, 162, 168, 272, 275, 435, 436, 474
<b>Photo:</b>	21, 71-83

## 8 Procurement (I-8)

This topic addresses all project-related procurement including works, goods and services. The intent is that procurement processes are equitable, transparent and accountable; support achievement of project timeline, quality and budgetary milestones; support developer and contractor environmental, social and ethical performance; and promote opportunities for local industries.

### 8.1 Background Information

The key law governing ICE's procurement processes is Law No. 8660 Strengthening and Modernization of Public Entities of the Telecommunications Sector. The Public Procurement Act, Law No. 7494, and its rules are applied for any areas not address by the provisions in Law No. 8660.

ICE has a handbook for all of its administrative rules regarding procurement. This contains: Law 8660; Regulations to Article II of the Law No. 8660; Internal Administrative Contract Regulations; Regulation for Internal Approval of Contracting and Conventions Not Subject to Endorsement of the Controller General; Reform of the Donation Regulation; Open Type Regulation; and Regulation of Acquisitions.

### 8.2 Detailed Topic Evaluation

#### 8.2.1 Assessment

##### Analysis against basic good practice

**Scoring statement:** *Major supply needs, supply sources, relevant legislation and guidelines, supply chain risks and corruption risks have been identified through an assessment process; ongoing monitoring is being undertaken to monitor effectiveness of procurement plans and processes.*

ICE considered procurement needs and planning in the 2009 PHR Feasibility Report. This outlined major purchase items, resources, timing, and processes needs. A variety of models were used for planning purposes to determine volumes, specifications, and timing needs.

More than 65% of the direct project costs were for machinery (25%), materials (24%), and equipment, furniture and tools (16%). Machinery included items such as articulated trucks, excavators, tractors and compactors, and was significant in PHR because of the large magnitude of excavations, fillings and spoils management. Major materials included aggregate, cement and steel. The major electro-mechanical equipment was for the main powerhouse, ecological powerhouse and substation (e.g. turbines, gates, transformers). Other major procurement requirements included land and easements (addressed in I-9 Project-affected Communities and Livelihoods), labour (addressed in I-12 Labour and Working Conditions), and goods and services associated with needs of the workforce (e.g. travel, transportation, lodging, meals, training, furniture, and equipment). A number of engineering and other professional services were also contracted, such as for independent advice, review and audits.

Construction planning in the Feasibility Report considered the timing and cash flow required to ensure that all items would be available for works when needed. Time-planning included preparation, evaluation and awarding of contracts, and follow-up such as legalisation, engineering and other approvals and permits, submission of purchase orders, factory acceptance testing, shipping documents, site checks, provisional acceptance and final acceptance. Construction planning considered the inter-linkages of financing and cash flows with procurement needs, steps and timing.

ICE's procurement teams had a good understanding of relevant legislation and guidelines, as well as the roles of the respective areas within the ICE Group involved in procurement (described under Management).



ICE considered supply chain risks in relation to timing in its construction planning. There were no significant risks identified in relation to availability of materials or equipment. ICE has a good understanding of corruption risks and manages such risks by adherence to the procurement processes required by law. The lenders and the Controller General of Costa Rica conducted reviews of major tenders.

Ongoing monitoring during project implementation paid close attention to the critical path and any risks arising from procurement that could put the critical path at jeopardy. The PHR procurement team was at site and was part of the integrated management processes described in I-4 Integrated Project Management. Each contract had a contract manager assigned who could identify any issues arising or respond to issues and needs identified from other sources. Transport and quality were risks which were monitored and managed through measures such as quality control inspections at critical steps, and requirements for insurance guarantees. Examples of major risks arising were delays in the delivery of the gates and delay in the completion of the bidding process for the substation; these were identified and acted on in a timely manner.

Complaints concerning local procurement prompted tightening of procedures where risks became evident (e.g. with local procurement of machinery discussed under Management).

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, the assessment includes opportunities for local suppliers and local capacity development.*

The Feasibility Report included consideration of national versus international sources of major project needs, and estimated likely areas where international sources would be necessary. An objective of the Social Management Plan 2012 was to seek to contract suppliers of machinery and transport equipment from communities in the directly-affected area (Área de Influencia Directa, AID).

ICE undertook an evaluation of local supply sources in 2009 and in September invited suppliers to attend a meeting to inform them about opportunities and processes arising with PHR. There were about 55 attendees at this meeting, which was well documented with signatures of meeting attendees and detailed minutes. From ICE's side, members of the social and the procurement teams attended. ICE outlined the legal requirements that ICE must meet, the procedural requirements, and the principles that ICE must adhere to including efficiency, effectiveness, transparency, open competition, equality, and good faith.

Criteria met: Yes

## 8.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Measures are in place to guide procurement of project goods, works and services and address identified issues or risks, and to meet procurement related commitments.*

In addition to the administrative rules set out in the Background section, the ICE Procedure for Management of Projects (2016) sets out the need for procurement planning to be included within the overall project management plan. The PHR Project Management Plan (2015) describes the role of the Supply and Materials Management Unit, and its responsibilities in carrying out petty cash purchases, direct contracting and bidding, effective storage and dispatch of goods, payments to suppliers, and claims management.

All ICE project procurement goes through a stepped process:

1. Project planning is done by the electricity business Planning and Development Unit, as part of the work done in the feasibility stage and preparation of project management and construction management plans;

2. The project's Supply Unit prepares relevant Requests for Proposal (RFP) documentation according to procedural requirements;
3. The ICE Group Procurement area reviews RFPs against administrative rules, publishes notifications, receives bids, evaluates bids, selects the winning bid, and issues purchase orders. Public tenders have four evaluations, on technical, economic, financial and legal grounds;
4. Contract execution goes back to the PHR Supply Unit, and a contract manager is assigned. This is to ensure the contractor delivers on all requirements in the RFP and delivery can be signed off to authorise payments.

Procurement-related commitments included opportunities for local suppliers, and following bank's requirements.

Processes allowing opportunities for local suppliers included investigating local supply sources, meetings, informing local suppliers about opportunities with the PHR, maintaining a local supplier register, and providing this register to major contractors. Whilst legally ICE was required to evaluate a local supplier on equal terms to all other bidders in accordance with contract law, it also made a public commitment to communities to prioritise local recruitment for human resources and machinery. ICE made a number of commitments to assist awareness of local suppliers of PHR's procurement needs, particularly in the form of advertising and provision of information. The need for a security guarantee was of concern for many local businesses, so most local attention was directed to smaller purchasing requirements and those that could be directly contracted.

ICE maintained a register of 66 local suppliers, with the business name, business activities, contact person or owner, location, and contact details (phone, fax, email, mailing address). Types of business activities on this list include general hardware, vehicles, equipment, machinery, vehicle repairs, air conditioning repairs, machinery parts, aggregate, construction materials, wood, combustibles, glass and windows, computer equipment, clothing, various food services, medicine, dentistry, books, agricultural suppliers, cleaning, and engineering.

Inter-American Development Bank (IDB) policies guided procurement processes for agreed major items, specifically GN-2349-7 Policy for Procurement of Works and Goods Financed by the Bank and GN-2350 Policy for Selection and Employment of Consultants Financed by the Bank. These policies were included in full in a national government gazette notice in April 2009. GN-2349-7 addresses fraud and corruption, procurement planning, international competitive bidding processes, other methods of procurement, preferences for domestic goods, bank review procedures, and guidance for bidders. IDB required public notices to be published in their IDB Journal, and timeframes are longer because of the need for IDB approvals.

Annex X of the Infrastructure Trust Agreement sets out Regulations on Procurement of Goods and Services for PHR. Four acquisition processes were agreed, with differing advertising, timeframes, number of offers, and review or appeal rights, depending on the value of the acquisition, as follows:

- International public tender for acquisitions more than USD 500,000;
- Private competition for acquisitions between USD 100,000 to USD 500,000;
- Price comparisons for acquisitions between USD 20,000 and USD 100,000; and
- Direct purchase, for acquisitions less than USD 20,000.

The most significant public tenders were for eight items shown in the following table.

Item	Contractor	Financing
Main Power House Turbines	Andritz Hydro, Austria	CABEI <sup>1</sup>
Main Power House Cranes	Power Systems, China	CABEI
Ecological Power House	Andritz Hydro, Austria	CABEI
Spillway Gates	SUMEC, China	IDB
Cleaning System for Main Intake Gates	Cesari Hydro SPA, Italy	IDB
Cleaning System for Ecological Power House Intake Gates	Cesari Hydro SPA, Italy	CABEI

Substation	Siemens – Inabensa, Costa Rica	IDB
Transformers	Siemens – Inabensa, Costa Rica	IDB

<sup>1</sup> Central American Bank for Economic Integration

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, processes are in place to anticipate and respond to emerging risks and opportunities; sustainability and anti-corruption criteria are specified in the pre-qualification screening; and anti-corruption measures are strongly emphasised in procurement planning processes.*

An important process element to manage procurement risks is the separation of the project-level Supply team from the ICE Group Procurement team. This separation ensures that relationships with contractors developed during contract execution do not influence selection of contractors for future tenders.

Emerging risks were identified through bid review processes, auditing processes, complaints processes, and Controller General review and legalisation of awarded contracts. Processes to manage contract delivery milestones included clear specifications on milestones, application of fines, requirements for insurances and security deposits, and holding of performance guarantees.

A “tender on demand” approach with the short tender process helped manage both risks and opportunities. In these tenders there is no cap on the volume that will be delivered. The initial contract is for one year, but can be extended to five years. This enables ICE to see how the contractor performs and to make a decision each year if the contract will be extended or not, based on an annual review. PHR contracts managed in this fashion included contracts for the supply of steel, food, office suppliers, and tyres.

ICE found that there was a very high degree of engagement from national suppliers given the high national profile of PHR, but not so high on the international side. A major project delay risk arose with supply of gates from a contract awarded to the Chinese SUMEC Consortium (Sinohydro and Jiajiang Hydraulic Machinery Co. Ltd). ICE was able to recognise and elevate response to this risk because of (1) its very close tracking of the PHR critical path, (2) the establishment of PHR as a project of national interest, and (3) its status as a national government business enterprise. ICE requested and received political assistance in putting pressure on SUMEC to perform according to contract, and assigned supervising staff to the manufacturing facilities in China to control day-to-day production, quality and progress. These steps were successful in addressing the identified risk.

Independent reviewers and ICE’s good relations with the lenders helped address some procurement risks that emerged. An example is a contracting impasse that arose relating to delivery of a resettlement completion audit. The Independent Environmental and Social Monitoring Consultant (IESMC) reported in June 2017 that this issue needed to be escalated for ICE to meet project closure targets with the lenders. Neither ICE nor the Trust were able to hold a restricted bid process for award of the resettlement audit without opening it up to the public, which would delay it further. Based on meetings of all concerned, the Trust agreed to get a legal opinion that a closed contract would be possible, and the lenders agreed to examine the possibility of a direct contract to one of the four preselected bidders. The decision was subsequently made for IDB to contract a resettlement audit specialist from one of four preselected bidders, and that work would commence in July 2017.

The ability of PHR to develop project-specific procedures and to liaise constructively with local authorities were important processes to manage risks. For example, a number of practical issues arose with prioritising local sources for machinery and equipment. ICE had a high dependency on machinery for the project’s critical path, there was a lot of business opportunity, and corruption and price inflation risks were high. Suppliers experienced problems relating to information accessibility and equity. ICE experienced problems with product quality, product reliability, and corrupt actions from those trying to take advantage of the process. To manage these risks, ICE bought a certain number of machines to not be totally dependent on leased machinery, and also spread

contracts across companies. Local suppliers did not feel they were getting enough opportunities, leading to local protests. To address these numerous risks, the ICE project team developed a procedure for contracting machinery, equipment and vehicles for PHR. This set out clear rules and processes that would be followed, including holding raffles to randomly select a provider if all other aspects were equal. The procedure also addressed office equipment sourced from local communities. ICE liaised with local law enforcement to address corruption risks, and on one occasion intercepted a money exchange with marked bills resulting in an individual going to jail.

ICE advised that a pre-qualification is only included when required by the international lender, as ICE believes a one-step evaluation process is more efficient. Pre-qualification of bidders is mentioned in the IDB procurement policy GN-2349-7 as necessary for large or complex works, or where the high cost of preparing detailed bids could discourage competition (e.g. for custom-designed equipment, industrial plant, or specialised services). Despite the absence of pre-qualification, sustainability and anti-corruption considerations are evident in all phases of the ICE procurement process. Clauses in the RFP and terms of contract address environmental protection and management, worker health and safety, compliance, meeting ICE policies, and controls on hazardous substances. ICE advertisements for bids outline clauses relating to occupational health and safety, the contractors' workers, environmental protection, equipment and machinery, and competencies of key personnel. Specific clauses in advertised bids address site visits and supervision.

Article 12 of Law 8660 addresses green procurement. This authorises ICE to promote purchasing and use of reusable, recyclable, biodegradable and upgradable materials, and recycled products made with environmentally friendly processes that meet technical specifications. ICE can give a 20% addition to bidders demonstrating that the products incorporate integrated waste management and management of waste at the end of their useful life. ICE's Procurement Unit includes information in its public notices for bidding or direct purchase about environmental criteria and life cycle of products. ICE included such requirements into a number of PHR contracts, for example in relation to cement, tyres, fruit pulp and lubricating oils.

Bidders sign an Affidavit when submitting their bid with a number of statements including that they are fully compliant with the law, that they will implement the policies of ICE regarding environment, labour and occupational health and safety, and that there are no conflicts of interest. Because the bid cannot be accepted without this Affidavit, this step is accepted as meeting the criteria requirement to ensure sustainability and anti-corruption criteria are considered in pre-qualification processes.

Other anti-corruption measures are provided in guiding documents, including the Costa Rican and ICE procurement rules and regulations, ICE's ethics policies, inclusions in the Trust agreements, and inclusions in contracts. A case during PHR development related to articulated trucks resulted in a company being banned by the Controller General from contracting with ICE for a period of years due to conflicts of interest. In another example, the Controller General identified a false Affidavit during its process of legalising a PHR contract.

Anti-corruption risks in procurement are further minimised by ICE Group through ensuring transparency at all steps. ICE uses an electronic system called "MERLIN" (Market On Line), on which it has all procurement-related information including the contract, payments, receipts, processing of any fines, and contract resolutions. ICE Group also publishes an annual purchasing program each year.

Criteria met: Yes

## 8.2.3 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *Processes and objectives relating to procurement have been and are on track to be met with no major non-compliances or non-conformances, and any procurement related commitments have been or are on track to be met.*

The Costa Rica Controller General reviews tendering processes and legalises contracts. If a contractor has a complaint, it is presented to the ICE Group Procurement Unit who asks ICE's legal team to review it. ICE legal review is the only process available for short tenders. Public tender complaints or appeals are reviewed by the Controller General. Bank appeals processes would apply for any tenders that went through IDB procurement processes. During this assessment ICE did not provide information on the number of requests for review or appeal made in relation to PHR despite the assessor's request.

Some non-conformances with procurement procedures are noted in the reports of the independent reviewers. An example of a non-conformance was in the contracting of external experts for interfacing issues relating to the dam, for which an insufficient number of bids was received (only two bids) and which procedurally would require re-tendering. Time did not permit retendering, and so the contracts were awarded on an individual basis for expertise in Concrete-Faced Rockfill Dams (CFRD), grouting, and hydromechanical engineering. Another example was mentioned under Management for the resettlement auditor, for which a solution was found. These non-conformances were justified in terms of timing, and in each case involve the use of international technical experts in very specific fields.

Commitments were made publicly on the procurement of goods from local communities. Quarterly environmental monitoring reports show evidence of complaints made and responded to in cases where the community did not feel that this commitment was being upheld. An example was with the substation works: ICE worked with Siemens to address this complaint and this was tracked in the monitoring reports.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

Other than the minor and justified non-conformances cited above, there are no examples of non-conformances or non-compliances regarding ICE's procurement processes during PHR development.

Criteria met: Yes

## 8.2.4 Outcomes

### Analysis against basic good practice

**Scoring statement:** *Procurement of works, goods and services across major project components is equitable, efficient, transparent, accountable, ethical and timely, and contracts are progressing or have been concluded within budget or that changes on contracts are clearly justifiable.*

In addition to the 8 major public tenders, the PHR had about 90 short tenders and about 1,150 direct contracts.

Annex X of the Trust Common Terms Agreement set Regulations on Procurement of Goods and Services for the PHR, states the fundamental principle that all contracting of goods and services carried out by the Trust for PHR construction would be subject to the principles of efficiency, equality, open competition, and transparency.

Suppliers interviewed for this assessment advised that the procurement processes were equitable, efficient, transparent, accountable, and ethical. They observed that the RFPs were accurate on details, which benefited from ICE being very knowledgeable about the project, the equipment and their needs. ICE made sure everything was documented, which was considered highly important by the suppliers so that everyone knew what was expected and what they were doing. The contract managers played an important role in knowing every detail of the contract and helping navigate any issues arising. Contract changes were handled smoothly. Comments on "timely" varied, as legalisation review by the Controller General and bank review could take some time.

At the individual contract level, the ICE contract manager was responsible for monitoring and ensuring delivery of all contractual commitments. For the major contracts, there were no claims for Andritz, no claims for Siemens

regarding the transformers, and there were some claims with Siemens with the sub-station that were resolved. ICE submitted a claim regarding the SUMEC contract and the delays. A process was set up for variations to the EPC Contract, for which the Independent Engineer provided the claims review.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, opportunities for local suppliers including initiatives for local capacity development have been delivered or are on track to be delivered.*

According to the Costa Rican public procurement legislation, ICE is not able to give preference in awarding contracts to local suppliers, as this would conflict with legal provisions regarding equal opportunity and open competition.

Despite this, the project has demonstrated that it created and delivered opportunities for local suppliers. Between the period of 2008 and 2016, the project created 390 distinct purchase orders, of which 338 were with Costa Rican businesses and 52 were international. Forty-two percent of the total procurement spend was within Costa Rica, i.e. USD 121.85 million out of a total spend of USD 283.49 million.

In the case of machinery and equipment, ICE drew extensively on local suppliers. Data for the project shows that 289 machines or vehicles were supplied from within the area of direct or indirect influence. This included 95 conventional vehicles, 47 4x4 vehicles, 34 excavators of varying sizes, 38 buses of varying sizes, and 22 trucks of various types. Over 150 items of machinery or equipment were sourced from outside of the project-affected area, typically in cases where items or quantities were not available locally or the local options did not meet necessary specifications (e.g. for size of loads). A number of lessons can be identified for future projects, for example having a clear procedure at the outset, heightening anti-corruption safeguards, and providing independent advisory services to hopeful local suppliers in relation to building their capacities, managing their businesses for the long-term, and avoiding scams (e.g. being sold an unsuitable vehicle to lease to the project, or something with excessive maintenance requirements). Some businesses have gone bankrupt since the PHR construction finished, which may have been avoidable.

The measures implemented by ICE did assist local suppliers to participate in the supply of goods and services to a significant extent. There was a plan for local capacity development but this focused on individual's skills especially for those individuals who had lost their land (e.g. in food processing, farm management, and literacy). However ICE did not undertake any initiatives for capacity development of local suppliers and businesses, for example in technical, business development, or business management needs, which may have enabled more businesses to expand to new clients. This is a **significant gap** at the level of proven best practice.

Criteria met: Yes

## 8.2.5 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

There were no initiatives to develop the capacities of local suppliers and businesses.

1 significant gap

## 8.3 Scoring Summary

Works, goods and services required for the PHR were considered in the 2009 Feasibility Study, informed by modelling studies for the construction planning and research on national versus international sources. Processes were guided by specifications in the Trust's Common Terms Agreement, backed by well-developed ICE regulations and processes. IDB policies guided the major international competitive bids. Sustainability and anti-corruption measures were present at many steps in the procurement process, and green procurement was emphasised. The PHR was able to identify and respond to emerging issues and risks, and to also provide significant opportunities for local suppliers to participate in the project. A significant gap against proven best practice is the lack of a capacity development programme for local businesses, helping them to not only participate but also build business capabilities for the longer-term.

**Topic Score: 4**

## 8.4 Relevant Evidence

<b>Interview:</b>	55, 62, 67, 71
<b>Document:</b>	26, 114, 178, 422-428
<b>Photo:</b>	84, 88, 89



# 9 Project-Affected Communities and Livelihoods

## (I-9)

This topic addresses impacts of the project on project-affected communities, in relation to economic displacement, impacts on livelihoods and living standards, and impacts to rights, risks and opportunities of those affected by the project. The intent is that livelihoods and living standards impacted by the project are improved relative to pre-project conditions for project-affected communities with the aim of self-sufficiency in the long-term, and that commitments made to project-affected communities are fully delivered.

Topics I-10 'Resettlement' and I-11 'Indigenous Peoples' that follow, specifically address two sub-sets of project-affected communities.

### 9.1 Background Information

This topic focuses on people affected by economic displacement, including loss of land, business or other means of livelihood, and any other social impacts on households and on communities except impacts due to physical displacement. Issues related to physical displacement are addressed under topic I-10 Resettlement. Benefit-sharing and additional benefits for affected communities are addressed under topic I-7 Project Benefits.

With the exception of the town of Siquirres that lies to the northeast of the project, communities in the area of PHR are small, sparsely-distributed rural communities. They are mainly engaged in small-scale agriculture, including small-scale cattle ranching, whilst some households produce cash crops for export and there are some forest plantations. The area is a transition between the mountain area and the coastal zone.

Project-affected communities and groups comprise of:

- Settlements located around main roads on both left and right banks of the reservoir in the vicinity of the project site. On the left bank, the villages of Florida, Alegría, Lomas, San Antonio, Pascua, Bonilla, El Llano, Cazorla, and El Cruce; and on the right bank, El Coco, Moravia, Guayacan, San Joaquin, Santa Marta, and Bajo 52; these lie within the area defined as the directly-affected area (Área de Influencia Directa, AID);
- Households within the above communities that may have experienced a loss of livelihood or decline in living standards due to the project's acquisition of their land for the main project site and the reservoir, and the transmission line (affecting 13 properties); the project acquired 132 properties, totalling 1863 ha, from 62 owners (including 3 who were physically-displaced);
- Employees of property-owners or businesses affected by land acquisition, including employees of a relatively large cattle farm, Monte Cristo, and employees of a forest plantation that supplied a plywood business, both of which were located in what is now the reservoir area;
- Communities affected by traffic, disturbance and local air and noise pollution during construction; in particular Florida on the left bank and El Coco and Moravia on the right bank;
- Individuals within the AID communities that may have experienced some loss of fishing as a leisure activity or as a minor subsistence or income-raising activity, or experienced a loss of visual appreciation of the river valley; and
- Downstream communities and businesses, potentially affected by altered river flows and sedimentation dynamics in the downstream Reventazón and Parismina Rivers, including businesses in the rafting industry.

The cantón of Siquirres has population of over 42,000, whilst the population in the AID was reported as 5669 people and 1459 households in the project's EsIA (p711; it is reported as 7100 in the final resettlement report). The AID population consists mainly of people who originally migrated from other parts of Costa Rica, especially from the city of Turrialba. The population of Siquirres cantón is described as a melting pot of ethnicities, including people of African, Chinese and indigenous ethnicity (Siquirres Local Development Plan; Plan de Desarrollo Local

del Cantón de Siquirres 2001-2010). Most communities on the left bank originally developed because of the construction of a railway, the Atlantic Railway, which closed in 1995 resulting in economic depression. Settlements on the left bank tend to be smaller, poorer and more isolated than communities on the right bank, which are closer to Siquirres.

Please note that it is not within the scope of this assessment to assess the details of any specific complaint or grievance raised to ICE, SETENA or ICE's lenders.

## 9.2 Detailed Topic Evaluation

### 9.2.1 Assessment

#### Analysis against basic good practice

**Scoring statement:** *Issues relating to project-affected communities have been identified through an assessment process utilising local knowledge; and monitoring of project impacts and effectiveness of management measures is being undertaken during project implementation appropriate to the identified issues.*

Impacts on project-affected communities were initially identified in the project's Environmental Impact Assessment (EslA) prepared in 2009. The EslA presents a description of the socio-economic environment of the AID districts and communities within them, including: location and administrative structure; demographic profile; health indicators; education, housing, and economic activities; infrastructure and energy; general problems; land use; land ownership and tenure (with numbers of properties in each); culture and society, including the problems of each community; and economic characteristics, with comparisons within the district and cantón. Impacts are predicted, based on an analysis by social specialists using the description of the socio-economic environment, field visits and community meetings, and a framework of potential impacts (drawn from international sources such as World Commission on Dams), for construction and operation stages, on: land use, demographic characteristics, community infrastructure and services, road safety, and economic impacts. In a further chapter that is mainly concerned with mitigation measures, the EslA addresses the same issues, characterising each impacts according to intensity (-4 to +4), permanence (temporary or permanent), scale (specific, local or regional), reversibility (reversible or irreversible) and creation of dependency (dependent/independent).

ICE further refined the identification of impacts in the preparation of the Social Management Plan (Plan de Gestión Social) in January 2012 and plans for land acquisition (see Management, below). In addition, also in 2012, a team of consultants appointed by Inter-American Development bank (IDB) further assessed the social impacts of construction and cumulative impacts (see I-3 Environmental and Social Issues Management for details).

The assessment process drew upon local knowledge in the AID: community participation was one of the specific objectives of the EslA, and the assessors presented socioeconomic information in participatory workshops for validation by community members. Further details are presented under Stakeholder Engagement below.

The identification of impacts in the EslA was focused almost entirely on the AID, and there was little assessment of downstream impacts, apart from a brief discussion of cumulative impacts and an assessment of the downstream flows necessary for cattle watering, fishing, rafting, and swimming. However, the additional studies commissioned by IDB included some downstream issues in an assessment of cumulative impacts, including altered flows, water quality and sedimentation.

Monitoring of project impacts during implementation focused on households affected by land acquisition, with follow-up visits every 6 months, and on construction impacts in neighbouring communities, for example noise monitoring by a community group in Florida, monitoring of traffic speeds, and monitoring of noise and air quality (see I-18 Waste, Noise and Air Quality). There were also regular community meetings: a total of 466 community meetings were held during construction, with the participation of 4854 people, including closing meetings in

each community on the completion of construction. In 2017 ICE produced a number of final reports in various areas including land acquisition, resettlement (complaints received/handled), community meetings, community infrastructure, and site tours for community members. ICE reported on a quarterly basis to IDB, including reporting on activities related to project-affected communities. ICE reports to SETENA also included some information related to affected communities (especially land acquisition and infrastructure).

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, monitoring of project-affected communities issues during project implementation takes into account inter-relationships amongst issues, and both risks and opportunities that become evident during implementation.*

Community meetings and household visits allowed the identification of emerging risks and inter-relationships amongst issues. For example, the PHR social team made follow-up visits to high vulnerability households for more than a year following land acquisition. The final resettlement report includes a report on each high vulnerability household, signed by each household. An example of an inter-relationship is construction noise and community participation in Florida – this was seen as an opportunity, with the establishment of a community committee to monitor noise levels. A further example is the link between land stability and land acquisition, so ICE has acquired a buffer zone and studied land instability in steep areas around the reservoir (see I-19 Reservoir Preparation and Filling).

Household livelihood strategies concern inter-relationships between assets such as land, financial assets and capabilities, and social assets such as proximity to family members for labour and assistance. These inter-relationships were considered by ICE to some extent, for example when searching for replacement land, efforts were made to obtain land nearer to Pascua and San Antonio (without success), but in general household monitoring did not consider inter-linkages between livelihood assets and capabilities, or household vulnerability. Monitoring of opportunities that became evident during implementation is discussed in more depth on I-7 Project Benefits.

Criteria met: Yes

## 9.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Measures are in place to address identified issues that affect project-affected communities, and to meet commitments made to address these issues; and if there are any formal agreements with project-affected communities these are publicly disclosed.*

Most of the measures ICE took to manage impacts on project-affected communities were initially set out in the Social Management Plan in 2012, including detailed measures to address the following impacts: traffic, noise and dust, impacts on groundwater, loss of land rights and economic displacement, landscape changes, affected private infrastructure, public infrastructure, demographic changes, social change and social issues such as crime, and pressure on educational, health, recreational, and water infrastructure. Measures were systematically outlined for each area, with each measure specifying the focal area, specific actions, budget, and monitoring and compliance indicators. The plan sets out the capabilities to be provided in the project's Environmental Management Unit, including six social planners, two foresters, administrative and support staff, a construction engineer, four inspectors, a social worker, two agricultural technicians and a resettlement expert. Before the Social Management Plan, some of the measures were set out in an Environmental Management Plan in the EsIA in 2008.

ICE took measures in the following areas: (i) the management of construction impacts on the neighbouring communities of Florida, El Coco, and Moravia; (ii) land acquisition and the restoration of livelihoods of affected people; and (iii) support to community infrastructure, employment and local capacity development for AID communities.

Regarding (i), ICE applied measures for the control of dust, noise, and traffic in local communities, including: designated hours for operations that produce dust or use of noise-producing equipment and machinery, preferably only working hours; road improvements including traffic lights, sidewalks for pedestrians, and fencing around schools; awareness-raising of communities on the dangers of vehicular traffic; training for drivers on responsible driving; and disincentives for speeding. The project's grievance mechanism (see Stakeholder Management below) provided a means of identifying issues arising.

Regarding (ii), ICE had already acquired or leased over 30 land parcels by the time it adopted measures to address the impacts of land acquisition when IDB became involved in 2012. ICE then developed a 'Strategic Framework for the Restoration of Improved Living Conditions' (Marco Estrategico de Restitución o Mejora de Las Condiciones de Vida) and two accompanying plans, a plan concerning compensation and livelihood restoration amongst all affected property-owners (Plan de Restitución o Mejora de las Condiciones de Vida, PRMCV) and one concerning relocation to replacement land (Plan de Reasentamiento y Restitución de las Condiciones de Vida, PRRCV). Through the implementation of these plans, ICE provided compensation and support to each property-owning household on the basis of their level of vulnerability, as follows:

- High vulnerability (i.e. households that use and financially-depend on the land, the land was to be acquired in its entirety or if partly acquired, the loss of income or food security would be significant, they have no other income, live in the area, and have a low level of education), eligible for: replacement land (land-for-land) or legal assistance in purchasing replacement land; technical assistance, social care (emotional needs during relocation, and social cohesion), and follow-up visits every 6 months;
- Medium vulnerability (i.e. households that use the land for income and their property is totally or partially affected, but they have another source of income which is not more than twice the minimum wage, they live in the area, and have completed or have some secondary education), eligible for: cash compensation; advice on the value of remaining land if they choose to sell it, and legal assistance to establish land boundaries; legal titles / cadastral plans for remaining land if previously not registered; and technical assistance;
- Not vulnerable (i.e. those who do not use their land for productive purposes or use it only occasionally or marginally, but do not depend economically on it, they do not reside in the area, they have educational level and capacity to make economic decisions and conduct negotiations without assistance, they have income from other activities greater than twice the minimum wage), eligible for: cash compensation only.

Cash compensation was determined through a land valuation and judicial process set out in a law (Ley 6313) concerning ICE's acquisition of land. Technical assistance through PRCV and PRRCV concerned measures to improve soil conditions (for example terracing), materials for fencing or hedges for erosion control, materials for livestock (corrals, feeders and drinkers), seed and labour for pasture establishment, biodigesters, waste management and organic fertilizer production, water supplies, and training, for example.

ICE acquired a total of 130 parcels of land (totalling over 1860 ha) from 62 property-owners. The majority (42) were not vulnerable. Out of ten households in the high vulnerability group (not including 3 who were physically-displaced, addressed on I-10 Resettlement), 2 chose replacement land allocated by ICE (at Calle Nubes in Florida), 3 chose cash compensation and assistance to acquire land elsewhere, and 5 chose cash compensation but declined to purchase replacement land. All of these accepted the offer of technical assistance, except 3 of the latter group (one chose to retire, and two were compensated prior to the Strategic Framework). Out of six households in the medium vulnerability group, just 2 households accepted technical assistance. Note that several households on the right bank that did not have legal titles, but had land use rights under a rural development

programme on Instituto de Desarrollo Rural (INDER) land, were given compensation equal to those with legal titles. Twenty-five people who were employees on land that was acquired were offered employment on the project, or training to enable them to find new employment.

Regarding (iii), ICE has supported community infrastructure in almost all AID communities, and provided preferential employment on the project for people in the AID. Community infrastructure is presented as a mitigation measure for impacts on livelihoods in the Social Management Plan, for example the surfacing of the road on the left bank (Ruta 415) may encourage economic development in the area and therefore the availability of employment opportunities. However, community infrastructure and preferential employment are mainly additional benefits for affected communities, and are discussed in I-7 Project Benefits in more detail. A Local Development Training Program was provided (244 training events with a participation of 1,119 participants), including literacy.

Regarding formal agreements, commitments to each community, made in the EsIA/EMP, were disclosed in a publication in 2008 “Protocolo de Responsabilidad Socioambiental”, and through community meetings. Households were asked to sign formal agreements on their category of vulnerability, their compensation packages, and completion of compensation; as they are private agreements they are not publicly disclosed.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, processes are in place to anticipate and respond to emerging risks and opportunities.*

PHR used some mechanisms to anticipate and respond to some risks for affected communities, such as the ICE Committee for Environmental and Labour Affairs (CAAL) which monitored and analysed environmental and social risks and impacts, maintaining records, recorded breaches, and proposed corrective measures, etc, particularly in relation to local traffic, noise and dust pollution. Ongoing community meetings and household visits allowed some emerging risks to be identified, and the grievance mechanism enables community members to raise issues, but it is not clear what mechanisms were in place to systematically respond to such issues or risks. In a number of examples raised by interviewees during this assessment, ICE was slow to respond, or did not respond to an emerging issue. This is discussed more in detail under Stakeholder Engagement below. Responding to opportunities that become evident during implementation is discussed in more depth on I-7 Project Benefits.

Criteria met: Yes

## 9.2.3 Stakeholder Engagement

### Analysis against basic good practice

**Scoring statement:** *Ongoing processes are in place for project-affected communities to raise issues and get feedback.*

Processes for stakeholder engagement began during the EsIA stage and have continued, mainly through the work of the PHR social team, to-date. During the EsIA, participatory approaches were used in a 2-phase approach consisting of: in-depth semi-structured interviews with 24 key informants in AID communities (12 on each bank, approximately equal numbers of women and men, using structured interviews of 48 open questions with key informants (identified by local organisations and mostly over 40 years in age), over 17-27 September 2007); followed by the presentation of findings in 12 open community meetings held on left and right banks (November to December 2007, attended by 262 persons in total). In addition, ICE conducted a questionnaire survey in March and April 2008 to gather community views of the project with over 230 respondents.

Social experts within the project’s environmental management team were the main channel for engagement with affected AID communities during implementation. They focused particularly on land acquisition: land

acquisition and livelihoods restoration measures in three community meetings in June-July 2012 in San Antonio, Pascua and El Coco-Moravia; 421 home visits to people affected by land acquisition, mainly over 2013-2015; and a number of leaflets and brochures concerning land acquisition. Home visits were also made to employees of landowners that lost their employment.

In addition, ICE took people from AID communities and affected property-owners on guided tours of the project site, continuously from 2010 to 2016. Through a series of annual programmes, all 15 AID communities participated, and by March 2016, when the guided community visits programme was completed, ICE had conducted a total of 111 visits and the participation of 1607 participants.

Affected people could raise complaints to ICE through various means, including direct contact with social experts, community meetings, letters, and a telephone hotline (800-Reventazón). ICE registered 196 complaints out of 285 reports (i.e. complaints and requests for information) from 2012 to 2017, including 121 reports from Florida and 47 from El Coco. The most frequent complaints concerned affected infrastructure, dust, noise and traffic, and requests for information concerned collaboration or employment.

Very few, if any, complaints were received from people in downstream communities. Downstream communities were involved, through consultations led by ICE's Environmental and Social team for the Huetar region (which has established relationships with downstream stakeholders, from ongoing mitigation of the effects of Angostura sediment flushing). Downstream stakeholders in Parismina during this assessment described numerous open meetings for discussions during the planning of Reventazón. Downstream stakeholders were involved through a 'lower basin committee' that met on a monthly basis for three years in advance of reservoir filling. The purpose of the 20-strong committee, consisting of community, political and government representatives was to address any problems arising during filling of the reservoir, and to facilitate emergency communications. It is now merged into a basin management commission, COMCURE, which addresses the entire catchment (see I-19 Reservoir Preparation and Filling for details).

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, feedback on how issues raised are taken into consideration is thorough and timely, and project-affected communities have been involved in decision-making around relevant issues and options.*

Project-affected communities were involved in decision-making on numerous occasions, for example: mitigation measures were discussed and agreed with AID communities during the ESI; the community of Florida established a committee for liaison with the project and decision-making on mitigation measures; high vulnerability landowners had options of land-for-land compensation or assistance to purchase new land elsewhere; and affected people had a range of training options. Community-involvement in decision-making on project benefits is discussed in I-7 Project Benefits.

However, feedback on how issues raised are taken into consideration is not thorough and timely. A number of examples emerged during interviews with affected people during this assessment, including slow responses to fixing road surfacing problems in Bonilla, inflexibility in responding to requests (for example if the household had received the specific assistance they were eligible for, such as gravelling an access road, they could not access any further assistance), and slow responses to improving wastewater drainage at Calle Nubes. There is a widespread perception amongst affected communities that it is necessary to make repeated calls to ICE to achieve a response. Few people are aware of the 800-Reventazón hotline, and even if they are aware of it, have not used it. Most people interviewed indicated that they would previously raise concerns directly with the former leader of PHR's social team, but they would not know how to raise an issue now, highlighting the risk in moving from construction to operation stages. There is also a perception amongst those who chose the option of cash compensation and purchasing land in their neighbourhood that they did not get as much support as those who

relocated to Calle Nubes. Limited and slow feedback and responses to issues raised by affected people is a **significant gap** against basic good practice.

Communications with all affected landowners, not only those residing in the affected area, could have been more regular, and the lenders' independent environmental and social monitoring consultants have also called for improved communications with this group. Limited or slow feedback may be a contributing factor in high profile cases of two large landowners challenging land compensation values. One of these landowners has instigated judicial proceedings through SETENA and grievances through the formal grievance mechanisms of three lenders (IDB, IFC and EIB). The SETENA cases were a request for information on materials extraction, and proceedings regarding perceived risks of materials extraction for a lagoon near the tail of the reservoir, located on their land. Formal grievances concern 12 environmental issues, and one of the lenders' mechanisms (IDB) has not upheld the grievance whilst the other lenders' are yet to conclude.

Criteria met: No

## 9.2.4 Stakeholder Support

### Analysis against basic good practice

**Scoring statement:** *Affected communities generally support or have no major ongoing opposition to the plans for the issues that specifically affect their community.*

Whilst there are ongoing claims from two parties regarding compensation and Reventazón's environmental impact, generally, affected communities support the project and there is no major ongoing opposition. There were some, repeated protests early during implementation, but they concerned specific issues, i.e. local suppliers' involvement in procurement opportunities, and left bank communities' demands for additional benefits. In a 2008 questionnaire survey, only 13 out of 232 surveyed disagreed or strongly disagreed with the project, and 149 had no concerns. The majority of concerns expressed through the questionnaire surveys were for community benefits and environmental protection.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, formal agreements with nearly all the directly affected communities have been reached for the mitigation, management and compensation measures relating to their communities.*

ICE made formal agreements with all AID communities concerning mitigation, management and compensation measures. In 2012 at an "Environmental Fair", ICE signed agreements, setting out commitments in the EMP, with community representatives. These commitments and agreements were documented in a "Socio-Environmental Responsibility Protocol" document. The objective of the fair and the document was to disseminate the information in the EMP and to publicly launch the formal commencement of construction.

Criteria met: Yes

## 9.2.5 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *Processes and objectives relating to project affected communities issues have been and are on track to be met with no major non-compliances or non-conformances, and commitments have been or are on track to be met.*

ICE has largely met its commitments to project-affected communities. For example, the eleven principles set out in the strategic framework for land acquisition, and the objectives set out in the 2013 PRCV and the social management plan have largely been met. Commitments concerning affected communities set out in the ESAP



(Environmental and Social Action Plan) agreed with lenders have been implemented such as implementation of a grievance redress mechanism, livelihood restoration, and mitigation for white-water rafting (but note, a commitment concerning a downstream alarm system has not been implemented; this is discussed on I-20 Downstream Flow Regimes). A resettlement audit is being carried out while this assessment is taking place, as a requirement of the lenders, providing a further opportunity to check conformance of the project's land acquisition and livelihood restoration with international standards.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

PHR may not have met its objective of restoring or improving the living conditions of all affected landowners or their employees, as discussed under Outcomes below. Otherwise, there are no non-compliances or non-conformances.

Criteria met: Yes

## 9.2.6 Outcomes

### Analysis against basic good practice

**Scoring statement:** *Livelihoods and living standards impacted by the project have been or are on track to be improved, and economic displacement is fairly compensated, preferably through provision of comparable goods, property or services.*

Implementation of PHR affected the livelihoods and living standards of people in two groups: property-owners affected by land acquisition; and employees of property-owners or businesses affected by land acquisition. In the first group, livelihoods and living standards: have improved for two households, in the high vulnerability group, that chose replacement land at Calle Nubes, as they have received land for cattle-raising with improved facilities such as corrals, dairy-making facilities, and water supplies, compared to the acquired land-plots; have been restored for most households in the high vulnerability group, but have possibly declined in 1 or 2 cases. The situation of these 1-2 households is unclear, but their livelihoods may improve if ICE provides continued assistance; ICE's inflexible response to these cases is discussed as a significant gap under Stakeholder Engagement (at the level of proven best practice) above. Livelihoods and living standards amongst those in the medium vulnerability and not-vulnerable groups have probably been restored, but no evidence is available to confirm or refute this.

In the second group, former employees were provided with the opportunity to take employment on the project, employment training, and training for a productive activity. Out of 25 individuals affected, 12 took employment during construction, and 13 took work in other activities (e.g. continued employment in the remaining area of their employers' land, work on their own farms, or other employment). Seven participated in ICE training (on waste management, cleaning, milk production and farm administration, adult literacy, leadership in organisations, basic accounting, and sewage systems). It is impossible to determine whether these individuals' livelihoods and living standards have improved or declined, as there is no data available for them. ICE did not carry out home visits to monitor such individuals. This is a gap, but is considered under proven best practice below.

Compensation for economic displacement has been provided fairly, through ICE's system of determining compensation for land. This consists of the following steps: an internal ICE expert prepares a land valuation using standard methodologies; ICE offers this amount to the owner, who has the opportunity to argue for an increased valuation; ICE's internal expert may increase the valuation if the owner's points are considered valid, and agreement is reached; if the owner refuses the valuation, a judicial process is followed, in which a judge appoints

two experts to estimate the property value, and the judge makes a proposal to the owner based on all three valuations; if the owner refuses this valuation, an appeals process is followed, through which 3 judges make a final valuation. Whilst this is a fair legal process, some vulnerable households may not have felt able to challenge ICE's valuation. Of those that did, 50% had their claims for higher compensation upheld (out of a total 120 valuations, 42 or 35% were challenged and followed a judicial process, compared to about 10% nationally, and ICE's valuation was not accepted in 21, or 17.5% of these).

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, the measures put in place to improve livelihoods and living standards are on track to promote self-sufficiency in the long-term.*

Please note that although the livelihoods and living standards of some affected people was improved in some cases, ICE's objective for land acquisition and livelihood restoration was to "restore or improve" livelihoods. In most cases, ICE was focused on ensuring the pre-project livelihood was restored – *not necessarily improved*, including amongst the high vulnerability group. Although "vulnerability" was used to describe the eligibility categories, assistance did not explicitly set out to reduce vulnerability (affected people are just as vulnerable to land instability, market prices, lack of employment etc as before). No transitional allowance was provided to ensure living standards were not lower in the period before self-sufficiency could be obtained.

Providing the opportunity of employment during project construction is an important project benefit for affected communities, as discussed on I-7 Project Benefits, but it has been considered as mitigation for the impact of lost land and employment in some cases (it is described as such in the final resettlement report), meaning that, with demobilisation following construction, some individuals have had to seek new employment in some cases far away from the project area. Employees of property-owners or businesses affected by land acquisition did not receive any alternative compensation if they chose not to take employment on the project. The risk that some affected households, including some highly vulnerable households and former employees of owners of acquired land, will not improve their livelihood or living standards, reduce their vulnerability, or be self-sufficient in the long-term, is a **significant gap** against proven best practice.

Criteria met: No

## 9.2.7 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

Limited and slow feedback and responses to issues raised by affected people.

There is a risk that some affected households, including some highly vulnerable households and former employees of owners of acquired land, will not improve their livelihood or living standards, reduce their vulnerability, or be self-sufficient in the long-term.

2 or more significant gaps

## 9.3 Scoring Summary

Impacts on project-affected communities were initially identified in the EsIA and Social Management Plan, and ICE took measures to manage construction impacts on neighbouring communities, acquire land and restore livelihoods of affected people, and support community infrastructure, employment and local capacity

development. Commitments to each community were disclosed in a publication and through community meetings.

Engagement with communities began during the EsIA stage and continued through implementation, with a total of 466 community meetings, and guided tours. Affected people could raise complaints to ICE through various means, and were involved in decision-making on numerous occasions. Generally, affected communities support the project and there is no major ongoing opposition, although there were some protests early during implementation. Community meetings and household visits allowed for the identification of emerging risks and inter-relationships amongst issues, though feedback on issues raised has not been thorough and timely.

Livelihoods and living standards that were affected by the project have improved or been restored for most households, but there is a risk that they have declined in 1 or 2 cases, unless ICE provides continued assistance. There are two significant gaps against proven best practice, resulting in a score of 3.

**Topic Score: 3**

## 9.4 Relevant Evidence

<b>Interview:</b>	1, 14, 17, 22, 25, 27, 30, 32, 41, 43, 47, 49, 51, 69, 74, 78, 85, 92, 93
<b>Document:</b>	18, 37, 112, 115, 121, 122, 135, 150, 161, 163, 168, 169, 202, 204, 209, 234, 268, 279, 280, 281, 429, 430, 431, 432, 433, 434, 473, 475, 476, 477
<b>Photo:</b>	9, 10, 11, 17, 18, 35, 36, 90-101

## 10 Resettlement (I-10)

This topic addresses physical displacement arising from a hydropower project development. The intent is that the dignity and human rights of those physically displaced are respected; that these matters are dealt with in a fair and equitable manner; that livelihoods and standards of living for resettles and host communities are improved; and that commitments made to resettles are fully delivered.

### 10.1 Background Information

The implementation of PHR physically displaced three households: PHR required all or almost all of the land of two households in San Antonio and one in Pascua (but not the land on which their dwellings were located) and so offered them the option of moving to a new location with replacement dwellings and land, which they accepted. In addition, ICE acquired land of INCOFER (Instituto Costarricense de Ferrocarriles; Costa Rican Institute of Railways) which one elderly man farmed: he did not permanently reside at the property, but has since moved to his replacement land. Topic I-10 focuses exclusively on these physically-displaced households, whilst acquisition of land affecting other households is addressed under I-9 Project-affected Communities and Livelihoods.

Law 6313 of the Republic of Costa Rica concerns expropriation and compensation for land by ICE specifically. There is no other law of government policy concerning physical or economic displacement.

### 10.2 Detailed Topic Evaluation

#### 10.2.1 Assessment

##### **Analysis against basic good practice**

**Scoring statement:** *An assessment of the resettlement implications of the project has been undertaken that establishes the pre-project socio-economic baseline for resettles and host communities; monitoring is being undertaken of implementation of the resettlement plans, and to see if commitments made to resettles and host communities have been delivered and are effective and to identify any ongoing or emerging issues.*

ICE considered the land requirements and implications for physical displacement of PHR at an early stage of design, seeking to minimise physical displacement. ICE considered a project design in 1998 with a reservoir level of 380 masl, which would have required more physical displacement. The final recommendation of the prefeasibility stage in 2003 was of a maximum operating level of 275 masl, which was then reduced further. These changes were made to maximize the cost-benefit ratio, but also had the advantage of reducing OHR's environmental and social footprint.

In 2009 ICE began PHR construction and land acquisition without the input or participation of social experts, and without establishing a socioeconomic baseline or considering social vulnerability. In 2011/2012, in response to their lenders' requirements, ICE prepared a Strategic Resettlement Policy Framework (as described below), requiring a detailed socio-economic analysis, and qualitative and quantitative indicators of progress and milestones. ICE documented socio-economic profiles of all affected property-owners (including those only economically displaced, and those from whom land had previously been acquired) in a Plan for the Restoration or Improvement of Living Conditions (Plan de Restitución o Mejora de las Condiciones de Vida, PRMCV) in 2013, and a socio-economic profile of 5 households, including three physically-displaced households, is annexed to the Plan for Resettlement and the Restoration of Living Conditions (Plan de Reasentamiento y Restitución de las Condiciones de Vida, PRRCV) in 2014. It is not clear where the socio-economic profile of the elderly man who farmed INCOFER land is documented.

Note that there are no host communities as three of the resettled households were relocated to an area of land that ICE bought from a large landowner in a rural area, and one was relocated within his existing community.

Monitoring of the delivery of commitments was undertaken through regular household visits to high vulnerability households, every 6 months, and the reporting of the social team, as described under I-9 Project-affected Communities and Livelihoods. ICE's final resettlement report includes a household report for all 4 physically-displaced households, documenting the delivery of commitments including the construction of productive assets such as corrals, dairies, fencing etc.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, the assessment of delivery of commitments to resettles and host communities takes into consideration both risks and opportunities.*

Planning of resettlement, reported in the Strategic Framework, considered the risks that: economic displacement would be so severe, i.e. all productive land would be acquired, that physical displacement would be necessary; that the quality of life for households remaining in the affected settlements would be reduced due to the loss of population; and that vulnerable families could be victims of opportunists if they chose to act on their own without ICE assistance. The PRRCV later reports on these risks, indicating how they will be addressed. ICE focused on the avoidance of the risk of impoverishment, and in particular household visits had the aim of identifying that there was no risk of impoverishment for the households. Monitoring and reporting on resettlement did not systematically consider opportunities. Please refer to Management for further discussion of risks and opportunities.

Criteria met: Yes

## 10.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Measures to address resettlement are documented in a Resettlement Action Plan; measures are in place to deliver commitments to resettles and host communities, and to manage any identified issues relating to resettlement, including provision of grievance mechanisms; and formal agreements with resettles and host communities are publicly disclosed.*

ICE documented its approaches and measures to land acquisition in three key documents:

- Strategic Framework for the Restoration or Improvement of Living Conditions (Marco Estrategico de Restitución o Mejora de las Condiciones de Vida) 2012;
- Plan for the Restoration or Improvement of Living Conditions (Plan de Restitución o Mejora de las Condiciones de Vida, PRMCV) 2013; and
- Plan for Resettlement and Restoration of Living Conditions (Plan de Reasentamiento y Restitución de las Condiciones de Vida, PRRCV) 2014.

The first two of these concerned both physical and economic displacement, i.e. all land acquisition, and they set out categories of vulnerability and eligibility, and associated packages of compensation and assistance. The Strategic Framework set out the legal framework, principles, criteria of vulnerability, valuation methodology (for land, crops and infrastructure), numbers of properties affected, alternatives to land-for-land compensation, technical and social assistance, cut-off date, consultation, organisational set-up, costs, and indicators of progress. The PRMCV is a full Resettlement Action Plan, providing further details in these areas, such as objectives and socio-economic profiles, and documenting the consultations undertaken by that time and the agreements reached with property-owners.

The PRRCV focused on relocation to the resettlement area (Calle Nubes) of five households, including 3 that chose to move home to Calle Nubes, as well as two economically-displaced households that opted for land-for-land compensation. It includes details of the search and selection of the resettlement area, an action plan (concerning access, services, and assistance for moving livestock and registration of livestock etc), monitoring plans, costs and programming.

These measures were put in place. ICE purchased land for resettlement in a 75 ha area extending from Calle Nubes (“Clouds Street”) in Florida. It is 3.9 km from Florida and 6 km from the nearest main road, Ruta 415. The three households that chose to move to Calle Nubes did so in December 2014, May 2015, and April 2015. ICE selected Calle Nubes following an extensive search, on the basis of a range of criteria, such as access to population centres, access to basic services (health, education, public transport), and suitability for cattle farming. ICE built a new 1.4 km road (14 m wide with right-of-way) to provide access to the property, and electricity and water connections. The 3 households were compensated with c. 20, 15 and 7 ha respectively, equal to the area of land acquired from them. ICE provided assistance including water supplies for livestock, land improvement (pasture establishment), bio-digesters, infrastructure such as corrals and dairies, fencing and tree seedlings and registration of cattle with authorities.

The case of the elderly man on INCOFER land is unusual: he was estranged from his wife, who owns their home (in an un-affected area) in San Antonio, and he often stayed in a “small house” or shack on INCOFER land; however, as he had no property title, ICE could not provide compensation for land following Law 6313. As a solution, ICE valued his standing crop and trees, and offered to provide this in cash compensation, at which time he was considering using the compensation to move to the city of Limón. Ultimately he was compensated in-kind, with a parcel of land (a remnant of land that had been acquired from one of the three households moving to Calle Nubes, by chance, his daughter and son-in-law) of at least the value of the compensation amount. On this land he built a small shack, and he now resides there full-time.

Any issues arising were addressed by the work of ICE’s social team, through regular household visits, and social assistance. Resettlees would make direct contact with this team to raise issues, and they also had the option of using the 800-Reventazón telephone hotline. Any grievances raised through these means would be registered and addressed through a grievance redress mechanism, described more fully on I-1 Communications and Consultation.

Formal agreements were signed with each relocated household, concerning the provision of land and construction of productive assets. These are private agreements, attached to the final resettlement report, and are not publicly disclosed, though they were made in the presence of the representatives of ADIs (Asociación de Desarrollo Integral).

Criteria met: Yes

### **Analysis against proven best practice**

**Scoring statement:** *In addition, processes are in place to anticipate and respond to emerging risks and opportunities.*

Household visits and the attention of the ICE social team may have been able to identify emerging risks for physically-displaced households, and opportunities such as provision of further training, or employment opportunities. ICE’s offer of in-kind land compensation to the the elderly man displaced from INCOFER land was a response to the risk that he would be impoverished by the use of cash compensation to move to Limón. Fortuitously, the land that ICE provided as compensation for standing crops/trees was available from a household relocating to Calle Nubes, and the man was able to obtain additional income from guarding vehicles or to secure state support for the construction of a new dwelling. Whilst the law prevents ICE from providing compensation for land that is informally-used and the absence of compensation for such land does not conform to international standards, ICE was sufficiently flexible in this man’s case to ensure he was not impoverished. However, with the

transition to the operation stage it is not clear what mechanism is in place to continue to monitor resettleses' living standards and incomes and respond as necessary. This is not a significant gap on I-10, as the risk that some affected households will not improve their livelihood or living standards, reduce their vulnerability, or be self-sufficient in the long-term is a significant gap on I-9 Project-affected Communities and Livelihoods.

Criteria met: Yes

## 10.2.3 Stakeholder Engagement

### Analysis against basic good practice

**Scoring statement:** *Ongoing processes are in place for resettleses and host communities to raise issues and get feedback.*

Physically-displaced households were consulted in-depth through the resettlement process, and processes for them to raise issues and get feedback remained in place throughout PHR implementation:

- Initially in June 2012 two community meetings were held, in San Antonio and Pascua, to present the PRMCV to communities, including the results of socioeconomic surveys and compensation packages; in these meetings, each property-owner signed a document agreeing to their allocation to high or medium vulnerability groups;
- Home visits were made with a social expert to discuss their transition (described in the final resettlement report, as expression of feelings, anger management, building positive responses to difficulties, social networks, expectations of a new life, and development of personal and family goals, for example); and
- Provision of information on the stages of the PRMCV and PRRCV through coloured leaflets and videos, presented in home visits.

The most frequently-cited means of raising issues in interviews during this assessment was direct contact with the leader of the ICE social team (Coordinación Social), with most having little knowledge of the 800-Reventazón hotline.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, feedback on how issues raised have been taken into consideration has been thorough and timely, and resettleses and host communities have been involved in decision-making around relevant issues and options.*

Feedback on how issues raised have been taken into consideration has not been thorough and timely in all cases, for example a physically-displaced interviewee, during this assessment, complained of ICE's slow response to a request for a wider (and so better functioning) wastewater drainage pipe on a dairy, and how their response ultimately depended on his agreement to cover the costs of materials. Limited and slow feedback is a significant gap, but is discussed on I-9 Project-affected Communities and Livelihoods.

Physically-displaced households were involved in decision-making on various issues and options, in particular on the selection of replacement land at Calle Nubes and the elderly man's selection of in-kind compensation in land.

Criteria met: Yes

## 10.2.4 Stakeholder Support

### Analysis against basic good practice

**Scoring statement:** *Resettleses and host communities generally support or have no major on-going opposition to the Resettlement Action Plan.*



Two of the four physically-displaced households were interviewed during this assessment and expressed support and satisfaction with their resettlement. There is no evidence of any on-going opposition at any time during implementation.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, there is consent with legally binding agreements by the resettles and host communities for the Resettlement Action Plan.*

As discussed under Stakeholder Engagement above, households that chose the option of relocating visited the proposed Calle Nubes area before a decision was made on its acquisition. During these visits, each household indicated their agreement to the area. ICE signed pre-agreements with each household in which it was indicated that if the land is purchased by the ICE, the owner and his family will agree to accept land exchange. Households also signed statements confirming their receipt of assets provides (housing, corrals etc). The elderly man on INCOFER land signed an agreement for compensation by land of 450 m<sup>2</sup> in January 2016.

Criteria met: Yes

## 10.2.5 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *Processes and objectives in the Resettlement Action Plan have been and are on track to be met with no major non-compliances or non-conformances, and any resettlement related commitments have been or are on track to be met.*

ICE has generally fulfilled the processes, objectives and commitments set out in the Strategic Framework, PRMCV and PRRCV, with regard to physically-displaced households. Although ICE did not succeed in avoiding relocation of affected households outside their community, which was an objective of the resettlement strategy, this was due to the limited availability of replacement land. Note that land in San Antonio was ruled out due to the geological instability of the area. There is no evidence of major non-compliances or non-conformances.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

PHR's resettlement plans were based on the Inter-American Development Bank Operational Policy OP-710 on involuntary Resettlement, and IFC Performance Standard 5 on Involuntary Resettlement. Resettlement implementation has not conformed to all requirements of these policies in two areas: transitional allowance was not provided to ensure that incomes did not fall during the process of resettlement (also discussed on I-9 Project-affected Communities and Livelihoods); and one household without legal titles to the land they used were not compensated for this land. However, they are not considered significant as households were able to generate income from their new properties immediately upon relocation (they moved their livestock to the properties) so a transitional allowance was not necessary, and the household without legal title was compensated with land equivalent in value to his standing crop.

Criteria met: Yes

## 10.2.6 Outcomes

### Analysis against basic good practice

**Scoring statement:** *Resettlement has been and is being treated in a fair and equitable manner, and resettles and host communities have experienced or are on track to experience a timely improvement in livelihoods and living standards relative to the pre-project baseline.*

ICE conducted physical displacement in a fair and equitable manner, with repeated consultation and involvement of affected households, and flexibility in obtaining a solution for the man resettled from INCOFER land. ICE has not provided quantitative data for any households to show that living standards or incomes have improved compared to the baseline. Indications from a site visit and interview with one household during this assessment, and household reports set out in ICE's final resettlement report, are that the 3 households relocating to Calle Nubes have experienced an immediate improvement in living standards by relocation to newly-built housing (in 2 cases, or 1 existing house in another case) and a probable improvement in livelihoods: ICE provided an exactly equal area of land, and productive assets (dairy cellars, dairies, corrals) appear to be superior to elsewhere in the area, complying with standards of the dairy industry regulator.

The standard of housing of the elderly man is of a similar low standard to his previous housing on INCOFER land, but it is probable that his income has improved due to his greater proximity to settlements for the sale of fish and agricultural produce, and he makes some income from guarding the vehicles of fishermen visiting the reservoir. In addition, ICE facilitated registration of his land, so he now has legal title, which he did not have on INCOFER land. At his own initiative, he has applied for a home to be built from a national agency for living standards (Instituto Nacional de Vivienda y Urbanismo, INVU), which will ultimately improve his housing standards.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, the measures put in place to improve livelihoods and living standards are on track to promote self-sufficiency in the long-term.*

It is likely that the households at Calle Nubes can maintain their improved living standards and potentially-improved livelihoods. The elderly man has used his own initiative to improve his income, but is dependent on the assistance of INVU for improved living standards. In his particular case, a risk of impoverishment has not emerged.

Criteria met: Yes

## 10.2.7 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

There are no significant gaps against proven best practice.

0 significant gaps

## 10.3 Scoring Summary

ICE considered implications for physical displacement at an early stage of design, and minimised physical displacement to four households. ICE began construction and land acquisition without the input of social experts but in response to their lenders' requirements, prepared a strategic resettlement policy framework and resettlement plans in 2011/2012.

ICE relocated three households to a 75 ha area (Calle Nubes) in one of the local communities following an extensive search, and provided assistance including water supplies for livestock, and land improvement (pasture establishment), etc. A fourth household was provided with in-kind compensation in land. Formal agreements were signed with each relocated household, concerning the provision of land and construction of productive assets.

Monitoring of the delivery of commitments was undertaken through regular household visits to the households, and the reporting of the social team. Households were consulted in-depth through the resettlement process, and involved in decision-making, in particular on the selection of replacement land. Processes for them to raise issues remained in place throughout implementation, but feedback has not been thorough and timely in all cases. There is no evidence of any on-going opposition.

ICE has generally fulfilled its strategic framework and resettlement plans, and it is likely that three households moving to Calle Nubes can maintain their improved living standards and livelihoods. The fourth household is dependent on further assistance for improved living standards. Planning of resettlement in the Strategic Framework considered a number of risks.

Topic Score: 5

## 10.4 Relevant Evidence

<b>Interview:</b>	1, 26, 45, 69, 74, 78, 92, 93
<b>Document:</b>	76, 112, 118, 121, 150, 158, 159, 162, 234, 280, 281, 473
<b>Photo:</b>	9, 10, 11, 18, 102-106

## 11 Indigenous Peoples (I-11)

This topic addresses the rights, risks and opportunities of indigenous peoples with respect to the project, recognising that as social groups with identities distinct from dominant groups in national societies, they are often the most marginalized and vulnerable segments of the population. The intent is that the project respects the dignity, human rights, aspirations, culture, lands, knowledge, practices and natural resource-based livelihoods of indigenous peoples in an ongoing manner throughout the project life.

This topic was not relevant to the assessment of the Reventazón project. None of the affected communities include indigenous communities or peoples, and the lands affected by the project are not identified as customary or ancestral lands by any indigenous peoples.

The Department of Territorial Studies of the Costa Rican National Commission on Indigenous Affairs (Comision Nacional de Asuntos Indigenas, CONAI) gave written certification that none of the project components lay within indigenous territories, during this assessment.

## 12 Labour and Working Conditions (I-12)

This topic addresses labour and working conditions, including employee and contractor opportunity, equity, diversity, health and safety. The intent is that workers are treated fairly and protected.

### 12.1 Background Information

The regulator for labour law and occupational health and safety (OHS) in Costa Rica is the Ministry of Labour and Social Security. The Labour Code of Costa Rica contains more than 600 Articles that are binding for all employers, addressing obligations including: work contracts, working hours, salaries, minimum wage, social security, sick leave, vacations, work injuries, and terminations. The Labour Code establishes a system of insurance for injured workers, provided by the National Institute of Insurance (Instituto Nacional de Seguros).

Labour requirements during construction of the Reventazón Hydroelectric Project (Proyecto Hidroeléctrico Reventazón, PHR) rose and fell between 2009 to 2016, with a peak workforce in 2014 of 4 472 employees. Fifty-three staff members are planned for the operation stage.

### 12.2 Detailed Topic Evaluation

#### 12.2.1 Assessment

##### Analysis against basic good practice

**Scoring statement:** *Human resources and labour management requirements have been identified through an assessment process, including occupational health and safety (OH&S) issues and risks; and processes are in place to identify any emerging or ongoing issues, and to monitor if management measures are effective.*

The 2008 PHR Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) did not address the labour force nor occupational health and safety (OHS). In response to this gap, the due diligence review of the Inter-American Development Bank (IDB) led to production of a Construction Environmental Management Plan in 2012. This plan provides considerable detail on OHS, with measures described under the Management criterion.

The 2009 PHR Feasibility Study did not have a specific section on labour requirements, but did analyse labour requirements as part of the chapter on Program Implementation and Costing. This work was done by the ICE electricity business planning and development unit. The estimated direct costs for the project included wages and associated costs for the labourforce such as safety equipment, lodging, transportation and food. The worker numbers were profiled through the project, with a peak for the construction workers estimated at 3 000. The labour-related component was about 26% of the project's direct costs (14% for the workforce, 3% contracted, and 9% for social security contributions and incentives).

Indirect cost estimates included administrative staff, estimated at 546 people, distributed in the following functional centres: project management, planning and control, human resources, information technology, documentation and library, general services, costs and accounting, works contracts, quality assurance, system management, community relations, engineering and design, environmental management, supplies and materials management, warehouses, quality control electromechanical works, occupational security, construction, support, technical office, topography, surveillance, occupational medicine, SETEC headquarters (technical services) and support staff. Associated costs were also estimated, such as travel, transportation, lodging, meals, training, furniture and equipment.

The Human Resources and OHS units were set up for the project, and had a number of assessment and monitoring processes. For OHS, a number of lead and lag indicators were used. Examples of lead indicators were

plant inspections, training programs, and program evaluations. Lag indicators include tracking of an Accident Frequency Indicator looking at the number of accidents per million man-hours worked. The reference standard was INTE 31-09-01-02 (equivalent to ANSI Z 16.2 standard) issued by the Instituto de Normas Técnicas de Costa Rica (INTECO), the National Standards Body of Costa Rica. The type of injury, body part injured, and root causes of accidents were also tracked.

Safety inspections were conducted by Prevention Officers within the OHS team, and the OHS team issued regular reports. The Human Resources team kept an employee register and all associated documentation, and also issued regular reports. The Independent Environmental and Social Monitoring Consultant (IESMC) included worker grievances and OHS in their twice yearly inspections and twice yearly desk-top reviews of project progress. The Labour and Social Security Ministry inspected worker conditions on site. The Union provided a monitoring role of worker conditions. The Communications team monitored and kept a register of worker grievances.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, the assessment takes broad considerations into account, and both risks and opportunities.*

The Labour Ministry inspections mostly focused on working conditions, whereas the lenders had a broader scope guided by the International Finance Corporation Performance Standard 2 Labour and Working Conditions (IFC PS2). The Labour Code requirements and ICE human resource policies and procedures were analysed in detail by the lenders, who set out a comprehensive set of labour and personnel requirements in the EPC Contract.

IESMC assessments identified a broad array of issues, including both risks and opportunities. For example, the following items were noted in the October 2014 IESMC report, all of which appear to have been acted on by ICE:

- The OHS, environment, and quality management systems were working independently and lacked integration, and documentation for each of these systems was in different sites with limited accessibility;
- There was no integration of different work areas of PHR and a lack of effective overall communication regarding OHS issues;
- The project reports made for the client were not written by the staff involved in OHS, and did not have the level of detail required;
- Subcontracted operators of heavy vehicles and machinery did not have the same monitoring and control procedures used by ICE operators of the project;
- Subcontractors were not using proper PPE because it was not being provided to them in a timely manner;
- Signage was missing throughout the project, notably for roads, work sites, for transportation and handling of materials, pedestrian walkways, and prohibited access areas;
- Visitors to the project were not given any induction about OHS regulations in the project. Entrance documents were not being handed in to all visitors; and
- The project did not have a doctor specialised in OHS matters.

A key measure implemented to improve overall integration were monthly meetings of the OHS team members (leaders, Prevention Agents, doctors, etc) with key members of the management team, including those in charge of construction, technical, engineering and workforce management. These meetings reviewed assessment results and compliance with OHS plans, and issues arising, and were able to lead to further improvements. Some examples relating to improved assessment processes are:

- OHS trainings were conducted in accordance with a project guideline, and assessments were conducted of the quality of the trainings with a sample of the trainees; and
- The OHS team increased monitoring of individual performance of members of the OHS team, such as in the trainings delivered, inspections undertaken, corrective actions closed, etc.

The Union branch at the PHR site monitored how the Director worked with the labourforce. They held monthly meetings with PHR management to discuss issues arising and find solutions.

Worker safety cards were used as a system to identify risks. Workers were required to fill in a card every two weeks, identifying a risk at the workfront and how it could be prevented. The OHS team received up to 200 cards per month, and had an indicator for submission of these cards with a benchmark of 80%. All issues raised were kept in a register and considered by the OHS team with management.

Opportunities identified in the IESMC assessments included bringing in specialists to assess and guide improvements. Early concerns about accident frequencies led to a specialised OHS audit. This assessment found that the Accident Frequency Indicator statistic was not being used correctly and was presenting an inflated picture of accident frequency, largely because it combined minor and moderate injuries. The visit identified a number of improvements to ICE’s OHS data analysis and reporting processes, along with other recommendations. A specialist was also brought in to review and guide one of the key areas of high risk, being the risks of falls from heights.

Criteria met: Yes

## 12.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Human resource and labour management policies, plans and processes are in place that address all labour management planning components, including those of contractors, subcontractors, and intermediaries, with no significant gaps.*

ICE’s Staff Regulations set out specific procedures and policies to be adhered to for human resources management within ICE. PHR had a number of its own human resources policies, based on requirements of the lenders set out in Section 6 of the EPC Contract, addressing: staffing and manpower; recruitment and terminations; wages and working conditions; working hours; worker accommodation; social security services; compliance; obligations for contractors; health and safety; supervision; qualifications and expertise of personnel; misconduct, negligent and unsafe behaviours; registration of personnel and equipment; and public disorder.

The PHR Construction EMP 2012 provides detail on planning for the labourforce from an environment, health and safety perspective. The PHR Project Management Plan 2015 also includes an overview of the OHS program, including complete lists of all procedures. Additionally, there was a PHR Implementation Plan for OHS.

The coordinator of the PHR OHS team reported to the head of PHR Administration who in turn reported to the PHR Project Director. The OHS team had two main parts, Occupational Safety and Occupational Medicine. At its peak the OHS team had 70 staff. There were 31 Prevention Agents (one for every 150 workers), 8 doctors (one for every 500 employees, including an occupational medicine specialist), 3 nurses, and paramedics. There was a health centre at the main camp, satellite health centres through the project area, a medical dispensary, and 5 ambulances. Prevention Officers worked day and night shifts.

There were numerous OHS sub-plans and types of procedures and guidance for the PHR:

- 18 OHS plans were made for specific work fronts (e.g. construction camps, transmission lines, roads, spoil disposal areas, dam). Another 7 OHS plans were made for areas with highly specialised engineering or works (e.g. the high pressure pipeline, gate installation, water intake racks and cleaning systems). Each plan



<p>provided an analysis of critical tasks, risk analysis, applicable rules and guidelines, PPE and equipment, training, OHS topics to cover in group meetings, medical management arrangements, and emergency management.</p>
<ul style="list-style-type: none"> <li>Procedures were developed for focal areas including leadership and management, education and training, inspections, critical tasks, accident analysis, work permits, PPE, program evaluation, work guidelines, group meetings, promotion of OHS, managing contractors, occupational medicine, behavioural safety, and emergency plans.</li> </ul>
<ul style="list-style-type: none"> <li>Methods were developed for major risks including explosive materials, occupational hazards, working at heights, welding and cutting, radiation safety, emission of gas, underground works, food safety and electrical safety.</li> </ul>
<ul style="list-style-type: none"> <li>Instructions were developed to guide activities including control of OHS indicators, individual performance evaluation for OHS staff, reporting on accidents, incidents and diseases, emergency communications, management of visitors to construction works, supervision of OHS for contractors, safety with leased vehicles and machinery, and techniques for safe work performance.</li> </ul>
<p>Processes to address worker health issues included health inspections at the clinics, training on risks of communicable diseases, avoidance measures for infectious risks such as dengue fever and zika, site inspections and application of insecticides and larvicides, and recruiting an occupational medicine specialist to address risks relating to occupational deafness or blindness.</p>
<p>Criteria met: Yes</p>
<p><b>Analysis against proven best practice</b></p>
<p><b>Scoring statement:</b> <i>In addition, processes are in place to anticipate and respond to emerging risks and opportunities.</i></p>
<p>The key processes in place that enabled anticipation and response to emerging labour-related risks and opportunities included:</p>
<ul style="list-style-type: none"> <li>Integrated management team monthly meetings;</li> </ul>
<ul style="list-style-type: none"> <li>Joint monthly meetings of the HR team with the Union;</li> </ul>
<ul style="list-style-type: none"> <li>Quarterly reviews by the IESMC and twice yearly site inspections;</li> </ul>
<ul style="list-style-type: none"> <li>Ensuring appropriately qualified expertise in the OHS team;</li> </ul>
<ul style="list-style-type: none"> <li>Bringing in specialist reviews for key focal areas;</li> </ul>
<ul style="list-style-type: none"> <li>Strong commitment by the Project Director and ICE to act on identified issues; and</li> </ul>
<ul style="list-style-type: none"> <li>A well-functioning worker grievance mechanism.</li> </ul>
<p>Some of these processes ensured the ability of ICE to respond to the improvement suggestions of the IESMC, or were developed in response to the IESMC improvement suggestions.</p>
<p>Engagement of workers in safety was an important process to address both risks and opportunities, through both the safety card system and also by having all employees sign a commitment to continuous improvement in safety.</p>
<p>Stock management of PPE emerged as an issue, especially in 2014 when recruitment increased well beyond projected levels (1 300 staff were taken on that year). Responses included bringing additional PPE in by air freight to address immediate needs, better control of PPE stock in warehouses, annual planning for PPE purchases, and ensuring appropriate procedures and requisition forms.</p>

<p>ICE committed to offer jobs for locals, and many local people took employment. Measures were implemented to avoid people moving into the area to seek employment, by registering those who the community recognised as belonging to the community. A number of measures evolved in response to issues arising with local worker needs, such as improvements to training, support services, and transport services.</p>
<p>ICE had a zero tolerance policy regarding the need to wear appropriate PPE, and more than 100 workers were dismissed for this reason, many of whom were local. ICE had nine lawsuits for unfair dismissal on these grounds, seven of which it won and the others for which it did not have sufficient evidence. Over time the number of dismissals relating to PPE decreased as workers understood that ICE took this seriously and would act on it.</p>
<p>Following the visit of the OHS specialist in risk of falls from heights and fall protection, improvements were made to training systems, documentation and risk management in this area, including the requirement for workers to be issued permits after going through the appropriate training.</p>
<p>ICE's maintenance of good relations with the Union had two-way benefits. ICE did not support the Union financially but did provide logistical support, such as with access to information, permits for the Union to go to workfronts, and enabling workers to have time to meet with the Union. Workers could come to the joint monthly meetings of the Union and management to explain the issues themselves if it was felt useful. Benefits, from the workers' perspective, included hot food at the workfronts, health services, transport services and safety equipment. The Union would represent the worker's case if they felt it had merit. From ICE's perspective, the Unions often helped explain PHR policies and expectations of workers and reinforce worker obligations in cases in which a worker's claims were unreasonable (e.g. the worker not being at the bus pick-up spot on time and missing the bus, or leaving site early without permission).</p>
<p>The availability and accessibility of support services for workers was important. Notable in this regard was the Institute for Drug and Alcohol Rehabilitation (IAFA), which had offices in Turrialba and Limón. Drugs and alcohol emerged as a significant issue with the PHR workforce, particularly for local workers. PHR had a zero tolerance policy and procedures to address this. Random and targeted tests were conducted with workers by medical staff, and if positive the worker was directed to IAFA for rehabilitation and could then return to work. This could occur twice, but a third positive test led to dismissal.</p>
<p>The OHS team found that the labourforce responded well to intensive safety awareness training, but the engineers and technicians were less responsive. They introduced more effort into training of this segment of the workforce, and the HR team introduced monthly performance evaluations for them with a safety component.</p>
<p>Promoting opportunities for women was an objective during the PHR. Whilst less than 1% of employees were female (413 in the worker database of 4 472 personnel), women were given positions in the field, provided with appropriate training, and those interviewed advised that they felt well supported. Very few grievances were raised regarding discrimination or harassment, and anecdotally these were escalated and acted on promptly.</p>
<p>The PHR OHS team found that the involvement of the lenders enabled them to enforce measures that they required. Workers understood the legitimacy of the measures if they were told that the lenders required the measures. ICE management became more supportive of the safety program prepared by the OHS team when it was confirmed by the lenders that it aligned with IFC PS2.</p>
<p>The draft Operations ESMP includes several plans related to IFC PS2:</p>
<ul style="list-style-type: none"> <li>Local recruitment. ICE has authorised filling of 53 staff roles, of which 12 will be transferred from another plant for highly skilled technical areas, and hiring from the Siquirres area will be prioritised for the remaining 41 roles. The IESMC May 2017 Report noted that a Local Hiring Recruitment Plan was still required.</li> </ul>

- An Integrated Management System for Operations, which includes Quality, Environmental, Social, and Health and Safety. For the OHS aspects, the international standard OSHAS 18001 will be implemented, incorporating IDB Operational Policies, IFC Performance Standards, and relevant aspects of the IFC Environmental, Health and Safety (EHS) General Guidelines.

Criteria met: Yes

### 12.2.3 Stakeholder Engagement

#### Analysis against basic good practice

**Scoring statement:** *Ongoing processes are in place for employees and contractors to raise human resources and labour management issues and get feedback.*

The PHR Procedure Entitled “Method for Handling Complaints and Suggestions for Reventazón Hydroelectric Project Workers and Contractors” set out the workers grievance mechanism. Worker grievances could be raised through: a free internal telephone line (7800); a dedicated e-mail address: 7800@ICE.GO.CR, grievance and suggestions boxes around the site, worksite health clinics and health posts, the Human Resources Department, and the Union. The workers grievance mechanism captured all labour-related complaints and suggestions in a centralised manner, regardless of the avenue used by workers to raise the issue and the division that received it. It applied to ICE employees as well as subcontracted workers. Procedure implementation was the responsibility of the PHR Communications unit, who appointed a person responsible for receiving, recording and tracking comments, suggestions, complaints and/or condemnations. Areas involved in the issue raised by the worker were responsible for processing the concern in a timely manner and providing the input that enabled the Communications unit to follow up and close each grievance.

A robust workers grievance mechanism was an important requirement of the Lenders. The IESMC feedback guided improvements to the system as it was developed, and the October 2014 IESMC report expressed satisfaction that the system was robust and met the expectations of IFC PS2. The November 2015 IESMC report provides an illustration of the level of use of the mechanisms, noting that 92 complaints were raised between April and September 2015, of which 64 were anonymous. Fifty complaints were received directly via the 7800 hotline, and 43 were received indirectly via the medical services (mostly cases related to alcohol and drugs). Data on the nature of complaints shows that: 52 were related to industrial safety (mainly the use of alcohol and drugs by project workers); 29 to provision of services to workers, mainly transportation; 3 to the labour environment; 1 to abuse of power by a supervisor; and none related to sexual abuse or harassment.

The final report of the PHR Communications unit identified that a total of 567 grievances were raised by PHR workers during the construction period using the 7800 hotline. Of these, 220 related to OHS, 161 to services, 88 to the working environment, 7 to environmental issues, 5 to harassment, 2 to discrimination, and 2 to corruption.

Criteria met: Yes

#### Analysis against proven best practice

**Scoring statement:** *In addition, feedback on how issues raised have been taken into consideration has been thorough and timely.*

Two concerns arose through the IESMC reviews that suggest that the grievance mechanism was not completely effective in reaching all workers or in centralising all grievances:

- Inclusion of sub-contractors. The IESMC noted during 2015 that all complaints were being posted by ICE workers, and no complaints were being received from subcontracted workers. To address this, ICE held

meetings with subcontractors and placed new posters inviting subcontracted workers to use the PHR grievance system. However, the November 2015 IESMC report observed that this strategy was not delivering positive results and more needed to be done.

- Inclusion of all grievances. The November 2015 IESMC report noted that complaints about termination of contracts, overtime payments, and compensation for temporary disabilities were being sent directly to the Human Resources unit and managed by them without being registered and treated within the workers grievance procedure. Consequently, the data was not reflecting the full number of labour-related grievances.

Despite the room for improvement, indications are that feedback on issues raised was thorough and timely. The PHR procedure for worker grievances set out a classification system for grievances received based on the source, theme and extent of worker involvement, and associated time periods for response for the different levels. Whilst a summary of performance of the grievance procedure against the procedural requirements was not provided to the assessors, there are no indications that thoroughness or timeliness of response was a concern. The November 2015 IESMC report noted that for complaints raised between April and September 2015, as of the end of October 2015 91 of the 93 entries (97.8%) were managed and closed, and 2 (2.2%) were in process. The May 2016 IESMC report listed 11 workers complaints registered during the first three months of 2016, and noted that all complaints were managed and solved in a timely manner.

Criteria met: Yes

## 12.2.4 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *Processes and objectives relating to human resource and labour management have been and are on track to be met with no major non-compliances or non-conformances, and any labour related commitments have been or are on track to be met.*

Labour-related commitments included:

- Recruitment of local workers – an estimated 60% of the workforce was from the local communities, totalling more than 2,000 workers;
- Alignment of the worker grievance mechanism with IFC PS2 – this was confirmed by the IESMC; and
- Alignment of the safety management system with OSHAS 18001 – all evidence indicates that this international standard set the framework for the system used at PHR.

ICE established a number of internal objectives with its program delivery, and tracked to see if they were meeting targets or if improvement measures were required. There are a number of examples where improvements were steadily documented through the project construction period, and eventually targets were met. For example, compliance of OHS officers with their program for inspection and follow-up on non-conformities was monitored, and reached its goal of 100% in 2016. The Accident Frequency Indicator was closely monitored, and declined from a figure of 80 for 2014, to 53 for 2015, and 35 in 2016 which was below the benchmark set of 38.

Compliance requirements for the PHR are set out in the Costa Rican Labour Code and in the terms of the EPC Contract. The June 2017 IESMC report noted that 311 legal actions brought by PHR workers are in the process of judicial review. 229 of these are related to in-kind salary payments, while 82 are of another nature, including worker dismissal with no justifiable cause, worker dismissal without employer obligations (*sin responsabilidad Patronal*) and situations that had put at risk the safety of the worker and/or co-worker when they were still employed by ICE. A number of these cases have been resolved, 95% of them in ICE’s favour. In eight cases however, the judge has ruled in favour of the plaintiff, ordering additional payment from ICE.

<p>ICE's documentary records show that terminations of staff for various reasons were not uncommon during the project construction period, and increasingly common as staff numbers were reduced later in the construction period. Reasons for terminations are documented and internally reported, and statistics kept. Reasons listed include voluntary surrender of contract, services no longer required, unwilling to sign contract, not passing probation, death, and breaches against Article 81 of the Labour Code. A number of steps were used in disciplinary measures, including reprimands and suspensions.</p>
<p>This assessment received verbal evidence in relation to the 8 cases that ICE lost, and no specific documentation on these cases. Verbal evidence from ICE were that of the 311 cases of complaints, only 8 were issued against ICE, for class A risks in which the work or activities carried out by the employee put his life at risk. ICE advised that it goes beyond the legislation, with contract clauses stating that an employee was dismissed immediately if putting life at risk, dismissing with monetary compensation. In some cases the monetary payment was delayed due to administrative problems, and ICE was required by the courts to pay. ICE clarifies that there was always the intention to pay.</p>
<p>The court findings against ICE involve relatively few cases, only 8 out of 5,455 on the employee register which is about 0.15%. Given that the number of cases found against ICE is very small, and on the advice of ICE the nature of the cases lost is largely in relation to administrative delays in payments, these are accepted as minor non-compliances and are not considered a significant gap against basic good practice.</p>
<p>Criteria met: Yes</p>
<p><b>Analysis against proven best practice</b></p>
<p><b>Scoring statement:</b> <i>In addition, there are no non-compliances or non-conformances.</i></p>
<p>Although there are not many court cases that have ruled against ICE, the final number is not yet known. The June 2017 IESMC report noted that judicial resolution of the types of legal actions raised can take from one to one and a half years, and since the Costa Rican Labour Code allows workers to initiate a legal action for up to one year after termination of contractual obligations, additional legal actions may occur up to mid-2018 and possibly beyond.</p>
<p>The assessors did not receive any documentary evidence about the court cases that were lost, and were not able to verify the exact number concerning dismissal and number concerning delayed compensation payments. In the judgement of these court cases which found against ICE, ICE was not compliant with legal requirements. These non-compliances are a <b>significant gap</b> at the level of proven best practice.</p>
<p>Criteria met: No</p>
<p><b>12.2.5 Outcomes</b></p>
<p><b>Analysis against basic good practice</b></p>
<p><b>Scoring statement:</b> <i>There are no identified inconsistencies of labour management policies, plans and practices with internationally recognised labour rights.</i></p>
<p>Costa Rica is a member of the United Nations International Labour Organization and has incorporated recommendations and rulings of this organisation into its Labour Code. IFC PS2 reflects internationally recognised labour rights, and the lenders' review of the PHR confirmed alignment.</p>
<p>There were two fatalities during the construction period. In 2013, a worker died due to electric shock, attributed to a miscommunication. In 2015 a very experienced crane operator died, attributed to a misjudgement.</p>

Some notable achievements for the PHR safety program over the period 2009-2016 include:
<ul style="list-style-type: none"> <li>• PHR invested more than USD 7 million in OHS;</li> <li>• 7 244 training sessions were held in preventive issues;</li> <li>• 5 066 safety inspections were made;</li> <li>• 25 489 group meetings were held at work sites involving the Prevention Agents;</li> <li>• 44 121 actions for improvement were generated and followed up; and</li> <li>• The Accident Frequency Indicator had a significant and sustained decline from 2013 to 2016, and the project closed with this indicator below the benchmark target.</li> </ul>
Criteria met: Yes
<b>Analysis against proven best practice</b>
<b>Scoring statement:</b> <i>In addition, labour management policies, plans and practices are demonstrated to be consistent with internationally recognised labour rights.</i>
Independent confirmation by the IESMC consultants that the PHR was aligned with IFC PS2 demonstrates consistency of the PHR with internationally recognised labour rights. Further, ICE has mapped consistency of its provisions for the labour force against International Labour Organisation conventions to further demonstrate this consistency.
Criteria met: Yes
<b>12.2.6 Evaluation of Significant Gaps</b>
<b>Analysis of significant gaps against basic good practice</b>
There are no significant gaps against basic good practice.
0 significant gaps
<b>Analysis of significant gaps against proven best practice</b>
A small number of non-compliances as shown in upheld PHR worker court claims against ICE.
1 significant gap
<b>12.3 Scoring Summary</b>
The labourforce for the PHR during construction peaked in 2014 with almost 4 500 workers. More than 60% were recruited and trained from local communities. Conditions were independently verified as meeting international standards expressed in the IFC Performance Standard 2 Labour and Working Conditions, with a particular focus on a systematic approach to occupational health and safety (OHS) and a robust worker grievance mechanism. Considerable investment was made by the project into OHS, with evidence of numerous continuous improvement measures and a number of targets realised. Consistency of labour policies, plans and practice with internationally recognised labour rights is well documented. However a small number of PHR worker court cases have ruled against ICE, which is not significant against basic good practice, but is a gap at the level of proven best practice.
<b>Topic Score: 4</b>

## 12.4 Relevant Evidence

<b>Interview:</b>	13, 16, 19, 20, 40, 75, 76, 91
<b>Document:</b>	77, 91, 116, 120, 123, 134, 160, 162, 166, 167, 185, 194-196, 254-256, 258, 264, 282-295
<b>Photo:</b>	7, 27, 30, 33, 34, 45, 52, 53, 55-58, 70, 107-123, 134-137



## 13 Cultural Heritage (I-13)

This topic addresses cultural heritage, with specific reference to physical cultural resources, associated with the hydropower facility. The intent is that physical cultural resources are identified, their importance is understood, and measures are in place to address those identified to be of high importance.

### 13.1 Background Information

Physical cultural heritage encompasses objects, sites, structures, natural features and landscapes that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. In the context of PHR, these relate to archaeological sites (from all thousands of years B.C to the fourteenth century, and the railway to the Atlantic that was built in the nineteenth century.

The establishment of the communities along the Reventazón River and within the area of influence (Área de Influencia Directa, AID) of the project are closely linked to the development and construction of the railway, built by the then Costa Rica Railway Company and the Northern Railway Company to increase trade with overseas markets, in particular to export coffee. The railway went from Alajuela to San Jose and then to Limón and worked until its complete closure in 1995, providing a means of transportation three times a day which was reliable and affordable. The EsIA states that the communities attribute most of the socio-economic and demographic instability of the area to the closing of the railway in 1995.

According to Costa Rican Law No. 6703 on National Archaeological Heritage (1982), the National Archaeology Commission (Comisión Arqueológica Nacional or “CAN”) is the entity responsible for authorizing archaeological excavations in Costa Rica. ICE employs in-house certified archaeologists and contracts additional archaeologists and crews when needed.

### 13.2 Detailed Topic Evaluation

#### 13.2.1 Assessment

##### Analysis against basic good practice

**Scoring statement:** *Cultural heritage issues, with respect to physical cultural resources, that are relevant to project implementation and operation have been identified through an assessment process utilising appropriate expertise; and monitoring is being undertaken during the project implementation stage appropriate to the identified issues.*

CAN requires the project proponent to identify potentially-affected sites during project development and the EsIA through archaeological investigations and surveys. The EsIA includes two sections on cultural heritage, one on archaeological sites and one dedicated to the railway. It describes the results of archaeological surveys carried out during the Reventazón pre-feasibility studies (2005-2006) and the archaeological investigations carried out during the EsIA process in 2007-2008 within the AID of the project, with the objective of compiling an inventory of existing archaeological sites and preparing a management plan to avoid, minimize and compensate any impacts of the project on archaeological heritage. ICE identified a total of 37 sites during the EsIA process, of which 19 would be directly affected by the Project. During each of the investigation stages, the surveys were carried out by competent and certified archaeologists either in-house ICE staff archaeologists or contracted external archaeologists and excavation teams when needed.

Of all the sites registered during the pre-feasibility studies and the EsIA process, the site in San Antonio was of particular significance because it included structural components associated with burial grounds or housing and was attributed to various periods between ranging from 300 B.C. to 1350 A.D. PHR components with the most significant impacts on archaeological heritage are the reservoir, surge tank, tunnel outlet, penstock, construction camp, borrow areas, and substation. Findings during the EsIA stage included pieces of ceramic, stone tools and arrowheads, remains of burial grounds and graves, petroglyphs, stone paved roadways, structural walls or foundations of structures. The EsIA also mentions a few fossils found near the river. The National Museum was present during the recovery of some of the artefacts. The EsIA identified potential sites within the AID that required further excavation prior to earth movements and construction activities.

The EsIA included a section dedicated to historical and cultural sites which included the railway to the Atlantic and estimated that approximately 11 km of the railway including bridges will be affected by the reservoir, with a large proportion of it being in disrepair and either affected by landslides, covered by existing roadways, destroyed by floods or affected by vandalism. The EsIA mentions that ICE will work with INCOFER (Costa Rican Railways Institution, Instituto Costarricense de Ferrocarriles) to relocate the bridges depending on their structural stability.

Regarding monitoring during implementation, CAN and the National Museum periodically supervised archaeological excavations that were carried out by certified archaeologists and crews preceding all construction activities and certified archaeologists monitored subsequent earth movement activities closely throughout the construction of the Project.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, monitoring of cultural heritage issues during project implementation takes into account inter-relationships amongst issues, and both risks and opportunities that become evident during implementation.*

The archaeological investigations and surveys were closely monitored by CAN and the National Museum during the implementation phase and involved significant coordination with the construction management and environmental management teams involved in the various phases/stages of Project implementation. CAN requires a proposal for excavation activities prior to these being executed and then subsequently issues a Resolution to authorize the dig. Once the excavation is completed, an evaluation report is prepared by the archaeologist on-site that includes recommendations on how to manage the findings, if any, or release the site to the construction group. CAN then issues a Resolution authorizing the release of the area for construction activities or to carry out recovery or replicas, and endorses the recommendations made by the archaeologist.

Examples of how inter-relationships, risks and opportunities were take into account include:

- The scheduling of the significant archaeology-related activities incorporated into the project’s construction schedule with appropriate contingency;
- Scheduling of construction activities to take into account time allocated to reporting (to CAN), and response time to receive Resolutions and authorizations from CAN, as well as the coordination with supervision by CAN or the National Museum and weather conditions;
- As was the case for all construction activities, the archaeology teams on site were also in constant contact with the Occupational Health and Safety (OHS) group that would receive alerts regarding the early warning system for floods and the electrical stormwatch; and

- Logistics and human resources – at the peak of the archaeology-related activities taking place on site, there were approximately 10 certified archaeologists with crews of approximately 4 people conducting excavations in various locations within the AID.

Criteria met: Yes

## 13.2.2 Management

### Analysis against basic good practice

**Scoring statement:** Processes are in place to ensure management of identified cultural heritage issues, and to meet commitments, relevant to the project implementation stage; plans are in place for the operation stage for ongoing cultural heritage issues management.

The construction ESMP includes the general management of issues relating to physical cultural heritage and identifies clear steps and responsibilities under the premise that all archaeological work must be carried out in strict accordance with Law No. 6703.

Prior to construction activities, the proponent of a project must provide a proposal to CAN regarding the location and extent of excavations which are then authorized through a Resolution. Both CAN and the National Museum supervise excavations at project sites to ensure they are carried out according to the established standards. All recovered artefacts must be handed over to the National Museum of Costa Rica.

The ESMPs for the various project components state that all construction activities and land used for any construction or project-related activity must be systematically subjected to an archaeological investigation and evaluation to confirm the presence or absence of cultural resources that may be affected during construction. The results of the evaluations are reported to CAN and include recommendations made by the on-site archaeologist. CAN reviews the reports and issues a Resolution (i) releasing the site for construction if there are no cultural resources present or there is no risk of damage to the existing resources, (ii) stating that the resource is intangible and that it must be maintained for future investigations and conservation purposes, (iii) that the cultural resource must be relocated to safeguard it, or (iv) that the cultural resource must be recovered. A Chance Find Plan and constant archaeological supervision of earth movements were carried during project Implementation.

Regarding ongoing operation, the lenders' Environmental and Social Action Plan (ESAP) under Performance Standard 8 includes the development and implementation of a specific plan to acquire land at the San Antonio site to develop a visitor's centre. Although ICE complied with developing a plan, it was not able to acquire the land. Currently, ICE is in the process of finalizing a plan for an alternative involving an archaeological exhibit at the Reventazón Visitor Information Centre.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** In addition, processes are in place to anticipate and respond to emerging risks and opportunities.

During the construction phase ICE was flexible and able to adapt to findings during the excavation activities. ICE relocated waste rock spoil areas to avoid significant archaeological findings and established archaeological reserves which will be used in future research by CAN, the National Museum, universities and researchers. For example, a significant archaeological site (The "La Isla" site) was found at the location of the "Escombrera 3"

(spoil rock heap no. 3). La Isla is a 12 000 year old site from the Pleistocene era where stone tools and arrowheads were found. The archaeological team collaborated with the construction team and project designers to exclude certain areas from construction activities which led to the creation of the “archaeological reserves”.

ICE invited Indigenous communities from the neighbouring communities to come and observe the archaeological excavations and the archaeology work carried out in the laboratory located on site, and have received visiting groups from local and regional schools and national universities.

The discovery of important archaeological sites at the project site contributed to publications such as “Arqueología del Caribe” by Luis Hurtado Mendoza, internal reports and information pamphlets. The project also built visitor information stations around the site and the creation of archaeological reserves on land that has been set aside by ICE for future research. These areas are fenced and will be maintained by ICE.

ICE was not able to acquire the land from the current owners at San Antonio where ICE proposed to establish a Visitor Centre to showcase the archaeological findings on the left bank of the reservoir. The centre was one of ICE’s EsIA commitments and activities included in the lenders’ ESAP. According to ICE, they will include an archaeological section at the Visitor Centre located adjacent to the power house to replace the one at San Antonio and they are preparing a notification of this change to be submitted to SETENA. The petroglyphs and archaeological information and replicas will be exhibited at the visitor’s centre.

The EsIA committed to including aspects of the railway’s history and significance to the region at the visitor centre. However the ESMP for operations does not include the provision to include information on the railway. This is a missed opportunity and a gap at the level of proven best practice, but is addressed under Compliance/Conformance below.

Criteria met: Yes

### 13.2.3 Stakeholder Support

#### Analysis against basic good practice

**Scoring statement:** *There is general support or no major ongoing opposition amongst directly affected stakeholder groups for the cultural heritage assessment, planning or implementation measures.*

ICE carried out stakeholder engagement throughout the EsIA process to identify any known cultural and heritages sites, including those related to historic events surrounding the construction of the railway. Interviews and workshops were held in the communities regarding the progress of cultural heritage investigations and studies. During project implementation, many schools from neighbouring communities visited the archaeological reserves located within the project area, as did indigenous communities, CAN, National Museum, university researchers, INCOFER, the national railway company and others

ICE archaeologists also participated in visits to community schools to present archaeological findings to students and provided guided visits of the archaeological sites that were discovered within the project area and of their laboratory to universities, schools, government entities and financial institutions, indigenous communities from the neighbouring Pacuare area and other groups and companies. All were very interested in the findings and supportive of the efforts carried out by ICE.

The communication efforts carried out by the archaeological teams in the local communities and the visits by various academic entities, governmental entities, companies and community groups contributed to stakeholder support.

Criteria met: Yes

<b>Analysis against proven best practice</b>
<b>Scoring statement:</b> <i>In addition, formal agreements with the directly affected stakeholder groups have been reached for cultural heritage management measures.</i>
The creation of “archaeological reserves” conserved for future investigations by CAN, the National Museum and the Universities (such as “La Isla” and “La Quebrada”) are described in a report dated June 2016 “Reservas arqueológicas Intangibles en el PHR Estado actual y recomendaciones”. A total area of about 15 247 m <sup>2</sup> has been set aside for reserves. No formal agreements have been made with stakeholder groups for the management of the reserves or to carry out future research at these sites, but the provisions of Law No. 6703 are strong and ICE has an effective working relationship with CAN and the National Museum, so this is not considered a significant gap. In addition, ICE has committed to entering into an agreement with INCOFER regarding the historical railway and to include aspects of the railway’s history and significance to the region at the Reventazón Visitor Information Centre. Non-conformance with this commitment is a significant gap but it is addressed under Conformance/Compliance below.
Criteria met: No
<b>13.2.4 Conformance / Compliance</b>
<b>Analysis against basic good practice</b>
<b>Scoring statement:</b> <i>Processes and objectives in place to manage cultural heritage issues have been and are on track to be met with no significant non-compliances or non-conformances, and cultural heritage related commitments have been or are on track to be met.</i>
According to internal and external interviewees and documentary evidence, ICE has fulfilled all its undertakings and responsibilities with no significant non-compliances or non-conformances. The commitments made to physical cultural heritage are being met, and ICE is in the process of finalizing its proposal for SETENA describing the alternative proposed for the archaeological site in San Antonio. Because land in San Antonio could not be acquired by ICE they are proposing that an archaeological exhibit is included at the Visitor Information Centre near the Reventazón power house.
Criteria met: Yes
<b>Analysis against proven best practice</b>
<b>Scoring statement:</b> <i>In addition, there are no non-compliances or non-conformances.</i>
ICE has also committed to enter into an agreement with INCOFER regarding the historical railway and to include aspects of the railway’s history and significance to the region at the Reventazón Visitor Information Centre. However, the Management Plan for the Archaeology Information Centre included in the ESMP for the operations phase focuses on the exhibits of archaeological information and petroglyphs, and the maintenance of archaeological reserves and does not include mention of the railway. Non-conformance with a commitment to enter a formal agreement with INCOFER and to include railway heritage in the visitor centre is a <b>significant gap</b> against proven best practice.
Criteria met: No

## 13.2.5 Outcomes

### Analysis against basic good practice

**Scoring statement:** *Negative cultural heritage impacts arising from project implementation are avoided, minimised, mitigated and compensated with no significant gaps.*

Identified negative cultural heritage impacts arising from project implementation were avoided and minimised, during implementation by conducting extensive archaeological excavations ahead of construction activities that identified significant cultural heritage sites and any archaeological findings.

An example of avoided negative impacts includes the re-location of project components. For example the waste rock spoil area was re-located and an archaeological reserve was established to preserve the site and provide opportunities for future researchers to investigate the area. When the findings or artefacts were not considered as significant, they were documented and removed from their location and dated before being handed over to the National Museum, provided the recommendations made by the project archaeologist were accepted by CAN. Artefacts included petroglyphs, ceramics, pottery, stone tools and arrow heads. Six petroglyphs were kept on site and will be exhibited in the visitor's centre in the archaeological exhibit. All findings are described in six final reports that describe the activities and findings for each of the 6 archaeological investigation stages that were carried out.

Negative impacts are and will be minimised, mitigated and compensated by documenting findings, exhibiting artefacts including petroglyphs, and providing opportunities for the public and other stakeholders to understand cultural heritage of the area.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, negative cultural heritage impacts arising from project implementation are avoided, minimised, mitigated and compensated with no identified gaps; and contributions to addressing cultural heritage issues beyond those impacts caused by the project are achieved or are on track to be achieved.*

ICE has contributed to the dissemination of cultural heritage findings in the surrounding communities, regionally and at the national level by providing guided tours of the archaeological sites and archaeological laboratories to universities and schools, government entities, financial institutions, indigenous communities and other groups. In addition, ICE developed the information gathered from community workshops during EsIA investigations into a publication on the archaeology of the Caribbean.

However, there is no provision in the ESMP for operations to enhance the cultural heritage value of the railway or to meet commitments regarding the inclusion of the railway in the visitor centre. This is a missed opportunity, and is a **significant gap** against proven best practice. The gap is also addressed on Conformance/Compliance above.

Criteria met: No

## 13.2.6 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

Non-conformance with a commitment to enter a formal agreement with INCOFER and to include railway heritage in the visitor centre.

1 significant gap

## 13.3 Scoring Summary

ICE carried out extensive archaeological and cultural heritage work during the planning and EsIA stages of the project and during implementation. A significant amount of artefacts and cultural heritage information was gathered by ICE and was shared with stakeholders, including communities, academic institutions, governmental entities, Indigenous communities and more.

Commitments in the EsIA included an archaeological centre to be established in San Antonio, although ICE was not able to acquire the land for the centre and is in the process of notifying SETENA of the proposed change. The ESMP for the operations phase incorporates the proposed change and plans are in place to implement an archaeological exhibit within the visitor centre adjacent to the power house. However, there is one significant gap at the level of proven best practice, concerning the historical railway and Conformance/Compliance and Outcomes: ICE has not met a commitment to develop a formal agreement with INCOFER and to include the railway in the visitor centre, and this is a missed opportunity to enhance the heritage value of a historically-important feature of the region. There is one significant gap against proven best practice, resulting in a score of 4.

Topic Score: 4

## 13.4 Relevant Evidence

<b>Interview:</b>	34, 88, 89
<b>Document:</b>	17, 18, 20, 110, 182, 189, 251, 253
<b>Photo:</b>	124, 125, 126, 127, 128, 129, 130, 131, 132, 133



## 14 Public Health (I-14)

This topic addresses public health issues associated with the hydropower project. The intent is that the project does not create or exacerbate any public health issues, that improvements in public health are achieved through the project in project-affected areas where there are significant pre-existing public health issues, and that commitments made by the project to implement public health measures are fulfilled.

### 14.1 Background Information

Prior to the implementation of the Reventazón Hydroelectric Project (Proyecto Hidroeléctrico Reventazón, PHR) communities in the directly-affected area (Área de Influencia Directa, AID) were served by various tiers of the public health care system which included primary and preventative health care centres (Equipos Básicos de Atención Integral de Salud, EBAIS) in Santa Marta and El Cruce, and small community level centres that offered services weekly or monthly. Any emergencies were directed to larger clinics in Siquirres or Turrialba. A new middle-tier hospital has been built in Siquirres three years ago.

The Ministry of Health in Costa Rica is responsible for authorizing any wastewater, potable water, and solid waste management facilities and activities as well as public health-related activities such as the control of vector-borne diseases in communities. The Costa Rican Department of Social Security (or CCSS, Caja Costarricense de Seguridad Social) is responsible for providing health care services and managing health care facilities such as hospitals, clinics and primary and EBAIS.

Health issues relevant to the project's labour force are covered under I-12 Labour and Working Conditions. Public safety aspects of PHR are dealt with under I-5 Infrastructure Safety. I-18 Waste, Noise and Air Quality deals with construction-related impacts that also have public health relevance. This topic also has strong linkages to I-7 Project Benefits and I-9 Project-Affected Communities and Livelihoods.

### 14.2 Detailed Topic Evaluation

#### 14.2.1 Assessment

#### Analysis against basic good practice

**Scoring statement:** *Public health issues relevant to project implementation and operation have been identified through an assessment process utilising appropriate expertise; and monitoring is being undertaken during the project implementation stage appropriate to the identified issues.*

In the EsIA, ICE used the Development Plan for the Canton of Siquirres (2001-2010) as a basis to evaluate the socio-economic impacts of the Project. The Local Development Plan for the *canton* of Siquirres (2001-2010) (Plan de Desarrollo Local del Cantón de Siquirres or PDLCS) identified the public health system deficiencies for the *canton* through a participative community process. The poor quality of medical care in the area was attributed to inadequate infrastructure, the insufficient frequency of medical visits to satisfy the needs of the population, the poor quality of medical services provided, delays in receiving medicine as well as the poor quality of the drugs prescribed by doctors. The information in the plan was used to identify mitigation and compensation measures for the Canton of Siquirres and the affected communities on a number of topics, including public health.

Building on the information gathered from the plan, ICE carried out additional surveys regarding the available health care services and to gather the communities' perceptions of how PHR would impact these services. The communities were of the opinion that the Project would significantly affect health care services. The EsIA

mentions that the case loads that dominate the local health care facilities are respiratory diseases, family planning and reproductive health, and diseases that must be reported to the national health care system which include dengue, scabies, shigellosis and trichomoniasis. The EsIA provides an inventory of public health services in the affected communities located on both the left and right banks of the river. The key potential negative impact(s) and issues identified in the EsIA include increased demand for, and pressure on, existing public health services and infrastructure, and the need for improved public health infrastructure.

The assessment process was carried out using appropriate expertise and the identified issues were monitored during implementation. Infectious diseases such as dengue, zika and chikungunya were closely monitored. This was complemented by ICE’s community brigades detecting mosquito breeding sites. Ongoing consultation and monitoring of affected people by ICE’s social team also provided a means to monitor public health issues (refer to I-9 Project-affected Communities and Livelihoods).

Public health issues during the operations phase are considered in the ESMP for the operations phase. The ESMP includes provisions for a Participatory Environmental Monitoring Plan (Plan de Monitoreo Ambiental Participatorio). This includes: epidemiological monitoring of disease transmission in neighbouring communities in collaboration with the Ministry of Health and CCSS with the objective of avoiding an increase in the transmission of vector-borne diseases attributable to the Reventazón reservoir; geological monitoring of slope stability surrounding the reservoir to identify public safety hazards. The plan includes brief descriptions of the monitoring and campaign activities and their frequency, as well as the responsible ICE staff and external contacts, all of which have the appropriate expertise for carrying out their functions during the operations phase of the project.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, monitoring of public health issues during project implementation takes into account inter-relationships amongst issues, and both risks and opportunities for different community groups that become evident during implementation.*

The monitoring of the workforce addressed risks and opportunities through constant evaluation of worker health statistics and follow-up of the screenings and check-ups conducted. ICE took a comprehensive approach to the inter-relationships between workforce health and affected communities, as described below under Management. The Ministry of Health regularly monitors the wastewater treatment facility and effluent quality, as well as the water quality of the potable water source used at the workers camp to ensure ICE complied with the conditions of their authorizations.

Criteria met: Yes

## 14.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Processes are in place to ensure management of identified public health issues, and to meet commitments, relevant to the project implementation stage; plans are in place for the operation stage for ongoing public health issues management including hand-over to local authorities as appropriate.*

PHR implemented the following measures to address worker-community disease transmission during implementation:

- Pre-labour medical examination included checks for communicable diseases and follow-up;

- Biological control program on site (e.g. dengue and other vector-borne diseases brigades, inspecting for breeding areas for mosquitos on site and spraying, all required by the Ministry of Health);

- Education and awareness campaigns, including posters, talks, and disease information, led by PHR’s medical team.

The health centre at the camp co-operated closely with neighbouring communities to deliver medical care to both the workforce (see I-12 Labour and Working Conditions) and the general public (e.g. the project camp ambulance was often used for the general public).

The mitigation measures described in the EsIA include: construction of a new EBAIS for the communities of El Coco and Moravia; expansion of the small clinic in Santa Marta; expansion of the El Cruce clinic; and workshops in affected communities on community health care, first aid, domestic violence, birth control, prevention of drug use, and the emotional and psychological effects of the project on communities.

Although there is no mention in the EsIA of the prevalence of HIV-AIDS or sexually transmitted diseases in the local communities or how they may be affected by an increase in construction activity and the attraction of workforce to the area, during implementation PHR systematically tested workers at the time of hiring, for HIV-AIDS, sexually transmitted diseases (STDs) and other infectious diseases, and put workers on treatment regimes that included follow-up. Most of the workforce was from the local communities and bussed in and out every day (up to 2200 workers from local communities were transported to site daily).

The Limón and Siquirres areas are known to have a high incidence of substance abuse. PHR implemented a programme to control drug abuse which included the random testing of 5% of the workforce for alcohol and drug use. All positive cases would be referred to the national institute for alcohol and drug dependence (IAFA or Instituto de Alcoholismo y Farmacodependencia) with sites in Limón and Turrialba. ICE was in direct contact with IAFA and able to get appointments the next day to have their workers admitted into treatment and preventative programmes.

To control insect vectors, ICE’s community brigades carried out fumigation campaigns in communities, as well as in project construction areas using chemical products authorized for that purpose. These brigades were coordinated with the Ministry of Health and conducted campaigns to raise awareness in the communities about the diseases and preventative measures to help eliminate breeding sites.

Plans are in place for the operational stage through the Participatory Environmental Monitoring Plan. The plan includes campaigns for the elimination of mosquito breeding sites and epidemiological monitoring of disease transmission in neighbouring communities in collaboration with the Ministry of Health and CCSS, with the objective of avoiding an increase in the transmission of vector-borne diseases attributable to the Reventazón reservoir. The EBAIS built by the project have been handed over to local health authorities.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, processes are in place to anticipate and respond to emerging risks and opportunities.*

Processes addressing worker health responded to the risks of worker-community disease transmission, and opportunities to have a positive impact on community health. For example, all workers screened for HIV-AIDS, STDs and other infectious diseases were put on treatment programmes with periodic follow-ups, contributing to improving their level of health and decreasing pressure on the local health care system. In addition, random testing of workers for alcohol and drug use, zero tolerance and fitness for work programme, and the referral of workers to the national institute for alcohol and drug dependence for treatment and preventative programmes, improved the safety culture amongst the communities where they live. ICE’s Occupational Health and Safety

(OHS) group carried out training talks on STDs for groups of male workers and different groups in the communities.

Through the health-related community infrastructure built by PHR, including the construction of EBAIS buildings in Florida and El Coco, and the extension of the Santa Maria clinic (also an EBAIS) according to CSSS standards, the project will be able to continue to respond to emerging public health risks. In addition, the construction of community halls in several communities and recreational facilities in Florida and the gymnasium in Siquirres will have benefits for public health and wellbeing.

In addition, the Participatory Environmental Monitoring Plan and epidemiological monitoring in the communities during the operations phase will inform decision making, for example regarding future needs for additional control of insect vectors around the reservoir.

Criteria met: Yes

### 14.2.3 Conformance / Compliance

#### Analysis against basic good practice

**Scoring statement:** *Processes and objectives in place to manage public health issues have been and are on track to be met with no significant non-compliances or non-conformances, and public health related commitments have been or are on track to be met.*

All processes and objectives have been, and are, on track to be met with no significant non-compliances or non-conformances, and all public-health related commitments have been or are on track to be met.

Criteria met: Yes

#### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

The assessors are not aware of any non-compliances or non-conformances.

Criteria met: Yes

### 14.2.4 Outcomes

#### Analysis against basic good practice

**Scoring statement:** *Negative public health impacts arising from project activities are avoided, minimised and mitigated with no significant gaps.*

Negative public health impacts arising from project activities were avoided, minimised and mitigated with no significant gaps. The local workforce would be able to access the project health care centre thereby decreasing the pressure on the local health care system. Caseload records do not show any significant increase in public health problems and the level of service extended to affected communities was not affected negatively by the project. According to the communities, drug problems that existed in the town of Florida prior to project implementation remain, but are no worse than before. A doctor interviewed at the Siquirres hospital was not aware of any project impact on public health.

The project construction phase did not cause a significant influx of workers or camp followers from outside of the area by employing a significant number of workers from the local area. The strict enforcement of zero tolerance for drugs and alcohol on site was mentioned by the OHS team as contributing to decreasing drug and alcohol abuse amongst the workforce including those from the local communities. In 2011, 11% of cases tested

positive whereas in 2016, only 1% tested positive, and this significant decrease indicates a shift in health and safety culture.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, negative public health impacts arising from project implementation are avoided, minimised, mitigated and compensated with no identified gaps; and enhancements to pre-project public health conditions or contributions to addressing public health issues beyond those impacts caused by the project are achieved or are on track to be achieved.*

Negative public health impacts arising from project activities are avoided, minimised and mitigated with no gaps. Examples of enhancement of pre-project health conditions or community wellbeing include: (i) the construction and extensions to local health care centres (EBAIS); (ii) dengue brigades and vector control in the communities as well as education and awareness campaigns (dengue and other mosquito borne diseases were already prevalent in the area and not a result of the reservoir), (iii) referring workers who were also local community members to drug and alcohol abuse rehabilitation centres, (iv) construction of recreational facilities in Florida and community halls in several communities; and (v) construction of a gymnasium in Siquirres. The ESMP for the operations phase includes provisions for monitoring of mosquito-borne diseases and campaigns in communities to raise awareness and to eliminate breeding sites for vector-borne diseases.

Criteria met: Yes

## 14.2.5 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

There are no significant gaps against proven best practice.

0 significant gaps

## 14.3 Scoring Summary

The health situation and the needs for public health interventions in the project area were assessed as part of the EsIA. Key aspects identified were dengue and vector-borne diseases and the increased pressure on the local health facilities.

The management of issues has focussed on reinforcing local health care facilities, carrying out dengue and other vector-borne disease brigades, and control of breeding areas on site and in the communities, pre-screening the workforce for communicable and infectious diseases, the strict monitoring of drug and alcohol abuse and the systematic referral of positive testing workers to local rehabilitation facilities. The project also made contributions to the healthcare infrastructure through its own health care facilities and services that were used by the communities during emergencies. For example, the project ambulance would be dispatched into the communities when needed. There are no significant gaps at the level of proven best practice, resulting in a score of 5.

Topic Score: 5

## 14.4 Relevant Evidence

<b>Interview:</b>	17, 20, 94
<b>Document:</b>	18, 118, 134, 162
<b>Photo:</b>	120, 121, 122, 123, 134, 135, 136, 137, 138, 139, 140, 141

## 15 Biodiversity and Invasive Species (I-15)

This topic addresses ecosystem values, habitat and specific issues such as threatened species and fish passage in the catchment, reservoir and downstream areas, as well as potential impacts arising from pest and invasive species associated with the project. The intent is that there are healthy, functional and viable aquatic and terrestrial ecosystems in the project-affected area that are sustainable over the long-term; that biodiversity impacts arising from project activities are managed responsibly; that ongoing or emerging biodiversity issues are identified and addressed as required; and that commitments to implement biodiversity and invasive species measures are fulfilled.

### 15.1 Background Information

The directly-affected area (Área de Influencia Directa, AID), including the reservoir area, of the Reventazón hydropower project (Proyecto Hidroeléctrico Reventazón, PHR) is mainly a transitional zone of very humid tropical forest to premontane. The downstream area is very humid tropical forest, through the area of the Reventazón River until the estuary.

Prior to the implementation of PHR: laurel (*Cordia alliodora*) plantations established by a plywood company stood in areas of the construction site including the penstock, substation, concrete plant, spoil areas, and some access roads; grassland and scrubland covered most of the left bank of the Reventazón River and some areas of the right bank, the tail of the reservoir and the powerhouse; narrow strips of forests were located on the riverbanks and primarily on the right bank of the Reventazón, in the area that would become the tail of the reservoir; and 409 hectares of grassland and 266 hectares of forest stood in the area of the reservoir.

There are three migratory catadromous fish species in the Reventazón river: tepemechín (*Agonostomus monticola*), bobo (*Joturus pichardi*), and chupapiedras (*Sicydium altum*). Shrimp species (*Macrobrachium* spp) also have similar migration patterns.

The Reventazón reservoir inundated part of the Biological Corridor Barbilla – Destierro, which is part of the Mesoamerican Jaguar Corridor. The Barbilla – Destierro corridor also provides a link between two protected areas: the Talamanca Cordillera and the Central Volcanic Cordillera. The Tortuguero National Park is located 50-60 Km to the north of the Reventazón river mouth. The park is a natural network of marshy islands formed by an archipelago of volcanic islands and alluvial sediments. Other areas that may be indirectly affected by the PHR include the Central Volcanic Cordillera, the Tortuguero Conservation Area, Territories of the Amistad Caribe Conservation Area, and one section of a protected area on the right bank of the Siquirres River.

The Reventazón river is already heavily modified by existing upstream hydropower plants, where there is significant eutrophication and water hyacinth growth. Therefore, the integrity of the river as a habitat is limited.

Wildlife rescue prior to and during filling is discussed in this topic, but vegetation clearance for reservoir management is addressed in I-19 Reservoir Preparation and Filling. This topic also covers implications of downstream flows for aquatic biodiversity, while I-20 Downstream Flow Regimes considers biological issues in the balance between environmental, social, and economic aspects to determine flow regimes.

## 15.2 Detailed Topic Evaluation

### 15.2.1 Assessment

#### Analysis against basic good practice

**Scoring statement:** *Biodiversity issues relevant to project implementation and operation have been identified through an assessment process utilising appropriate expertise; and monitoring is being undertaken during the project implementation stage appropriate to the identified issues.*

ICE's team of biologists and experts carried out field surveys in 2007-2008 to prepare the environmental baseline of the Environmental Impact Assessment (EslA) in 2008. ICE complemented the surveys with a review of recent previous studies. Fauna surveys involved sampling in transects, both day and night, in the direct and indirect area of influence.

The EslA identifies habitats, biodiversity indices, species in danger of extinction or threatened and endemic species. Key flora species identified include: "palmito amargo" (*Socratea exorrhiza*) and "palmito dulce" (*Iriartea deltoidea*), manú (*Minuartia guianensis*), bromelias and orchids, in particular "guaria Turrialba" (*Cattleya doviانا*) is an endemic species and at risk of extinction. Tree species of importance identified include "cola de pavo" (*Hymenolobium mesoamericanum*), and "cristóbal" (*Platymiscium pinnatum*) both in danger of extinction.

The EslA identified species on the official list of threatened species of Costa Rica, and CITES (Convention on International Trade in Endangered Species), but does not identify IUCN Red List categories. The biodiversity management plan prepared by the lenders' consultants in 2012 provides Red List categories and BirdLife International lists. The information below is based on the official list of threatened species of Costa Rica.

The fauna surveys identified:

- 25 species of mammals in the project area, including threatened and endangered species, such as the jaguarondi or eyra cat (*Puma yagouaroundi*), anteaters, sloths, tayra, the congo monkey, white-headed capuchin (*Cebus capucinus*), otters, and footprints of mountain goats, and ocelots. Observations reported the presence of fishing bats in the Guayacán creek, and manatees in the channels area of the lower Reventazón.
- 251 bird species were observed during the surveys. The confluence with the Parismina reported the greatest diversity and abundance. Within the Project area, the areas with greater diversity included the Guayacán creek, the Lancaster lagoon, and Florida on the left margin dam site. The roseate spoonbill (*Platalea ajaja*) and the sunbittern (*Eurypyga helias*) are in danger of extinction, both observed in the lower Reventazón basin. The muscovy duck, the green ibis and the agami heron are on the list of endangered species. The crane hawk (*Geranospiza caerulescens*), the great black hawk (*Buteogallus urubitinga*) and the king vulture (*Sarcoram papa*) migrate in large groups between April and October and use forested areas sectors to spend the night during the migration.
- 31 species of reptiles, including poisoning snakes (e.g. coral, velvet and bocaraca) and the boa, which is in danger of extinction. The site with the greatest diversity was La Quebrada Guayacán. The surveys reported a group of 42 white-lipped mud turtles (*Kinosternon leucostomun*) near the spillway, in a temporary wetland. Leatherback sea turtles (*Dermochelys coriacea*) and green turtles (*Chelonia mydas*) nest in the Parismina sector and on Jalova beach; both species are on the list of endangered species. Crocodiles (*Crocodylus acutus*) are present in the confluence with the Parismina river, and caimans inhabit the lagoon of the Peje river. These two species are on the lists of species threatened with extinction.



<ul style="list-style-type: none"> <li>• 32 species of amphibians (mainly frogs, toads and newts) of which eight are threatened and one is of restricted distribution. The sites that showed the greatest diversity of species were Guayacán creek and the creeks Tres Amigos, Sibón and Rivulus;</li> </ul>
<ul style="list-style-type: none"> <li>• 52 species of fish that were collected on the Reventazón basin, and the confluence of the Reventazón and the Parismina River, and the Peje River were the most diverse sites. Tepemechines, juvenile bobos, “chupapiedras” (a type of clingfish), and shrimp, were observed in the Reventazón river and in tributaries of the basin. Common sawfish (<i>Pristis pristis</i>), and tropical gar (<i>Atractosteus tropicus</i>) were reported in Tortuguero. These two species are classified as in danger of extinction internationally, and there are recommendations to declare it threatened in Costa Rica.</li> </ul>
<p>The presence of terrestrial invertebrates of importance was not evaluated in the ESIA. This is a gap, but assessors are not able to say whether this is significant as there is no evidence of presence of invertebrate biodiversity of significance that could be affected by PHR.</p>
<p>The EsIA identifies impacts of each project construction and operation activity, including impacts on biodiversity. Key impacts include: loss of fragile ecosystems; interruption of Destierro-Barbilla biological corridor; interruption of passage of animals by construction works and the reservoir; loss of habitat in the reservoir area and construction sites; loss of fragile ecosystems; impacts on threatened species and species in danger of extinction; collision of birds with the transmission line cables; interruption of fish migration; proliferation of introduced unwanted species (tilapias); impacts of sediment discharges from the bottom outlet; impacts on protected areas downstream; and vegetation clearance and forest fragmentation. The complementary biodiversity studies prepared by the lenders’ consultants identified a number of additional impacts, including: the transformation of 8 km of river to an artificial lacustrine environment (reservoir); elimination of critical river habitats for fish species; alterations in water regimes and water quality downstream of the dam; fragmentation of a continuous aquatic environment; creation of a physical barrier that fragments biological corridors and generates loss of habitats and environmental services; and negative impacts on the survival of key terrestrial fauna and flora species.</p>
<p>The environmental management plan describes the biodiversity monitoring procedures to be undertaken during implementation, and species and ecosystems indicators. Monitoring has focused on jaguar, wild cats, and fish, as well as amphibians and reptiles. ICE monitored fauna at relevant points e.g. fauna release points and with relevant indicators for the identified issues; for example, fauna passages, fauna release points, aquatic macroinvertebrates, reforested areas, nursery production, and mortality rates of fauna. Monitoring of fauna and flora covered the direct and indirect influence areas, until the estuary, and covered the Parismina river.</p>
<p>Assessments were prepared by appropriate national and international experts. International experts prepared additional environmental studies to ensure that the lenders environmental requirements are met. Additional studies relevant to this topic are a fish habitat study, and a cumulative effects study.</p>
<p style="text-align: right;"><b>Criteria met: Yes</b></p>
<p><b>Analysis against proven best practice</b></p>
<p><b>Scoring statement:</b> <i>In addition, monitoring of biodiversity issues during project implementation takes into account inter-relationships amongst issues, and both risks and opportunities that become evident during implementation.</i></p>
<p>The monitoring of biodiversity issues during project implementation took into account inter-relationships amongst issues. Each work front required the presence of a multi-disciplinary team formed by biologists, an archaeologist, and a health and safety specialist to inspect the area before the clearance commenced. ICE</p>

identified the aquatic habitat restrictions for bobo and tepemechin, using the information provided by the panel of experts on minimum flows and field surveys. Monitoring of sediments during construction took into account possible effects on fish and sensitive areas. ICE evaluated cumulative impacts through an additional study required by the lenders which includes cumulative effects on biodiversity caused by other hydropower projects and agricultural practices in the basin.

The monitoring of biodiversity issues also took into consideration both risks and opportunities that became evident during the implementation. For example, fauna monitoring on the Biological Sub-corridor Barbilla-Destierro involved a partnership with “Panthera” to join efforts and share experiences. ICE and FONAFIFO monitor landowners’ compliance with the contracts for “payment for environmental services”.

There are a number of mechanisms that can identify emerging risks and opportunities. For example: inspections undertaken by ICE’s Environmental Supervision Unit (Unidad de Supervisión Ambiental, USA); complementary studies and visits of the lenders’ environmental consultants; ICE trained construction workers on flora and fauna identification, protection and management; and ICE participates in the Barbilla-Destierro biological corridor committee, which meets on a monthly basis and gathers representatives from ICE, SINAC, SETENA, NGOs, local teachers and tour-operators, and community members who participate in the ICE-FONAFIFO programme on payments for reforestation.

The presence of invasive species or risks of introducing invasive species was not evaluated in the EsIA. ICE used Kudzu grass, an invasive species that has caused problems in other countries, to revegetate slope areas. ICE did not monitor the risk that this species spreads, but it appears that native vegetation was dominant over Kudzu, and it did not cause any problems, so this is not significant.

Criteria met: Yes

## 15.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Processes are in place to ensure management of identified biodiversity issues, and to meet commitments, relevant to the project implementation stage; and plans are in place for the operation stage for ongoing biodiversity issues management.*

ICE developed a Construction Environmental Management Plan (EMP) set out the commitments for the implementation stage and measures to address identified impacts. For example, to prevent possible impacts on fauna, ICE installed bird deterrent devices on electric lines, installed signposts to prevent feeding and hunting animals and damage from traffic, constructed two aerial fauna passages (cables between posts and trees) at Puente Hermosa and Puente La Linda (south of the reservoir tail). ICE also followed the requirements set out in: the procedures for ecological restoration in areas of fauna relocation; procedure for the clinical management of fauna in ICE construction sites; environmental management plans tailored for each work site; the fauna rescue plan; and a procedure to rescue fish during the river diversion. ICE implemented measures to prevent illegal hunting in the project area, for example, through awareness and training campaigns for workers, and prohibition of hunting.

ICE cleared about 300 hectares of forest from the reservoir area and relocated over 38 000 animals including mammals, amphibians, and reptiles as part of the fauna rescue programme. More than half of the animals were relocated in private properties and about 10 000 in ICE’s property. Injured animals were taken to wildlife refuges and received medical assistance.

International experts prepared additional biodiversity plans to ensure that the lenders' environmental requirements are met. Additional plans relevant to this topic are: a biodiversity management plan; a construction management plan; and an aquatic compensation and offset plan.
Ongoing biodiversity issues that require management include: fragmentation of habitats; barriers to terrestrial and aquatic migration and biological corridors; restoration of construction sites; reforestation and compensation for the loss of habitats; control of water hyacinth in the reservoir; and indirect biodiversity effects downstream caused by erosion and sedimentation impacts and reduced flows, especially impacts on Tortuguero National Park. ICE will update the EMP for the operation stage and submit it to SETENA for approval.
Key plans for the operation stage are: the operation EMP, which includes programmes to address ongoing issues; a plan to strengthen the sub-corridor Barbilla-Destierro through an agreement on "payments for environmental services" with Costa Rica's Forest Financing Fund (Fondo Nacional de Financiamiento Forestal, FONAFIFO); an adaptive management plan for possible downstream impacts; the Parismina aquatic compensation and offset project; the water hyacinth control and management programme; the mid and lower Reventazón basin management plan; revegetation procedures; and a reservoir access and uses plan (see I-19 Reservoir Preparation and Filling). The operations manual sets the minimum flows for PHR operations, and the calculation of minimum flows took into account flow depth and velocity preferences of bobo and tepemechin.
<b>Criteria met: Yes</b>
<b>Analysis against proven best practice</b>
<b>Scoring statement:</b> <i>In addition, processes are in place to anticipate and respond to emerging risks and opportunities.</i>
Processes are in place to anticipate and respond to emerging risks and opportunities. These include oversight by SETENA, via their "Plenary Commission", and the lenders' review of the construction and operation EMP, and their inspections and monitoring visits.
The adaptive management plan for downstream areas and biodiversity monitoring plans for key habitats and species, together with the reviews and inspections by ICE's USA, and the recommendations of the lenders' environmental consultants, have provided and will provide means to address emerging issues during construction and operation. The offset plan was a response to the infeasibility of creating an effective fish passage.
There are processes to anticipate and respond to risks in the following areas:
<ul style="list-style-type: none"> <li>• The Parismina offset is not effective – this will be monitored by ICE and the lenders, and results re-evaluated every 5 years;</li> <li>• The Parismina will be developed for hydropower – river is protected for 25 years;</li> <li>• Downstream impacts – through the adaptive management plan (but please refer to I-20 Downstream Flow Regimes); and</li> <li>• The FONAFIFO plan is not effective, and key species (e.g. jaguar) will not be able to migrate across the corridor – responses will include training for landowners or further incentives for participation.</li> </ul>
As an example of an opportunity taken, ICE's environmental team collected seeds from species that will be affected by the construction and filling of the reservoir, and developed a nursery on site that produced over 285,000 plants over six years for reforestation of the reservoir buffer zone and the sub-corridor, and the spoil sites.

FONAFIFO has identified risks that could jeopardize the success of the “payment for environmental services” programme, for example: risks of fires are minimal; they provide training to landowners on pest control; and finding new ideas to incentivising new landowners and those wanting to withdraw their contract (none to date).

Criteria met: Yes

### 15.2.3 Conformance / Compliance

#### Analysis against basic good practice

**Scoring statement:** *Processes and objectives in place to manage biodiversity issues have been and are on track to be met with no significant non-compliances or non-conformances, and biodiversity related commitments have been or are on track to be met.*

Processes and objectives of the plans listed in Management above are on track to be met. Environmental Management Plan measures have been implemented with the exception of the creation of a fishery to restock fish in the reservoir, transport migratory fish, creation of vegetation screens, and creation of a frogs breeding community programme. Some of these measures were not feasible, and other and more effective measures, such as the Parismina and Dos Novillos offset programme, were developed and implemented to address impacts on aquatic ecology. Therefore this is not considered a significant non-conformance. SETENA has not identified any significant non-compliances. Grievances filed through the lenders are addressed in I-9 Project Affected Communities.

As required by national legislation, ICE obtained forest clearing permits to cut trees, and specimens that required protection were temporarily housed as a reference collection in the ICE laboratory and then delivered to the national collections. As required by legislation, ICE sent aquatic macroinvertebrates to the Zoology Museum of Costa Rica University.

ICE and FONAFIFO signed an 11-year agreement in 2015 to reforest 728.8 hectares of forest, protect 78 hectares to promote the regeneration of natural vegetation, and plant 34 150 trees in the area of the biological corridor Barbilla-Destierro and around the tail of the reservoir. The programme is on track as it has achieved 95%, 48% and 95% of those targets.

ICE’s USA supervises activities at least one or two months in advance of the start of construction activities. USA and the lenders did not report significant biodiversity non-compliances or non-conformances.

Criteria met: Yes

#### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

There are non-compliances or non-conformances with the EMP, but in many cases the proposals were not feasible and alternative measures have sufficiently addressed the intent. For example, EMP includes a measure to reproduce frogs in captivity, but this was never implemented. This gap is addressed on I-3 Environmental and Social Issues Management and is not considered significant on I-15.

Criteria met: Yes

**Analysis against basic good practice**

**Scoring statement:** *Negative biodiversity impacts arising from project activities are avoided, minimised, mitigated, and compensated with no significant gaps.*

The project has avoided and minimised some specific impacts through design and construction activities. For example, ICE built the penstock over a bridge to avoid impacts on the Guayacán creek; ICE relocated orchids; and ICE maintained an area of 1.5 hectares near the main construction work site that had important native species such as: mahogany (*Carapa guianensis*), “cativo” (*Prioria copaifera*) and mountain almond tree (*Dipteryx panamensis*). Reforestation plans around the reservoir, construction sites and spoil sites, and the “payment for environmental services” programme are on track.

As an example of impacts mitigation, ICE relocated fauna and flora prior to the filling of the reservoir (see I-19 Reservoir Preparation and Filling). Key residual impacts that require compensation include: the loss of forest, and habitats in the reservoir area and construction, impacts on the sub-corridor Barbilla-Destierro, and barriers to migration of fish species. The biodiversity mitigation and compensation plans include: 1 492 ha in the corridor; a 50m buffer zone around the reservoir; and an aquatic ecology offset programme to compensate the residual and cumulative effects on the aquatic biodiversity and environmental services of the Reventazón River, and create a net loss null or a positive net gain.

Conclusions of the first year of monitoring of in the lower Reventazón basin, indicate that the ‘quality of aquatic ecosystems’ has slightly improved compared to baseline conditions. Fish abundance has declined but the richness is maintained or improved in some places such as Jalova.

The Parismina-Dos Novillos offset programme aims to compensate: the net loss of fauna in the direct influence area (471 to 538 species, of which, 34 are endangered species and 58 are threatened species); the loss of flora (about 193 species, of which, 15 are endangered and 6 are threaten); loss of terrestrial habitats and connectivity; and impacts on fish migration.

The offset includes the establishment and management of a protected area encompassing a 100.5 km, a corridor along the Parismina River with 794 hectares of protection zone, and 8 178 hectares of a 500 m buffer zone on each river bank. Key measures include: revegetation of river banks; eco-toxicology and contamination studies; preparation of a risk management plan; promote good agricultural practices; environmental education; monitoring of water quality, habitats, flora and fauna; improved waste management practices; and partnerships with NGOs, communities and landowners, and commercial agricultural producers. The programme expects a net gain of 40% or more if proposed management measures are implemented accordingly. Expected gains of the project include: riparian habitat increase (quantity and quality); improved connectivity; improved river hydrogeomorphology; increase presence of key fish species; and better water quality.

In July 2016, the government declared the Parismina and Dos Novillos offset programme area as “free of barriers” and of public interest (decree 39772-MINAE). Earth University and MINAE are planning to create the “Parismina Biological Corridor”, which will include the offset areas.

The success of the offset will be measured using metrics on the quantity and quality of the affected aquatic habitat before and after the programme until the year 2035. The quality of the aquatic habitat is calculated using recognised indicators such as a water quality index (Índice de Calidad de Agua, ICA and Biological Monitoring Working Party-Costa Rica, BMWP-CR), the Fluvial Habitat Index, the Hydro-Geomorphological Index, and the Ribera Forest Quality Index.

The selection of the Parismina River and its tributary Dos Novillos as a river compensation site to compensate for the residual and cumulative impacts complies with the requirements of the “Business and Biodiversity Offsets Programme” (BBOP) 2013. It was selected in 2012 following the assessment of a range of criteria, by international experts, for several catchments on the Caribbean coast. The most important criteria were: the presence of key aquatic migratory species (e.g. bobo), and no plans to develop hydropower projects. The Pacuare basin, located approximately 10 Km to the east of the Reventazón reservoir, was the first best option, but it was not selected because the government had plans to develop hydropower at the time (but in 2015, the government declared Savegre and Pacuare Rivers as protected from hydropower development for the next 25 years). The Pacuare basin would have had the advantage of protecting the river all the way to the coast. Although the Parismina offset will not protect the most downstream section of the Reventazón river, the adaptive management plan is intended to address any emerging downstream issues (see below).

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, negative biodiversity impacts arising from project implementation are avoided, minimised, mitigated and compensated with no identified gaps; and enhancements to pre-project biodiversity conditions or contribution to addressing biodiversity issues beyond those impacts caused by the project are achieved or are on track to be achieved.*

Negative biodiversity impacts arising from project implementation are avoided, minimised, mitigated and compensated with no identified gaps. There are uncertainties on how the downstream areas will adapt to the operating plant, and potential impacts on Tortuguero National Park associated with the reduced sediment deposition rates and flows, and future dewatering events. The adaptive management plan and monitoring in downstream areas will provide means to prepare adaptive measures. The adaptive management plan for downstream areas proposes actions based on possible monitoring results of the riparian habitat and aquatic ecosystems quality, and fish abundance. This plan involves, for example, the revegetation of critical erosion areas with native species such as Sotacaballo (*Zygia longifolia*). There may be a risk that it will be impossible to address changes due to altered flows regimes, but this is discussed in I-20 Downstream Flow Regimes.

ICE’s preliminary results of the offset programme indicate that the conditions have slightly improved compared to the pre-project indices. However, it is too early to conclude that the programme is a success and ICE will continue monitoring under the supervision of the lenders’ environmental experts.

If the offset achieves a net gain, the project can provide an enhancement to pre-project biodiversity conditions. PHR will mitigate and compensate for the loss of forest through the mitigation and compensation programmes: 792 ha, including 300 ha of forest, was cleared in the reservoir area, and the FONAFIFO programme has already reforested 616 ha, achieved 37.6 ha of natural forest regeneration, and planted 32 107 trees in agricultural areas. Lenders’ IESMC concur that mitigation and compensation activities are adequate.

Criteria met: Yes

## 15.2.5 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

There are no significant gaps against proven best practice.

0 significant gaps

## 15.3 Scoring Summary

Specialists with appropriate expertise assessed the biodiversity impacts arising from PHR. Plans to manage biodiversity impacts are described in the EMP, a Construction EMP, EMP for specific work sites, the fauna rescue programme, and a biodiversity management plan. Key plans for the operation stage include: an EMP for operations; a plan to strengthen the sub-corridor Barbilla-Destierro through an agreement on payments for environmental an adaptive management plan for possible downstream impacts; the Parismina aquatic compensation and offset project; the water hyacinth control and management programme; the Reventazón mid and lower basin management plan; revegetation procedures for construction sites and spoil areas; and a reservoir access and uses plan that is under development. There are no significant non-compliances or non-conformances. There are elements of the EMP that were not implemented as they were not feasible, but mainly alternative measures have been implemented.

To compensate for residual impacts on biodiversity, i.e. fish and wild cats migration, and the loss of wildlife and forest, PHR has implemented an offset. The offset includes the establishment and management of a protected area, a corridor along the Parismina River, and a 500 m buffer zone on each riverbank. The offset and reforestation activities around the reservoir and along the Reventazón riverbanks downstream are likely to achieve a net gain.

Topic Score: 5

## 15.4 Relevant Evidence

<b>Interview:</b>	18, 21, 23, 24, 28, 36, 39, 60, 70, 73, 82, 86, 90
<b>Document:</b>	3, 17-19, 23, 104-105, 107, 118, 134-136, 147, 161-162, 171, 174, 181, 203, 208, 220, 227, 275, 297-313
<b>Photo:</b>	42, 96, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 167, 172, 175

## 16 Erosion and Sedimentation (I-16)

This topic addresses the management of erosion and sedimentation issues associated with the project. The intent is that erosion and sedimentation caused by the project is managed responsibly and does not present problems with respect to other social, environmental and economic objectives; that external erosion or sedimentation occurrences which may have impacts on the project are recognised and managed; and that commitments to implement measures to address erosion and sedimentation are fulfilled.

### 16.1 Background Information

The Reventazón river could be divided into three morphological sections before PHR construction: (i) the middle section of the river, from Angostura dam to the Reventazón dam site (40 km) with a 1.3% gradient; this section was characterised by transport and temporary storage of coarse sediment from upstream reservoir releases; (ii) a transition section (20 km), where the river gradient decreases to 0.6%, and the river leaves mountain areas to enter the alluvial zone; this section is characterised by the storage and deposition of coarse sediments; (iii) an alluvial section (40 km) where the gradient is low (0.036%) and sand and silt form the riverbed materials; this section is more dynamic and the riverbanks are easily eroded.

The watershed area of Reventazón River at the dam site is 1 739 km<sup>2</sup>. Average annual precipitation is 3 317 mm, average annual river discharge is 152 m<sup>3</sup>/s, and PHR power station has a design discharge of 240 m<sup>3</sup>/s. PHR has a bottom outlet with a discharge capacity of 600 m<sup>3</sup>/s. The estimated total annual sediment load in the reservoir is 4 240 752 tonnes taking into account natural suspended load, natural bed load, and Angostura's reservoir flushing load.

PHR rehabilitated and improved the conditions of about 30 km of roads. Run-off from construction sites, including roads and spoil areas is addressed in this topic in relation to their contribution of sediment to watercourses. I-18 Waste, Noise and Air Quality will address management of spoil. Catchment management measures are mentioned in this topic, but details of catchment management measures for reservoir quality and filling are addressed in I-19 Reservoir Preparation and Filling, and I-15 Biodiversity and Invasive Species.

### 16.2 Detailed Topic Evaluation

#### 16.2.1 Assessment

##### Analysis against basic good practice

**Scoring statement:** *Erosion and sedimentation issues relevant to project implementation and operation have been identified through an assessment process utilising appropriate expertise; and monitoring is being undertaken during the project implementation stage appropriate to the identified issues.*

ICE's Environmental Impact Assessment (EslA, 2009) included a study of the river morphology, longitudinal profile, granulometry, and analysis of sediment loads and transport in the river during normal periods of operation and during dewatering events at Cachí and Angostura reservoirs.

Impacts identified for the construction phase included: land use change in construction areas, spoil areas, and the reservoir, impacts of the creation of new roads, risks of soil contamination, changes in erosion rates in construction sites and increased run-off, and risks of slope instability.

The EslA identifies the following impacts during operation: hydromorphological changes downstream; alteration of the sediment balance and imbalance in the river's natural dynamics; a lower amount of sediment will be



transported and deposited to the lower reaches, resulting in greater erosion downstream; increased depth of the river downstream; sediment storage in the reservoir; and cumulative impacts, for example increased erosion due to poor agricultural practices downstream.

ICE's Environmental and Social Management Plan for the maintenance of the road network identifies sites and roads prone to erosion due to sediment run-offs from spoil sites (sites 3, 2 and 15), sites prone to landslides, and water courses that could be affected by road construction (Guayacan, Tres Amigos, Sibon, Rivulus, and Pistola).

In 2012, the Inter-American Development Bank (IDB) contracted a multidisciplinary team of consultants from Integrated Environments (2006) Ltd., Environmental Resources Management (ERM) and Applied Aquatic Research Ltd to prepare an additional sediment study to look at possible effects of PHR operations, planned sediment flushing periods, and sediment dynamics changes on downstream sections of the Reventazón river and the Tortuguero National Park. Another sedimentation consultant looked at sedimentation rates and patterns in the reservoir, and provided recommendations for a sediment management plan. The studies are based on data collected over 40 years of historical daily flows and derived sediment load (June 1963 to April 2005) from the gauging station located at Pascua (within the reservoir area). Sediment records included data of suspended sediment load, bed load, and high sediment loads during flushing events of Cachí and Angostura reservoirs (approximately 3 days in September and 3 days in November every year), sediment data for the Angostura hydrological station (located downstream of the Angostura dam), and 21 years (1973 to 2003) of sediment data for El Congo hydrological station.

The consultant's estimate of the average annual natural suspended sediment load was 2.63 million tonnes compared to 3.13 million tonnes presented in the feasibility report. The study used the Bed Load Assessment of Gravel-bed Streams (BAGS) model to generate the bed load transport rating curve of the Reventazón River below the confluence with the Toritos tributary. The model used data of river cross sections, reach-average slopes, discharge or flow duration curve, and particle size parameters estimated from samples of the bed sediment. LIDAR data and the Reventazón dam design drawings provided by ICE were used to define the river cross sections. The model covers approximately 14 km of the river reach, extending approximately 11 km upstream from the dam section. The modelling of sediment deposition and transport in the Reventazón reservoir used the Reservoir Conservation (RESCON) model. RESCON indicated that flushing is the best alternative among four management options considered: flushing, hydro-suction sediment removal system, dredging, and dry excavation. The consultant studied the effectiveness of flushing for removing sediment from Reventazón reservoir using the MIKE 21C model. This model indicates that the anticipated storage loss in the absence of sediment management would amount to about 35% of the total and 33% of the active storage volume over a 40-year period. The study recommended a partial drawdown flushing for Reventazón.

ICE's data from October 2005 indicate that above 0.744 million tons of sediment reach Pascua but only 0.496 million tons of sediment reach Hamburgo. This indicates that 67% of sediment passes and 33% is left behind. ICE predicts that an amount of approximately 2 million tons per year of sediment will reach the estuary just from the Reventazón River. The other rivers flowing into the estuary, particularly the Parismina River, could carry similar amounts of sediment. ICE is now monitoring sediments on the Parismina River to enable better sediment balance calculations in the estuary.

ICE modelled two extreme and unlikely scenarios of landslides in the reservoir and the potential dam break effects of a wave. The study concludes that this type of event is very unlikely and if it occurs, the movement is expected to be very slow from less than 1 m / week to 1 m / day. The analysed cases used speeds of 0.96 m / s up to 2.56 m / s which are considered as very fast slip. There will be no overflow under the conditions modelled.

The EsIA, monitoring and additional studies were undertaken by appropriate experts in sedimentation, hydrologists, and engineers. During PHR implementation, ICE continued to monitor sediments at the same stations on the Reventazón river, and creeks that may be affected by run-off and discharges from construction

sites, for example, from the concrete plant, road construction and sediment settling ponds. ICE also monitored slope instability in the reservoir area.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, monitoring of erosion and sedimentation issues during project implementation takes into account inter-relationships amongst issues, and both risks and opportunities that become evident during implementation.*

ICE took into account inter-relationships amongst issues when monitoring erosion and sedimentation issues during construction. For example, the revegetation of reservoir protection buffer zone (see I-19 Reservoir Preparation and Filling) will not only help to stabilise the slopes but will also help to improve connectivity of ecosystems and water quality. ICE monitors sediment levels to assess potential effects on aquatic fauna.

PHR took into account risks that become evident during implementation. ICE identified unstable and vulnerable areas surrounding the reservoir and monitored them (see I-19 Reservoir Preparation and Filling; studies concluded that there is no induced instability due to the creation of the reservoir). ICE monitored areas prone to instability using inclinometers, GPS-RTK (Global Positioning System - Real Time Kinematic) points, time domain reflectometry (TDR), piezometers, 11 digital seismological stations, and 12 hydro-meteorological stations. ICE also surveyed these areas and created an inventory of existing infrastructure and its conditions prior to construction.

The adaptive management plan identifies monitoring indicators and thresholds based on known standards that require the implementation of measures if and when changes are detected. This plan addresses other risks that may appear after the filling of the reservoir. ICE has classified the Reventazón river in sections considering factors such as agricultural activities, waste, discharges from urban areas, comparison between before and after discharges to the Reventazón River of possible pollutants through tributaries and artificial channels. ICE monitors a series of interrelated parameters as set out in the adaptive management plan sediment aquatic ecosystem quality, water quality, riparian vegetation quality, navigation quality and river morphology, and biological indicators. ICE takes measurements at 10 sampling sites from the tailrace to the Reventazón mouth including the confluences with the Parismina and Jaloba.

PHR took into account opportunities during construction, for example, a partnership with Comisión para el Ordenamiento y Manejo de la Cuenca Alta Río Reventazón (COMCURE) to prepare a lower Reventazón basin management plan, social benefits for reforestation in partnership with FONAFIFO, and opportunities to create re-circulation technologies to improve the efficiency of sediment ponds at the quarry on site.

Criteria met: Yes

## 16.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Processes are in place to ensure management of identified erosion and sedimentation issues, and to meet commitments, relevant to the project implementation stage; plans are in place for the operation stage for ongoing erosion and sedimentation issues management.*

The Environmental Management Plan (EMP) provides mitigation measures for all impacts identified for construction and operation. The EMP for the construction phase is completed with specific work sites EMPs. For example, ICE prepared and implemented an Environmental and Social Management Plan for the maintenance of the road network (2013), which includes measures such as: training of workers on erosion and sedimentation

issues, measures to prevent erosion (e.g. revegetation of slopes), and measures to prevent sediment run-off (e.g. sediment settling ponds, and barriers, and road ditches). ICE also prepared Environmental Management Plans (EMP) for specific work sites; for example, the EMP for the concrete plan requires the installation of run-off control ditches to direct run-off to sediment settling ponds, clean the sediment ponds once a week, and dispose the sediments in spoil areas. ICE revegetated affected slopes and spoil sites using vetiver, and, in some cases, kudzu (see I-15 Biodiversity and Invasive Species). Visual evidence indicates that native vegetation has rapidly covered affected and revegetated sites.

Plans for the operation stage include: an adaptive management plan for downstream areas; an operations manual; a reservoir-zoning plan; and a management plan for the mid and lower Reventazón basin.

The lenders' consultants recommended that ICE prepare an adaptive sediment management plan for the operation phase that should include: flushing procedures, mitigation responses for each river section, monitoring and data collection, sediment transport models and bathymetric surveys, an analysis of land use changes and sediment changes, a schedule of flushing events, and mitigation measures based on the result of 2D or 3D models. ICE prepared an adaptive sediment management plan in August 2015 and monitoring began in 2016. Examples of adaptive mitigation measures that can be implemented to mitigate possible impacts in the estuary include: flushing during high flows and rainy periods, riverbank plantations and stabilisation, analyse other methods of sediment removal, and prepare an estuary monitoring plan that includes suspended sediments, bathymetry, flows, tides, waves, sediment transport and granulometry. ICE is preparing a plan for controlled sediment flushing using the bottom outlet. Although the reservoir may not require flushing for 20 years, some flushing may be necessary to provide sediment downstream to avoid or minimise erosion.

ICE acquired more land than the area inundated by the reservoir to extend ICE's property to unstable areas and reforested a buffer zone of 50m around the reservoir perimeter. ICE is preparing a reservoir-zoning plan of possible reservoir uses considering the erosion and sedimentation risks (see I-19 Reservoir Preparation and Filling).

The PHR operations manual includes a generic procedure for partial dewatering of the reservoir and flushing sediments. ICE is preparing a detailed plan for partial dewatering considering synchronisation, generation aspects with Angostura and Cachí, and environmental aspects.

ICE, in partnership with the Commission for the Management of the Upper Reventazón River Basin (COMCURE, Comisión para el Ordenamiento y Manejo de la Cuenca Alta Río Reventazón), Ministry of Environment and Energy (MINAE, Ministerio de Ambiente y Energía) and Associations of Water Supply Systems and Rural Sewers (ASADAS, Asociaciones Administradoras de Sistemas de Acueducto y Alcantarillados Rurales) prepared and implemented a management plan for the mid and lower Reventazón basin. The plan includes forestry projects to reforest and enhance existing native forests with the aim, amongst others, to reduce erosion and sedimentation and control run-off caused by poor agricultural practices and deforestation (see I-15 Biodiversity and Invasive Species).

Damage to the electro-mechanical equipment from coarse sediment is avoided by capture of this sediment in the reservoir, and the intake is protected by its position and trashracks.

**Criteria met: Yes**

**Analysis against proven best practice**

**Scoring statement:** *In addition, processes are in place to anticipate and respond to emerging risks and opportunities.*

During construction, ICE's team was responsible for implementing the EMP, under the supervision of ICE's Environmental Supervision Unit (USA, Unidad de Supervisión Ambiental) team. USA raised non-conformances

with the EMPs, for example issues on the maintenance of sediment settling ponds, and followed them up until the issue was resolved.

The lenders' consultants also provided recommendations to improve the EMP for the construction phase and the adaptive management plan for the operation phase. The adaptive management plan, the basin management plan, and the monitoring programmes will allow ICE to anticipate and respond to emerging risks when monitoring data reaches the established thresholds. Examples of emerging risks that can be addressed include sediment accumulation in the reservoir, and erosion downstream.

ICE has responded to emerging risks concerning the road to San Joaquin, which is failing in one place due to erosion, and instability in Ruta 415 in several places around Pascua and Bonilla. It has facilitated repair of the San Joaquin road by the municipality, and repaired Ruta 415 as required (though will not be responsible for this in future, please refer to I-7 Project Benefits for further details).

Opportunities taken to enhance pre-project issues are related to erosion protection and reforestation of areas around the reservoir and downstream. This is included in the mid and lower Reventazón basin management plan. ICE works together with partner agencies, local farmers and businesses, and landowners in the implementation of the plan.

Criteria met: Yes

### 16.2.3 Conformance / Compliance

#### Analysis against basic good practice

**Scoring statement:** *Processes and objectives in place to manage erosion and sedimentation issues have been and are on track to be met with no significant non-compliances or non-conformances, and erosion and sedimentation related commitments have been or are on track to be met.*

SETENA has not raised any non-compliances on erosion and sedimentation issues based on the periodic reports submitted by ICE ("Informes de Regencia" or compliance reports to SETENA). ICE's supervision team raised non-conformances related to the maintenance and capacity of sediment settling ponds used during improvement works of access roads on sites near creeks and at the quarry. These issues caused temporary and reversible adverse impacts on sediment discharges and the quality of Tres Amigos creek, and Sibon creek. ICE found ways to resolve the problems, for example by changing the location of the sediment ponds and clean them more often, and the conditions of affected creeks returned to their original status after the construction works.

Criteria met: Yes

#### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

There were recurrent non-conformances with regard to sediment and run-off management from several work sites as described above. During the first 2 years of construction, no sediment control measures were put in place, but measures were adopted later at the instigation of the lenders. There are also non-conformances with the sediment monitoring plan. ICE has not collected data on the first three established monitoring points immediately downstream of the dam since the filling of the reservoir (part of the adaptive management plan) due to accessibility issues and bad weather conditions. This pattern of non-conformances is a **significant gap** against proven best practice.

Criteria met: No

**Analysis against basic good practice**

**Scoring statement:** *Erosion and sedimentation issues during project implementation are avoided, minimised and mitigated with no significant gaps.*

Significant erosion and sedimentation issues during implementation were avoided, minimised or mitigated. The management of spoil sites and run-off from the construction of access roads presented challenges during construction, and caused temporary negative impacts on Tres Amigos and Sibón creeks. After construction, sediment discharges and erosion rates reverted to background levels. Monitoring data shows that sediment concentrations in the runoff from the construction site were not higher than in the Reventazón River. Some areas of the reservoir, especially on steep areas of the tail of the reservoir and unstable areas still have standing trees, and this helped erosion control during and after reservoir filling.

The monitoring results gathered downstream during the first quarter of 2017 (January-February-March) as part of the adaptive management plan indicate that "aggressive river syndrome" has already cause some negative effects in sections 3 and 4 of the river as measured by the "hydrological quality" and "quality of the channel" indicators of the ICFSF index, but the effects are not necessarily attributable to the project.

Sediment will accumulate in the reservoir and suspended and bedload sediment will reduce downstream during the first years of operations. Effects in downstream areas are uncertain, but the monitoring and adaptive plan will enable responses to changes in the sediment transport dynamics, erosion, estuary, and river morphology.

Criteria met: Yes

**Analysis against proven best practice**

**Scoring statement:** *In addition, erosion and sedimentation issues during project implementation are avoided, minimised, mitigated and compensated with no identified gaps; and enhancements to pre-project erosion and sedimentation conditions or contribution to addressing erosion and sedimentation issues beyond those impacts caused by the project are achieved or are on track to be achieved.*

Sediment and run-off control were not ICE's practices during the first two years of construction and therefore impacts were not avoided, minimised or mitigated. ICE's contractual agreements with the IDB required sediment management practices that were implemented although recurrent issues and difficulties around maintenance occurred. This is a significant gap against proven best practice, but is the same gap identified under Conformance / Compliance above.

PHR will mitigate any potential residual or emerging impacts through the adaptive management plan actions.

The reservoir-zoning plan will contribute to improved management of the reservoir area and potential uses considering instability issues. By addressing these areas with an integrated land use management approach the project avoids the social impacts of land acquisition, and contributes to limiting on-going land degradation and declining productivity.

The project is enhancing pre-project erosion and sedimentation conditions through the implementation of the mid and lower Reventazón river basin management plan, and the "payment for environmental services" programme (see I-15 Biodiversity and Invasive Species), which will reduce the erosion potential of land surrounding the reservoir and downstream areas, restoration of river banks and riparian vegetation, regenerating agro-forestry areas with native vegetation and working with landowners to improve farming practices. Initial results from the implementation of the plan show that the objectives are on track to be achieved.

Criteria met: Yes	
<b>16.2.5 Evaluation of Significant Gaps</b>	
<b>Analysis of significant gaps against basic good practice</b>	
There are no significant gaps against basic good practice.	
0 significant gaps	
<b>Analysis of significant gaps against proven best practice</b>	
There were recurrent non-conformances with regard to sediment and run-off management from several work sites, and ICE is not collecting data from all planned monitoring sampling points.	
1 significant gap	
<b>16.3 Scoring Summary</b>	
PHR assessment of erosion and sedimentation issues was comprehensive and relevant to project implementation and operation. The assessments were based on field measurements and recognised models. ICE continued to monitor sediment loads on the Reventazón River and creeks that could be affected by the construction works. The monitoring of erosion and sedimentation issues takes into account inter-relationships amongst issues through and opportunities were taken to implement new systems to manage sediments on site.	
ICE prepared and implemented Environmental and Social Management Plans for the maintenance of the road network and for specific work sites that include measures to control run-off, erosion and sediment control. During operation, erosion and sedimentation issues will be managed through a number of plans: an adaptive management plan for downstream areas; an operations manual; a reservoir-zoning plan; and a management plan for the mid and lower Reventazón basin.	
PHR has no significant non-compliances or non-conformances. ICE experienced recurrent challenges in the implementation of sediment and run-off control measures, but those were resolved. However, there are non-conformances regarding the location of data collection points downstream of the dam. PHR is expected to improve the erosion and sediment situation around the reservoir and downstream through the implementation of the mid and lower Reventazón basin management plan, and a programme that provides payments to local communities and businesses to provide ecosystem services.	
There is one significant gap against proven best practice, resulting in a score of 4.	
Topic Score: 4	
<b>16.4 Relevant Evidence</b>	
<b>Interview:</b>	6, 21, 54, 58, 65, 70, 73, 77, 82, 90
<b>Document:</b>	18, 22, 36, 61, 71, 89, 94, 97, 103, 118, 133, 134, 136, 151, 152, 155, 161, 162, 174, 177, 212, 213, 220, 227, 228, 314, 442-453
<b>Photo:</b>	42, 59, 83, 154, 155, 156, 157-161, 172

## 17 Water Quality (I-17)

This topic addresses the management of water quality issues associated with the project. The intent is that water quality in the vicinity of the project is not adversely impacted by project activities; that water quality issues are monitored and addressed as required; and commitments to implement measures to address water quality are fulfilled

### 17.1 Background Information

The overall water quality of the Reventazón River was good before the construction of PHR, although there are existing sources of pollution upstream and, in some downstream areas, mainly coming from intensive agriculture. Groundwater quality in the region is good. Mercury levels in the water are unknown, and there are no studies available for the Reventazón basin.

The most relevant aspects regarding water quality are: the construction site management of water quality; the future water quality of the reservoir; downstream river quality; and the management of sewage discharge. Construction activities could have affected a number of creeks, including Sibon, Tres Amigos, Guayacan, Rivulus and Las Lajas.

Treatment of water for drinking by workers is addressed in I-12 Labour and Working Conditions. I-15 Biodiversity and Invasive Species addresses issues relevant to aquatic ecology; I-16 Erosion and Sedimentation covers erosion and sedimentation issues; and I-18 Waste, Noise and Air Quality addresses construction-related pollution, but this topic (I-17) addresses water quality of discharges from wastewater treatment plants.

### 17.2 Detailed Topic Evaluation

#### 17.2.1 Assessment

#### Analysis against basic good practice

**Scoring statement:** *Water quality issues relevant to project implementation and operation have been identified through an assessment process utilising appropriate expertise; and monitoring is being undertaken during the project implementation stage appropriate to the identified issues.*

ICE's Environmental Impact Assessment (EsiA, 2009) describes the water quality baseline conditions based on monthly surveys, carried out between 2000 and 2004, at the dam site. ICE analysed 18 physical and chemical parameters at ICE's Laboratory of Basic Studies in San Jose. In 2006, the study continued and incorporated one additional sampling point, at Hamburgo in the lower basin, and in 2008 a sampling point was added near Angostura's tailrace at Las Juntas.

The EsiA analysis followed the regulation for the evaluation and classification of water bodies (Decree 33903-MINAE-S, 2007) which recommends the use of the Dutch index and the BMWP-CR index. The Dutch Index measures organic pollution based on the percentage of oxygen saturation, biochemical oxygen demand (BOD) and ammoniacal nitrogen. The EsiA also used the Water Quality Index developed by the National Health Foundation of the United States of America which consists of nine physical-chemical and bacteriological parameters.

Pre-project baseline conditions indicated that the Reventazón river water quality is relatively constant during the year. Concentrations of dissolved minerals are "normal", without evidence of contamination. The Water Quality index (Indice de Calidad de Agua, ICA) is good to excellent over a year. Before the construction of Reventazón,

water quality measured with the Biological Monitoring Working Party-Costa Rica (BMWP'CR) index at the dam site and at the tailraces of Angostura and Cachí was of "low quality" with moderate contamination. Sediments collected in different points of the Reventazón river and tributaries upstream of the Cachí reservoir and in the reservoir itself show high levels of metals, suggesting that there is an influence from the effluents of upstream industries. However metals found in sediments did not affect water quality according to the EsIA. Water quality at the tributaries was "good" in the in the upper areas, but was "poor" near the population centres.

Impacts identified for the construction phase included: risks of surface water and groundwater contamination, increased run-off in construction sites, and possible effects of spoil sites (1, 5 and 12) on water springs. The EsIA and an additional water quality study (2012) identified the following impacts during operation: changes in water temperature both in the reservoir and downstream; risks of eutrophication in the reservoir; and cumulative impacts, for example increased erosion and suspended sediment due to poor agricultural practices. Water hyacinth is widespread at Cachí and Angostura's reservoirs, and it is already present at Reventazón reservoir. Water hyacinth can alter water clarity and decrease phytoplankton production, dissolved oxygen, and concentrations of nitrogen, phosphorous, and heavy metals.

The assessment process used appropriate water quality expertise. In 2012, the lenders contracted a multidisciplinary team of consultants from Integrated Environments (2006) Ltd., Environmental Resources Management (ERM) and Applied Aquatic Research Ltd to prepare an additional water quality study to look at potential impacts associated with changes in water temperature and risks of eutrophication and stratification. Discharge of waters with low temperatures and low oxygen content could have biological impacts downstream. The study used two models created by the U.S. Army Corps of Engineers (the CE-QUAL-W2 water quality model, and the BATHTUB model) to evaluate if eutrophication could be an issue in the reservoir. The results of the modelling indicated: water that leaves the reservoir is warmer than the inflows by 0.78 degrees; discharged water is 1.27 degrees warmer in July and 0.22 degrees warmer in April; the reservoir would be eutrophic regarding phosphorus and nitrogen content, and secchi disk transparency; and the reservoir would be mesotrophic regarding possible algae generation.

A reservoir water quality model was applied to evaluate possible changes on water quality due to climate change under four different scenarios of temperature and dissolved oxygen. Modelling results indicated that climate change impacts on water quality are minor, and GHG emissions from biomass left in the reservoir are minor. The reservoir was likely to experience an increase in organic matter content due to the flooded riparian zone, and an associated low concentration of dissolved oxygen until the reservoir stabilises and the water quality improves.

During implementation, ICE monitored water quality on the Reventazón River and creeks that may be affected by construction works and spoil areas. Monitoring points coincided with sediment sampling points (see I-16 Erosion and Sedimentation). ICE had a water quality laboratory and an accredited biologist on site to analyse the samples. ICE's Environmental Supervision Unit (Unidad de Supervision Ambiental, USA) also carried out their own sampling campaigns.

During the operation phase, ICE will monitor physical-chemical parameters at 22 sites (12 in the biodiversity-offset area in the Parismina River, and 10 on the Reventazón River). ICE also monitors water quality in the reservoir at 13 points to measure oxygen content, biochemical oxygen demand (BOD), chemical oxygen demand (COD), nitrates, ammonia, phosphates, temperature, pH, total carbon, and chlorophyll.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** In addition, monitoring of water quality issues during project implementation takes into account inter-relationships amongst issues, and both risks and opportunities that become evident during implementation.



PHR considers inter-relationships amongst issues, for example: ICE monitors water quality in the Parismina river to assess the influence of reforestation activities and biodiversity offsets on water quality; PHR identified areas where water hyacinth may grow based on sediment deposition dynamics, and monitors its growth; and PHR uses index indicators that are a function of multiple aspects, such as water quality, sediment, and aquatic ecosystems. ICE also monitors physico-chemical parameters at six sampling points, three times a year on the Angostura reservoir and at the tailrace, and during sediment flushing periods. A complementary study prepared by the lenders' consultants evaluated possible water quality cumulative effects with existing hydropower plants, plantations, farming and urban areas, and ICE monitors water quality to identify potential sources of pollution and plan control measures.

The water quality modelling considers scenarios that account for climate change effects on possible changes of temperature, and precipitation. There are number of risks that PHR has not addressed. This is a **significant gap** against proven best practice. PHR has not established baseline conditions or monitoring campaigns of concentration of heavy metals in water, and potential bioaccumulation in fish. There is evidence that heavy metals are found in sediments flushed from upstream reservoirs. The sediments will be trapped in the Reventazón reservoir and flushed with the risk to reach downstream areas in higher concentrations. The cumulative effects study recommends monitoring of heavy metals and assessing the potential for mercury release.

Opportunities for water quality are identified through partnerships with agencies and communities participating in the preparation of the mid and lower Reventazón basin management plan.

Criteria met: No

## 17.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Processes are in place to ensure management of identified water quality issues, and to meet commitments, relevant to the project implementation stage; and plans are in place for the operation stage for ongoing water quality issues management.*

Measures implemented during construction to avoid and prevent surface water and groundwater contamination include: construction of soil containment structures, sedimentation ponds, concrete slabs, road ditches, construction of oil traps, use of impermeable layers for road construction, installation of a wastewater treatment plant with aerators, and containment measures of hazardous substances and waste.

An area corresponding to approximately 60% of the flooded area was cleared to reduce the risk of potential water-quality impacts. ICE cleared the vegetation in the reservoir with the exception of about 50 hectares due to accessibility issues, and trees that had no commercial value or use. ICE intends to clear the vegetation at the tail of the reservoir during the next dry season to mitigate visual impacts, and remove areas that provide good conditions for the spreading of water hyacinth.

Plans developed and implemented for the operation stage include: the monitoring plans described above, a plan for the prevention and control of water hyacinth in the reservoir, an adaptive management plan for downstream areas, the mid and lower Reventazón basin management plan, and the Parismina River offset. ICE still has to prepare a plan for dewatering and sediment flushing of the Reventazón reservoir that considers the mitigation of sedimentation and water quality changes due to stratification and eutrophication, based on the retention time (22 days) and presence of pollution sources (see I-19 Reservoir Preparation and Filling). This is not significant gap for water quality because the initial monitoring results in the reservoir indicate that there are no significant

changes in the reservoir that could affect the water quality discharged, and ICE still has time to finalise the plan before this risk materialises.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, processes are in place to anticipate and respond to emerging risks and opportunities.*

Processes were put in place to anticipate and respond to risks during implementation. For example, ICE prepared an oil spill response procedure that fulfils the requirements of the national legislation and describes responsibilities and the response process.

ICE only monitored in the navigable sections of the Reventazón River from 2013 to 2016. The first three monitoring points, immediately downstream, were not sampled due to non-favourable weather conditions. ICE set up the station “Codo del Diablo” to enable the flows monitoring at the tailrace at the start of operations, but there are no records of water quality since the filling of the reservoir immediately downstream. This is not a significant issue but if in the long term data is not collected at those locations, it will minimise PHR’s capacity to respond to water quality changes.

During operation, the water quality monitoring programmes in the reservoir, Parismina, and downstream (adaptive management plan) provide processes for PHR to identify and respond to emerging risks. ICE has a plan to increase the water-oxygen levels in the reservoir using pumps, if monitoring shows a reduction in oxygen availability or risks such as algal blooms or an increase in cyanobacteria emerge. ICE has developed a plan to manage water hyacinth growth in the reservoir if this is an emerging risk for water quality. Potential eutrophication and stratification changes in the reservoir, including the creation of an anoxic layer at the bottom of the reservoir will be mitigated through dewatering periods. ICE is monitoring water quality in the reservoir at seven locations and at different depths. The lenders’ consultants recommended changing the location of monitoring points on the second monitoring campaign to be aligned along the centre of the reservoir, and ICE will follow this recommendation.

Processes in place to anticipate and respond to opportunities are included in the mid and lower Reventazón basin management plan. The plan includes measures to reforest areas around the reservoir, and downstream, and promote the regeneration of natural vegetation. This will have an indirect positive effect in the water quality of the Reventazón and Parismina rivers and the reservoir. The plan has established partnerships government agencies (COMCURE, FONAFIFO, MINAE), local farmers and businesses, and land-owners to implement this plan.

Criteria met: Yes

## 17.2.3 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *Processes and objectives in place to manage water quality issues have been and are on track to be met with no significant non-compliances or non-conformances, and water quality related commitments have been or are on track to be met.*

Water quality processes, objectives and measures have been and are on track to be met. Sampling procedures have followed the requirements of the national decrees and ICE protocols. MINAE has not reported significant non-compliances on water quality. ICE’s USA has overseen the implementation of water quality measures during construction, and raised and followed up non-conformances.

Criteria met: Yes
<b>Analysis against proven best practice</b>
<b>Scoring statement:</b> <i>In addition, there are no non-compliances or non-conformances.</i>
There are non-conformances with the water quality monitoring plan. ICE was not able to collect data on the first of the three established monitoring points immediately downstream of the dam since the filling of the reservoir. This is a significant gap, but it is addressed in I-16 Erosion and Sedimentation.
Criteria met: Yes
<b>17.2.4 Outcomes</b>
<b>Analysis against basic good practice</b>
<b>Scoring statement:</b> <i>Negative water quality impacts arising from project activities are avoided, minimised and mitigated with no significant gaps.</i>
Negative water quality impacts arising from construction were avoided, minimised and mitigated. Measures to prevent water quality contamination were effective with the exception of a cement discharge incident at Tres Amigos creek that affected water quality. This issue was resolved by redirecting wastewater from concrete mixers, and eventually the machinery to another site away from the creek, and water quality conditions were restored to their initial conditions. Oils spills response plans were implemented adequately.
The first monitoring report (November 2016) of the adaptive management plan results presents the status of the ICFSF index. This index is calculated based on the results for hydrological functional quality, functional quality of the aquatic ecosystem, functional quality of the channel, functional quality of the banks, and functional quality for social use. Data indicate that there have not been any significant adverse effects on water quality downstream. The water quality monitoring results gathered downstream during the first quarter of 2017 (January-February-March) do not show any negative effects compared to the baseline conditions.
The results of the first water quality sampling campaign in the reservoir indicate that there is an accumulation of salts and a decrease in the oxygen content at the tail of the reservoir. Reservoir profiles show an anoxic layer and positive thermocline from 50 m depth to the bottom, from which the temperature increases. This is not close to the intake level.
Criteria met: Yes
<b>Analysis against proven best practice</b>
<b>Scoring statement:</b> <i>In addition, negative water quality impacts arising from project implementation are avoided, minimised, mitigated and compensated with no identified gaps; and enhancements to pre-project water quality conditions or contribution to addressing water quality issues beyond those impacts caused by the project are achieved or are on track to be achieved.</i>
Negative water quality impacts arising from project implementation are avoided, minimised, and mitigated with no identified gaps. There are no identified residual impacts that require compensation.
Monitoring results downstream from the first year of operations (2016) show that water quality downstream has not significantly changed. The mid and lower Reventazón river basin management plan also includes actions that will reduce and minimise the impacts of waste and agricultural practices on water quality downstream. PHR is likely to have a positive effect on water quality downstream as the Reventazón reservoir will retain more

sediment. As part of livelihood restoration measures amongst farmers affected by land acquisition, PHR has already supported the provision of biodigesters to farmers in the immediate area around the reservoir.

Criteria met: Yes

## 17.2.5 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps

### Analysis of significant gaps against proven best practice

PHR did not monitor or evaluate potential risks of concentrations of heavy metals in water, and potential bioaccumulation in fish.

1 significant gap

## 17.3 Scoring Summary

Water quality issues relevant to project implementation and operation were identified through field sampling campaigns and modelling exercises which took account of climate change effects on temperature and precipitation. ICE monitored relevant biological and chemical water quality parameters during implementation and continues to monitor during operations.

Measures implemented during construction to avoid and prevent surface water and groundwater contamination included containment structures, sedimentation ponds, concrete slabs, road ditches, c oil traps, impermeable layers, and a wastewater treatment plant with aerators. Approximately 60% of the reservoir area was cleared to reduce water-quality impacts. Plans for the operation stage include a plan for the prevention and control of water hyacinth in the reservoir, an adaptive management plan for downstream areas, the mid and lower Reventazón basin management plan, and the Parismina River offset.

Processes and objectives in place to manage water quality issues are on track to be met, though there is a non-conformance with downstream monitoring plans. Water quality impacts are avoided, minimised, and mitigated and PHR is likely to have a positive effect on water quality downstream through the provision of wastewater treatment plants and improved agricultural practices.

However, PHR has not established baseline conditions or monitoring campaigns of concentration of heavy metals in water, and potential bioaccumulation in fish. This is a significant gap against proven best practice, resulting in a score of 4.

Topic Score: 4

## 17.4 Relevant Evidence

<b>Interview:</b>	6, 21, 54, 58, 65, 70, 73, 82, 90
<b>Document:</b>	4, 18, 36, 99, 101, 106, 117, 118, 134-136, 161-162, 174-175, 187, 209, 220, 227, 229, 230, 242, 315-325, 442, 446, 449-454
<b>Photo:</b>	38, 41, 43, 45, 47, 157-162, 174-176

## 18 Waste, Noise and Air Quality (I-18)

This topic addresses the management of waste, noise and air quality issues associated with the project. The intent is that noise and air quality in the vicinity of the project are of a high quality and not adversely impacted by project activities, and that project wastes are responsibly managed.

### 18.1 Background Information

The Reventazón project generates significant quantities of solid waste, including some hazardous waste, noise from construction activities, including blasting and traffic, and air emissions in the form of gases and particulates, such as dust. The project activities are complex and spread out over a large area, and affect multiple communities as well as the natural environment. Those impacts are also discussed under topics such as I-9 Project-Affected Communities and Livelihoods with respect to recipients of those impacts.

In 2010, significant changes were made to waste management legislation in Costa Rica, which affected the Reventazón project. New regulations required waste separation and classification, maximised re-use and recycling, and required waste to be transported and disposed of by certified waste management companies to minimize the amount of waste being landfilled. Waste management companies are certified and registered by the Ministry of Health for any or all of the following: waste transportation, pre-treatment, treatment, storage and final disposal, which may include export. The Ministry of Health and MINAE co-regulate waste management in Costa Rica and SETENA monitors compliance with EMPs.

The excavation of river rock and gravel and the transport of excavated materials are addressed here, as they generate noise and dust. The disposal of excavated materials in various spoil areas is also mentioned here. Noise and air quality issues are covered here as they affect surrounding communities and the environment, but their impact on workers is addressed under I-12 Labour and Working Conditions.

### 18.2 Detailed Topic Evaluation

#### 18.2.1 Assessment

#### Analysis against basic good practice

**Scoring statement:** *Waste, noise and air quality issues relevant to project implementation and operation have been identified through an assessment process utilising appropriate expertise; and monitoring is being undertaken during the project implementation stage appropriate to the identified issues.*

The Reventazón Environmental Impact Assessment (EslA) mentions only general references to an increase in solid waste and wastewater generation during the construction phase as well as the generation of hazardous waste (contaminated solid wastes and used hydrocarbons), but detailed methods and procedures for waste management were prepared by ICE for the Reventazón Project with detailed information on types of waste generated, stored and disposed of during the construction phase. A detailed assessment of the locations for disposal of waste rock (escombreras) was also included in the EslA.

The EslA chapter on “Atmospheric Quality” provides the following baseline information: background baseline noise measurements were taken at night and during the day at 12 locations in January 15<sup>th</sup>, 2008 and February 26 and 27<sup>th</sup>, 2008, and they met the Costa Rican standards except for one measurement that was slightly higher (attributed to children playing football in a field near the monitoring point).

The EsIA predicts that the main sources of noise will be from construction machinery, traffic, excavations, material extraction from the river and blasting. Factors influencing noise levels are speed (driving), type of vehicle, road surface, traffic intensity and environmental factors such as topography, vegetation, wind speed and direction, presence of fog, natural and artificial barriers.

The EsIA does not include any baseline data for particulates and dust, however it does state that the project will cause an increase in particulates and dust that may potentially impact the vegetation surrounding the Project, water quality in nearby streams and visibility. This will be generated mainly from the following construction activities: excavations, civil works, concrete batch plants, crushing plants, construction of access roads, vehicular traffic within and around construction areas. The EsIA states that both noise and dust have the potential to be a nuisance and the source of complaints from the local communities.

The management systems and programmes listed under Management below include measures for the monitoring of waste, noise and vibration, and air quality during the construction phase. For example, the ESMP for the powerhouse includes provisions that the environmental management unit will be responsible for monitoring noise, air quality and gas levels in tunnels, and maps of sensitive receptors (including coordinates) in the nearby community of El Coco where noise levels will be monitored to ensure they don't exceed Costa Rican maximum permissible levels (65 dB during the day and 45 dB at night).

A noise study commissioned by ICE in 2013, and carried out by a laboratory and environmental consulting company "PROCAME" (Programa de Estudios en Calidad, Ambiente y Metrología), included sampling points near machinery or sources of noise, sampling points in the communities and in residences that were affected by noise and established a baseline of background noise levels (without project related noise) in communities around the project (La Florida, El Coco, San Joaquin, Guayacán, Lomas).

During the implementation stage, the project has tracked the amounts and types of waste generated, how they were managed and disposed of, in accordance with the newly enacted waste management legislation and in accordance with their long term agreements with waste management companies. In addition, the project reported quantities and types of waste generated and managed, transported off site and disposed of in the lenders' quarterly reports. These reports also included the amounts of organic waste that were composted on-site, sediments recovered from the various sedimentation basins and stormwater management systems located at and around the project construction areas, environmental incidents involving hydrocarbon spills, corrective actions taken, and how contaminated soil was treated or disposed of.

The lenders quarterly reports also include all complaints received through the grievance mechanism, the corrective action taken and a date when the issue was considered closed or addressed. During the implementation stage, a significant proportion of the grievances received were related to dust and noise issues, in particular from the communities of La Florida and El Coco.

In summary, all relevant waste, noise and air quality issues were identified in the EsIA and EMPs or subsequently during implementation, and are being systematically monitored. All assessments and monitoring were conducted using appropriate expertise.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, monitoring of waste, noise and air quality issues during project implementation takes into account inter-relationships amongst issues, and both risks and opportunities that become evident during implementation.*

Monitoring took into account the inter-relationships with community involvement and localised pollution. ICE retained independent entities to monitor dust and noise levels in and around the project including in the affected communities (for example in La Florida, El Coco, San Joaquin, Lomas and Guayacán): (i) PROCAME, to carry out a noise study, and (ii) the National University to analyse dust samples. In addition, an effort was made by the project to address issues that may potentially affect the communities' well-being and psychological health and mechanisms were in place to allow ICE to respond to grievances related to noise and dust from construction activities and associated with increased traffic on roads used by the communities. The project monitored the speed at which ICE and project vehicles would drive on the main project roadways especially in and around the communities of El Coco and La Florida. This was achieved by providing the communities with speed detectors (participatory monitoring) and by installing GPS devices in vehicles.

Waste management by the project also increased opportunities for the emergence of local businesses in response to new waste legislation. For example, the large waste management companies would enter into agreements with smaller local waste management providers for the management, treatment or disposal of specific types of waste such as wood waste sold to a local company that manufactured wood pellets.

Criteria met: Yes

## 18.2.2 Management

### Analysis against basic good practice

**Scoring statement:** *Processes are in place to ensure management of identified waste, noise and air quality issues, and to meet commitments, relevant to the project implementation stage; and plans are in place for the operation stage for ongoing waste management.*

The project has developed and implemented management systems and programmes to manage and monitor environmental performance including aspects related to waste, noise and vibration and air quality during the construction phase. These provide the management structure and guidelines that allow the project to consistently manage, track, monitor, report, apply corrective actions and address shortcomings. They include but are not limited to:

- Specifications for the preparation of ESMPs (*Especificaciones para la elaboración de los Planes de Manejo Ambiental y Social (PMAS) y/o Informe de Cierre de Obra, CGA-USAP-01*);
- Part 1: Environmental Management System for the Construction Phase of the Reventazón Hydroelectric Project (*Parte 1: Sistema de Gestión Ambiental para la fase constructiva del Proyecto Hidroeléctrico Reventazón*);
- Method for Evaluation and Control of Environmental Aspects during the Construction Phase of the Reventazón Project (*Método para la evaluación y control de aspectos ambientales para la fase constructiva del Proyecto Reventazón, PHR-GA-05*);
- Method for the Management of Solid Waste (*Método para la gestión integral de los residuos sólidos del Proyecto Reventazón, PHR-GA-09*);
- Procedures for Managing Organic Wastes and the Production of Compost (*Procedimiento Manejo Residuos Orgánicos en la producción de abono tipo compost en le Proyecto Hidroeléctrico Reventazón, PHR-GA-04*); and
- The various ESMP's developed for the different work sites (such as the ESMP for the Power House, ESMP for the Crushers, and ESMP for Access Roads etc.).

These documents describe the responsibilities of the construction area managers and the environmental management unit at Reventazón and general management procedures as well as list monitoring and mitigation



measures. For example, in terms of waste, noise and air quality, the ESMP for the powerhouse includes aspects of construction activities that generate noise and vibrations and how to control them, and measures to control of night time noise levels, limit speed of vehicles used for the project etc. The ESMP for access roads and roadways includes measures to control dust emissions and noise with particular emphasis on roads used by project vehicles and heavy equipment in and around the communities of El Coco and La Florida.

The environmental management unit at Reventazón periodically inspected the work sites to assess compliance with ESMPs and allocated each non-compliance that was detected with a high, moderate or low magnitude proportionate to the level of potential impact. A “high” level non-compliance requires an immediate corrective action (within 24 hours), a “moderate level” non-compliance requires corrective measures within 72 hours and a “low level” non-compliance, within two weeks. For example, these inspections would highlight issues related to waste storage and the lack of, or incomplete documentation regarding the types and amounts of waste generated, stored and sent to the main waste management and storage facility at EL Plantel (main construction camp), etc.

The ESMP (Plan de Gestión Ambiental y Social Para la etapa operativa del PH Reventazón, versión 4, March 2017) for the operations phase includes a list of 19 plans, some of which include general provisions and commitments for waste management during the operations phase. An example is the Water Hyacinth Management Plan (Plan de prevención y manejo del lirio acuático) which describes the mechanical removal of the hyacinth from the reservoir, but does not discuss its disposal. As yet there is no document describing the methods, processes, roles and responsibilities, or waste classification schemes for the operating Reventazón Project facilities, similar to those described in the Método para la gestión integral de residuos en el proyecto Reventazón (No.PHR-GA-09) which is applicable to the construction phase only. However, the ESMP also includes a section on integrated management focussed on activities that will allow the Reventazón project to be certified under ISO 9001, ISO 14001 and OSHAS 18001 standards which would ensure that ongoing waste, noise and air quality issues are managed correctly. ICE’s Generation group, which will operate project, has been certified to ISO 9001, ISO 14001 and OSHAS 18001 standards since 2012. According to the ESMP document, certification of the Reventazón project itself is scheduled for 2017.

The lenders require that a Decommissioning and Restoration Plan that identifies the destination of all decommissioning wastes be prepared by November 2017.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, processes are in place to anticipate and respond to emerging risks and opportunities.*

During the implementation stage, the project implemented a number of changes to respond to noise, vibration and dust complaints. All complaints were registered and investigated. The project addressed noise and dust issues as they would arise in close coordination with the affected communities, by implementing changes in the location of certain construction activities (for example the dredging of river bed materials using a crushing plant located farther away from sensitive receptors in the community of La Florida), and making changes to the schedules of the activities (limiting certain activities to daytime).

In response to community complaints, the project increased spraying and implemented innovative automatic sprinkler systems in areas that generated the most concern from communities. One particular complaint came from community members in La Florida that threatened to close a road used by the project if ICE did not maintain and continue to spray Calle Nubes. Road repairs were carried out in October 2014 and spraying of the road continued. The project carried out structural inspections following complaints related to blasting activities or vibrations from heavy equipment carrying out road maintenance activities (roller compactors), and measured



noise levels in residences and investigated dust issues in communities. Spraying of roads would be increased where appropriate, and an automatic sprinkler that detected traffic was installed near the community of Florida.

The partnership with the University to address issues related to noise in the communities demonstrated ICE's un-biased position in addressing community grievances by having an independent and trusted institution carry out investigations and measurements, and provide recommendations. The project implemented PROCAME study recommendations including upgrades to the houses where noise levels exceeded maximum permissible levels (improvements to confinement and insulation to windows, ceilings, doors and walls of affected houses).

ICE and the project were able to respond to emerging risks and the opportunities that were brought about by the changes to the national waste legislation in 2011. The change in legislation required the project to change waste management practices and retain the services of waste management companies that would either be paid to take away non-valuable waste or would pay for valuable waste products (such as scrap metals, wastes than can be re-used or transformed into fuels such as pelletized wood chips, alternate fuels from used oils and fuels). Because ICE is a public entity, they cannot generate revenues by the sale of wastes from publicly-funded equipment or material. The agreements ICE entered into with the large waste management companies are unique public private partnership (PPP) contracts, whereby the waste management company keeps track of the value of valuable waste streams that are generated and manages the non-waste streams without any direct cost or revenue to ICE, allowing them to comply with the new standards and develop unique PPPs in Costa Rica.

ICE anticipated and avoided the risk that workers would not implement measures by including training in ESMPs. For example, the ESMP for the powerhouse included training requirements for workers on potential environmental impacts including noise, increase in dust emissions, and impacts on local communities, mitigation measures on noise and dust emissions and waste management, and technical aspects of sampling/measuring noise, emissions. The ESMP for access roads and roadways included provisions for workers training in aspects related to noise and dust and associated mitigation measures.

Criteria met: Yes

### 18.2.3 Conformance / Compliance

#### Analysis against basic good practice

**Scoring statement:** *Processes and objectives relating to waste, noise and air quality have been and are on track to be met with no significant non-compliances or non-conformances, and any related commitments have been or are on track to be met.*

Procedures have been in place and adapted during the implementation phase to respond to waste, noise and air quality issues and the project has been compliant with their licenses with respect to waste management (composting plant) and wastewater treatment facilities located on site. Dust levels sampled and analysed by an independent laboratory indicate compliance with permissible PM10 levels and any exceedances of maximum permissible noise levels at sensitive receptors were addressed by the project.

The commitment to help the town of Siquirres to develop a sanitary landfill was not met because Siquirres municipality administration has not yet been able to identify and acquire the necessary land for the landfill site. However, this is one of a range of commitments in the ICE-Siquirres municipality agreement that were not met, and this non-conformance is considered on I-7 Project Benefits.

Criteria met: Yes

#### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances.*

As of May 2017 and as reported by the independent environmental and social monitoring consultant (Monitoring Report #12) acting on behalf of the lenders, one non-conformance remains related to the final disposal of wastes currently located on site and those that will be generated by the decommissioning of the remaining construction site and camp facilities.

Although the operations group is planning to have the project certified under ISO 14001 standards there is no specific plan in place at the moment that describes how these wastes will be managed. The ESMP for the operations phase does not include provisions for the current wastes located on site or the wastes generated by the decommissioning of remaining facilities. A Decommissioning and Restoration Plan that identifies the destination of all decommissioning wastes, is required by the lenders by November 2017. At this time it is unknown if the project is on track to meet this commitment, but ICE has time to prepare this plan, so it is not considered significant on this topic. A significant gap concerning conformance with lenders' requirements is included on I-3 Environmental and Social Issues Management.

Criteria met: Yes

## 18.2.4 Outcomes

### Analysis against basic good practice

**Scoring statement:** *Negative noise and air quality impacts arising from project activities are avoided, minimised and mitigated with no significant gaps, and project wastes managed responsibly.*

Noise and dust issues raised by the neighbouring communities were addressed and managed appropriately during the implementation stage of the project. Measures implemented by the project resulted in avoiding, minimizing and mitigating noise levels and dust emissions in the project area and in the communities. From the point of view of affected communities, the key project impact is dust and noise generated by traffic directly or indirectly caused by the project and the various construction activities.

Reports from the National University's laboratory on dust samples taken in 2013 at seven locations in Florida, El Coco and the main construction camp (El Plantel) indicate that PM10 levels are within acceptable limits ranging from 25 to 57 micrograms/m<sup>3</sup> (which is under the maximum permissible level of 150 micrograms/m<sup>3</sup>).

Measurements taken at night by the PROCAME study in 2013 indicated that maximum permissible levels (45 dB) were exceeded at all sampling sites by ambient background noise levels without the project noise source. Background levels were then taken as the reference level to assess noise levels. The background noise levels were exceeded at five of the sampling points with the project source noise. One house exceeded maximum permissible levels during the daytime (45 dB) with project source noise (a house on calle Fuentes in La Florida, with 68.61 dB). The study assessed each of the affected houses and made recommendations to improve insulation of walls, ceilings, windows and doors as well as making recommendations to ICE on how to reduce and mitigate noise from construction activities and machinery, all of which are reported to have been implemented by ICE.

Currently, there are some waste streams that continue to be stored at the main construction camp waste management storage facility and at other intermediate waste storage sites throughout the construction camps (for example, scrap metal, decommissioned pre-fabricated enclosures or security huts, idle equipment waiting to be reallocated to other projects or discarded) that is expected to be disposed of as decommissioning activities take place.

Criteria met: Yes

<b>Analysis against proven best practice</b>
<b>Scoring statement:</b> <i>In addition, negative noise and air quality impacts arising from project activities are avoided, minimised, mitigated and compensated with no identified gaps; project wastes are managed responsibly; and the project contributes to addressing waste management issues beyond those impacts caused by the project.</i>
During the implementation phase, negative noise, vibration and dust were avoided and minimized and compensated with no identified gaps. In addition, project wastes were managed responsibly, however some waste scrap metal and idle equipment remain at the construction camp. It is unclear how these will be re-used or disposed of while there is no alternative ICE project that can use them at the moment. A Decommissioning and Restoration Plan that identifies the destination of all decommissioning wastes will be prepared for the lenders by November 2017.
The project contributed to waste management issues beyond those impacts caused by the project by donating two garbage collecting trucks to the Municipality of Siquirres, and by holding various educational campaigns and capacity building related to solid waste management in communities. It may also contribute to agricultural waste management through the Middle and Lower Reventazón Watershed Management Plan and the offset programme for the Parismina river (Programa de Compensación Fluvial río Parismina), but that is mainly for the purposes of managing water quality. The partnership with Siquirres municipality to build a landfill has not proceeded because Siquirres has not yet acquired land for this purpose.
Criteria met: Yes
<b>18.2.5 Evaluation of Significant Gaps</b>
<b>Analysis of significant gaps against basic good practice</b>
There are no significant gaps against basic good practice.
0 significant gaps
<b>Analysis of significant gaps against proven best practice</b>
There are no significant gaps against proven best practice.
0 significant gaps
<b>18.3 Scoring Summary</b>
The Reventazón project is responsible for additional solid waste generation as well as noise and air pollution in a previously clean environment. The EsIA provides sufficient information in terms of baseline data and impact analysis for solid waste, noise and air pollution, and the monitoring of these impacts during the project implementation stage is also adequate.
During project implementation, modified construction practices and mitigation measures were implemented, and adapted to changes in waste management legislation. The project implemented a number of changes to respond to noise, vibration and dust complaints. All complaints were registered and investigated and addressed as noise and dust issues in the communities. Dust suppression and measures to address noise issues in communities were implemented. There are a number of plans for the operation stage.
Supervision carried out by the Ministry of Health and SETENA included periodic inspections of on-site waste management and wastewater facilities for compliance with licence conditions and commitments made in the EMPs.

## 18.4 Relevant Evidence

<b>Interview:</b>	55, 62, 76, 81, 87, 88
<b>Document:</b>	6, 18, 106, 111, 134, 161, 162, 173, 174, 176, 214, 215, 216, 220, 240, 241
<b>Photo:</b>	37, 43, 46, 47, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173

## 19 Reservoir Preparation and Filling (I-19)

This topic addresses management of environmental, social and economic issues within the reservoir area during project implementation, and planning for reservoir management for the operating hydropower facility. The intent is that reservoir preparation and filling is well managed, taking into account construction, environmental and social management requirements, and future power generation operation, maintenance and multi-purpose uses where relevant.

### 19.1 Background Information

The Reventazón River basin drains from southwest to northeast. The Reventazón hydropower plant catchment has an area of 174.39 km<sup>2</sup>. The Parismina River basin covers an area of 736 km<sup>2</sup>, and discharges into the Reventazón River 5 Km before its mouth. The Reventazón-Parismina basin is 2 818, 85 km<sup>2</sup>.

The Reventazón hydropower plant has a reservoir with a useful volume of 119 hm<sup>3</sup>. The normal minimum level (NML) and maximum operating level (MOL) are 245 metres above sea level (m.a.s.l.) and 265 m.a.s.l. respectively. The retention period is about 22 days.

The reservoir has a length of 8 km, volume of 294 million m<sup>3</sup> and an area of 7 km<sup>2</sup> at 265 m.a.s.l. ICE acquired 858 ha of land, to cover the reservoir area, and the buffer zone, and an additional 585 ha in areas with land instability. Inflows vary considerably and can be as low as 20 m<sup>3</sup>/s or as high as 1 000 m<sup>3</sup>/s. The spillway is located on the right bank of the Reventazón River and it was designed for a flood of 11 380 m<sup>3</sup> / s. The dam crest is located at 270 m.a.s.l. and has a length of 64.6 m. The water intake is located at 236 m.a.s.l. and the bottom outlet has the capacity to discharge 630 m<sup>3</sup> / s at MOL.

This topic focuses on the preparation, filling and operations of the reservoir. It includes details of catchment and shoreline erosion, operation stage water level operating rules, assessment and management of greenhouse gas (GHG) emissions from the reservoir, and the influence of inflows for reservoir levels. Where necessary, this topic refers to issues in other topics, specifically I-3 Environmental and Social Issues Management, I-15 Biodiversity and Invasive Species, I-16 Erosion and Sedimentation and I-17 Water Quality.

### 19.2 Detailed Topic Evaluation

#### 19.2.1 Assessment

#### Analysis against basic good practice

**Scoring statement:** *The important considerations prior to and during reservoir filling and during operations have been identified through an assessment process; and monitoring of implementation activities is being undertaken appropriate to any identified issues.*

The project feasibility studies, project designs, evaluations of slopes stability, the Environmental Impact Assessment (EsIA, 2009), and additional studies requested by lenders identified important considerations and impacts caused during the preparation of the reservoir area. For example: hydrology patterns and inflows; instability of slopes; seismic risks; noise and dust creation from the reservoir clearing (see I-18 Waste, Noise and Air Quality); loss of archaeological sites (see I-13 Cultural Heritage); vegetation clearing and loss of forest cover and habitats (see I-15 Biodiversity and Invasive Species); and land acquisitions (see I-10 Resettlement). ICE also undertook topographic and Light Detection and Ranging (LIDAR) surveys. The reservoir area was significantly reduced compared to earlier options with a higher operating level. The same studies identified the following

issues of reservoir filling include: inflows and the timing of the filling; wildlife rescue and loss of connectivity (see I-15 Biodiversity and Invasive Species); instability of slopes and seismic risks; changes in groundwater levels; maintenance of the minimum flows downstream (see I-20 Downstream Flows Regimes).

Important operations issues are identified in the operations manual, the EsIA and the additional environmental studies. For example: slope instability and seismic risks and floods; erosion and sedimentation in the reservoir; loss of connectivity especially along the Barbilla-Destierro biological corridor; water quality changes in the reservoir (e.g. eutrophication and stratification (see I-17 Water Quality); changes in groundwater levels; and control of water hyacinth. Issues of public safety around the reservoir are not documented, but ICE is aware of potential safety risks and has implemented actions (see Management below). Shoreline erosion is not expected to unveil new archaeological sites, and dust generation is not expected when the levels of the reservoir are lower.

Monitoring of preparation and filling activities included: monitoring of groundwater levels using seven piezometers; seismological monitoring using nine stations; monitoring of slope stability using inclinometers, GPS-RTK (Global Positioning System, Real Time Kinematic) points, time domain reflectometry (TDR), 11 digital seismological stations, and 12 hydro-meteorological stations. ICE monitors erosion and sedimentation using gauging stations, point sampling and bathymetric surveys. ICE also undertakes visual inspections of the reservoir regarding potential land movements.

ICE prepared a study on potential GHG emissions from the reservoir that predicted that PHR net emissions will be 356 170 tonnes of CO<sub>2</sub> equivalent per year. The study concludes that PHR emissions will be slightly above IEA (International Energy Agency) estimates of regional emissions per kWh, or in the worst case, PHR will not significantly alter regional GHG emissions.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, monitoring of reservoir preparation and filling activities takes into account inter-relationships amongst issues, and both risks and opportunities that become evident during implementation.*

Monitoring of reservoir preparation and filling activities takes into account inter-relationships amongst issues. ICE surveyed unstable areas around the reservoir to identify existing infrastructure and its conditions prior to the filling of the reservoir and liaise with local communities on reservoir filling effects concerns. There was good coordination between ICE's wildlife rescue team, the vegetation clearing team, the safety team and the technical team; prior to clearing, the teams inspected the clearing areas to determine a sequence of preparation surveys and works.

ICE has monitored natural hazards that could have an impact on the reservoir and operations. Natural hazards include earthquakes, landslides, and floods. ICE modelled two extreme and unlikely scenarios of landslides in the reservoir and the potential dam break effects of a wave (see I-16 Erosion and Sedimentation). Since the beginning of seismic monitoring in 2008, 573 earthquakes were recorded in an area of 40 km<sup>2</sup> around PHR. Since the beginning of the reservoir filling the magnitude of cortical earthquakes increased from 2.14 to 2.3 over 4 months, but ICE's experts did not consider this as induced seismicity.

PHR did not perform soil sampling in the reservoir area to evaluate presence of contaminated soils, for example along the old railway line. This risk was not considered, and it is a significant gap against proven best practice, addressed in I-17 Water Quality.

ICE monitored key species of fauna and relocation areas during the implementation of the fauna rescue plan. ICE has identified opportunities to partner with NGOs (Panthera), local communities, the commission of the biological corridor, and government agencies such as the Costa Rica Forest Financing Fund (FONAFIFO, Fondo de

Financiamiento Forestal de Costa Rica) to address wildlife connectivity issues and regeneration of natural vegetation around the reservoir.

Regular visits by the lender's consultants also provide a means to identify risks and opportunities. For example, the lack of a reservoir uses and access plan was a requirement of the lenders.

Criteria met: Yes

## 19.2.2 Management

### Analysis against basic good practice

**Scoring statement:** Measures are in place to address identified needs during reservoir preparation and filling; and plans are in place to manage the reservoir and any associated issues for the operating hydropower facility.

ICE did not prepare a reservoir preparation and filling plan but the key issues have been addressed through various plans and measures. Measures to address identified needs during reservoir preparation and filling were developed and implemented through a number of plans: land acquisition and resettlement plans (as a requirement of the lenders), the wildlife rescue plan, collection of seeds from native species in the reservoir, the vegetation-clearing plan, the plan for the filling of the reservoir including communication with affected communities, archaeological prospections, removal of the railway line, and documentation and recovery of archaeological remains.

ICE estimated that the filling of the reservoir would take 72 days to reach 245 m.a.s.l to start the wet tests, and 130 days to reach the MOL of 265 m.a.s.l. The filling commenced on 27<sup>th</sup> November 2015, during the rainy season, and ended on 13 July 2016. The filling comprised four stops to monitor any possible changes, and it was limited to 2m per day during the first 3 sections, and 1m per day during the last section. The reservoir took seven months to fill to the normal minimum level (NML) from November 2015 to February 2016, including two pauses of 16 days and a period when inflows were lower than historical values due to El Niño. Filling followed the overall expected filling trend until 245 m.a.s.l, but it took 2 months more than anticipated to fill the reservoir to 265 m.a.s.l. PHR met the minimum flow commitment during the first few days of the filling by constructing a 7 km channel on the right bank to direct the water to the bottom outlet intake until the level of the reservoir reached that point.

Regarding operations, PHR has an operations manual, and an operations EMP. The operations manual describes operations restrictions. The reservoir levels will oscillate annually, decreasing during the dry season and rising again in the rainy season.

The operations EMP includes a number of programmes to manage reservoir issues during operations: a reservoir and protection zone management plan to preserve biodiversity, and improve habitat connectivity; a connectivity mitigation plan along the Barbilla-Destierro corridor; a programme for monitoring wildlife at the tail of the reservoir in partnership with Panthera; a programme for the prevention and control of water hyacinth in the Reventazón reservoir; and a programme to control water hyacinth in Cachí and Angostura reservoirs. A 50-metre buffer zone surrounds the reservoir to provide biodiversity habitat, and improve land stability. The width of the buffer zone is variable around the reservoir perimeter. Access and uses of the reservoir are not yet defined.

Measures to ensure public safety around the reservoir include signposting, public awareness campaigns, and ICE's land property is fenced off with a triple wire fence, but the public and recreational fishermen can still access the reservoir. ICE is preparing a reservoir uses and access plan that will consider the future uses of the reservoir. This would be the first plan of this kind in Costa Rica.

Criteria met: Yes

<b>Analysis against proven best practice</b>
<b>Scoring statement:</b> <i>In addition, processes are in place to anticipate and respond to emerging risks and opportunities.</i>
ICE has considered the risks of land instability, high inflows, spread of water hyacinth, risk of deforestation, and water quality changes, and has developed plans to respond to emerging issues in these areas. ICE acquired more land than the area inundated by the reservoir to extend ICE’s property to unstable areas by 300 hectares and reforested a buffer area or protection zone of approximately 50 m around the reservoir perimeter. Monitoring of land stability, sediments and water quality in the reservoir will provide means to anticipate and respond to emerging changes during operation. The reservoir filling took longer than anticipated, and ICE deployed more resources to continue to deliver their commitments on the plans, e.g. fauna rescue.
Opportunities that ICE has taken include incentivising local landowners to engage in reforestation programmes around the reservoir and the biological corridor. In exchange, they receive support for more efficient agro-forestry systems.
However, public safety measures do not seem sufficient to prevent accidents and fatalities in the reservoir. There has been a fatality in the reservoir in the first year of operation. A reservoir access and uses plan was not prepared before the filling of the reservoir to anticipate to these potential risks. The operations EMP and the proposal for a reservoir plan do not include public safety measures. This is a <b>significant gap</b> against proven best practice.
In addition, there are no processes to anticipate and respond to emerging recreational and tourism opportunities. There are now private initiatives around the reservoir, such as the “Mirador” restaurant, but there is no zoning plan yet in place to manage other potential uses of the reservoir. This is addressed under Conformance and Compliance below.
<b>Criteria met: No</b>
<b>19.2.3 Conformance / Compliance</b>
<b>Analysis against basic good practice</b>
<b>Scoring statement:</b> <i>Processes and objectives in place for reservoir management have been and are on track to be met with no significant non-compliances or non-conformances, and reservoir management related commitments have been or are on track to be met.</i>
Processes and objectives for reservoir management have been and are on track to be met. There are delays in the implementation of the water hyacinth control programme and the development of the reservoir access and uses plan but ICE recognises them, plans are under development, and ICE is committed to developing them by September 2017 to enable the transition to the operation phase (i.e. these commitments are “on track to be met”).
The minimum flows were maintained during the filling of the reservoir (please refer to I-20 Downstream Flow Regimes for details). The filling of the reservoir took longer than anticipated but this is not a significant gap. The process was carried out successfully, and maintaining minimum flow requirements. Revegetation around the reservoir perimeter was completed on time, and the agreements with FONAFIFO are on track (see I-15 Biodiversity and Invasive Species). SETENA has not raised any non-compliances.
<b>Criteria met: Yes</b>



<b>Analysis against proven best practice</b>	
<b>Scoring statement:</b> <i>In addition, there are no non-compliances or non-conformances.</i>	
However the delays in the implementation of the water hyacinth control programme and the development of the reservoir access and uses plan are non-conformance with ICE's commitments and lenders' requirements. The reservoir access and uses plan was meant to have been developed prior to the filling of the reservoir, and EMP commitments concerning the development of the reservoir for tourism have not been addressed. This is a <b>significant gap</b> against proven best practice.	
Criteria met: No	
<b>19.2.4 Evaluation of Significant Gaps</b>	
<b>Analysis of significant gaps against basic good practice</b>	
There are no significant gaps against basic good practice.	
0 significant gaps	
<b>Analysis of significant gaps against proven best practice</b>	
Public safety measures are not sufficient to prevent accidents and fatalities in the reservoir.	
There are delays in the implementation of the water hyacinth control programme and the development of the reservoir access and uses plan.	
2 or more significant gaps	
<b>19.3 Scoring Summary</b>	
The EsIA and additional studies required by the lenders identified important considerations for the preparation, filling and operation of the reservoir. Monitoring of reservoir preparation and filling activities took inter-relationships amongst issues into account, for example between land stability and social issues, and has adapted to emerging risks, such as changes in water quality and GHG emissions. ICE has identified opportunities to partner with NGOs (Panthera), local communities, the commission of the biological corridor, and government agencies.	
Multiple plans were in place to address identified needs during reservoir preparation and filling, such as fauna and flora rescue, land acquisition and resettlement, removal of the old railway line, and vegetation clearance. Ongoing monitoring as well as visits audits by the lenders' consultants provide the means to anticipate emerging risks and opportunities.	
However, public safety measures are not sufficient to prevent accidents and fatalities in the reservoir. A reservoir access and uses plan was not in place before the filling of the reservoir to anticipate to these potential risks. There are delays in the implementation of the water hyacinth control programme and the development of the reservoir access and uses plan. There are two significant gaps against proven best practice, resulting in a score of 3.	
Topic Score: 3	
<b>19.4 Relevant Evidence</b>	
<b>Interview:</b>	3, 6, 11, 21, 23, 24, 36, 54, 58, 60, 63, 65, 70, 73, 82, 86, 90

<b>Document:</b>	2, 11, 12, 18, 22, 25, 28, 29, 32, 36, 37, 61-69, 71, 75, 88, 92, 94-98, 109, 118, 119, 132, 134, 139, 146, 149, 152, 154, 155, 161, 163, 170, 179, 180, 184, 186, 188, 189, 205, 207, 210, 217-219, 230, 235-239, 326-334, 441-442
<b>Photo:</b>	50, 51, 96, 174-180

## 20 Downstream Flow Regimes (I-20)

This topic addresses the flow regimes downstream of project infrastructure during the project implementation stage. The intent is that flow regimes downstream of project infrastructure are planned and delivered with an awareness of and measures incorporated to address environmental, social and economic objectives affected by those flows.

### 20.1 Background Information

Rainfall and flows in the project area follow a unimodal distribution. In the period June 1963 to April 2005 (excluding 1994-1995) monthly average flows at the Pascua monitoring station (a short distance upstream of the dam site) ranged from 81.8 m<sup>3</sup>/s in March to 209.4 m<sup>3</sup>/s in September. The annual average flow at the Pascua monitoring station at the time of the feasibility study was 151.9 m<sup>3</sup>/s. Tributary inflows downstream of the dam site are relatively minor until the Parismina River c.38 km downstream.

The minimum and maximum monthly averages from 1963 to 2005 were 38.6 m<sup>3</sup>/s in 1978-1979, and 327.8 m<sup>3</sup>/s in 2002-2003. Two-year, 5-year and 10-year return-period low flows are 33.6, 24.6, and 20.4 m<sup>3</sup>/s respectively, and 2-year, 5-year and 10-year return-period high flows are 1 028, 1 448, and 1 780 m<sup>3</sup>/s respectively. Note that the highest probability of peak flows does not occur in September: December has the highest probability of flows above 1 000 m<sup>3</sup>/s, and the probability of exceeding 750 m<sup>3</sup>/s peaks in both August and December.

The active storage capacity of the reservoir is equivalent to about 9 days of the average annual flow, so is not sufficient for inter-seasonal regulation. The design flow of the powerhouse is 240 m<sup>3</sup>/s and the minimum flow of one turbine is 30 m<sup>3</sup>/s. The spillway has been designed to accommodate the flow of an estimated 10 000-year recurring flood (11 379 m<sup>3</sup>/s).

The 4 km stretch of river between the dam and the powerhouse outflow is described as the “critical section”, and the river downstream of the powerhouse and beyond is described as the “regulated section” in this topic, in keeping with terminology used in the PHR Manual on Hydraulic Operations.

Potential effects on downstream flows, without mitigation, are:

- During reservoir filling, reduced flow in both the critical and regulated sections;
- During operations, in the critical section, a reduction in flow of up to 240 m<sup>3</sup>/s depending on the volume of flow diverted for generation; without provision of an environmental flow, there would be no flow in this section for most of the year, and even in the wettest months it would be significantly reduced;
- During operations, in the regulated section, reduced flow at times that the reservoir is filling, and variations in flows with operations, especially peaking; however, at times when the reservoir is full during the wet season, flows will be equal to pre-project flows;
- As the spillway gates are opened and closed, rapid increases and decreases in flow in the critical section; these variations in flow may also be significant downstream of the powerhouse, depending on the volume used for generation;
- During flushing of sediment from the reservoir (and associated lowering and re-filling), significant increases and decreases in flows in both critical and regulated sections.

Please note that whilst flows in the Reventazón River prior to the implementation of the project were already modified by the upstream hydro projects, Angostura, Cachí and Río Macho, this modification was very limited, due to their limited reservoir volumes compared to inflows (Angostura 11 million m<sup>3</sup> with 101 m<sup>3</sup>/s average

flows, Cachí 39 million m<sup>3</sup> and 53 m<sup>3</sup>/s, and Río Macho 0.39 million m<sup>3</sup> and 22 m<sup>3</sup>/s). Angostura became operational in 2002.

There is no legal requirement in Costa Rica for a minimum flow for social or environmental reasons, but the EsIA process provides an opportunity to assess impacts and determine legal commitments.

## 20.2 Detailed Topic Evaluation

### 20.2.1 Assessment

#### Analysis against basic good practice

**Scoring statement:** *Issues in relation to flow regimes downstream of project infrastructure during the project implementation stage have been identified and assessed; and monitoring is undertaken to assess effectiveness of flow management measures or any emerging issues during project implementation.*

ICE assembled data on hydrology in the project's feasibility study, presenting hydrological analysis and flow duration curves for the Pascua monitoring station. The feasibility study was based on an assumption that an environmental flow of 15 m<sup>3</sup>/s would be provided in the critical section.

ICE presented an assessment of some key biological and social issues in the cumulative effects section of the EsIA study in 2009. The EsIA report refers to a study "Determination of a methodology for establishing the flow of compensation in the rivers of Costa Rica from two case studies", carried out by an interdisciplinary team (from ICE and a Swedish consulting firm, Hydroconsult Sweden AB, with support from the Swedish Cooperation Agency for Development, SIDA), which was applied for the critical section only. The report indicates that a flow of 15 m<sup>3</sup>/s had, since the operation of Angostura, a return-period just below 2 years, and flows below that level are observed 5% of the time. The analysis focused on the habitat availability requirements for two migratory fish species, tepemechín (*Agonostomus monticola*) and bobo (*Joturus pichardi*), a basic analysis of depth and width requirements for rafting, and the needs for swimming, fishing, and water extraction for livestock is also presented. The analysis concluded that 15 m<sup>3</sup>/s was sufficient for these social purposes, and would provide sufficient (more than 45%) availability of flow depths and velocities for bobo which presents greater habitat availability constraints than tepemechín. This was based on more than 1400 observations of tepemechín's depth and velocity preferences in the Reventazón and another river, but on only 46 observations of Bobo. This part of the EsIA also recommends a minimum of 40 m<sup>3</sup>/s downstream of the powerhouse, due to the long distances to significant tributary in-flows (16 km to Peje, 38 km to Parismina) and the importance of water in the river for in summer for both biological and social values, but no analysis is presented of this figure.

ICE's lenders for the project required additional studies in 2012, including studies to ensure that cumulative impact assessment was compatible with their environmental safeguard policies. The additional study on cumulative impacts identified water quantity and flow as a valued environmental component (VEC) and several other VECs were partly or wholly-linked to downstream flows, including rafting, sedimentation, hydro-geomorphology, and water quality. The study does not carry out any quantitative analysis of flows. Other additional studies (water quality, biodiversity, and fish) mention downstream issues, for example with mention of sport fishing at the estuary. The studies conclude that downstream impacts are very uncertain.

Summarising, in relation to the potential effects cited in the Background above:

- During reservoir filling, reduced flow in both critical and regulated sections – this was assessed briefly in the EsIA and qualitatively in the additional studies;
- During operations, in the critical section, a reduction in flow of up to 240 m<sup>3</sup>/s depending on the volume of flow diverted for generation – this was assessed for the social aspects referred to above, and the minimum

requirements for two migratory fish species, and the environmental flow of 15 m <sup>3</sup> /s considered to be sufficient;
<ul style="list-style-type: none"> <li>• During operations, in the regulated section, reduced flow at times that the reservoir is filling, and variations in flows with operations, especially peaking – this was not assessed;</li> <li>• As the spillway gates are opened and closed, rapid increases and decreases in flow in the critical section – this was not assessed;</li> <li>• During flushing of sediment from the reservoir (and associated lowering and re-filling) – this was not assessed.</li> </ul>
Specifically there is no quantitative assessment of the variations in flow resulting from generation, spilling and sediment flushing, and the implications of this for public safety and biological integrity. This issue is discussed further under Management.
A particular challenge lay in providing an environmental flow at the very beginning of reservoir filling, before the reservoir level reached the bottom outlet. ICE prepared a technical note, assessing several options to address this. They assessed two options in detail: the first was an environmental channel; the second was using the gates on the diversion tunnel. The first of these was chosen and the second kept as contingency. Flows were tested filling.
Regarding monitoring, ICE maintains automatic monitoring of flows, with data available to all ICE staff via the company intranet, of points below the dam and powerhouse. The early warning system, seen in the control room of the powerhouse, shows flows from the powerhouse, ecological powerhouse, and spillway, as well as reservoir levels and Angostura and tributary inflows. During implementation, ICE also mobilised teams to observe flows in the regulated section down to the river mouth, and social monitoring through community meetings.
<b>Criteria met: Yes</b>
<b>Analysis against proven best practice</b>
<b>Scoring statement:</b> <i>In addition, monitoring of downstream flow issues takes into account inter-relationships amongst issues, and both risks and opportunities that become evident during implementation.</i>
ICE is monitoring river channel morphology, water quality and biodiversity indicators as part of an adaptive management programme. The premise of the programme is to monitor and respond to unpredictable downstream flow impacts, particularly those arising from the inter-relationship between sediment dynamics, water quality, biodiversity and social values of the river. Further details of the programme are provided under Management below.
Climate change may be a risk for downstream flows, if it results in less water availability to provide environmental flows without compromising generation. ICE has studied the implications of climate change for the hydrological resource across Costa Rica. These studies have predicted future scenarios of rainfall and its seasonal distribution, evapotranspiration, flow duration curves, and turbinable flow in dry and wet seasons. The analysis concludes that there will be little change in either dry or wet seasons, and no evidence of an increase in the peak or length of extreme flows. Current variability is higher than the trend in climatic change.
<b>Criteria met: Yes</b>

**Analysis against basic good practice**

**Scoring statement:** *In the case that a need to address downstream flow regimes has been identified, measures are in place to manage identified downstream flow issues; and where formal commitments have been made, these are publicly disclosed.*

The project has adopted the following measures to address downstream flow issues:

- During filling, the provision of an environmental flow of a constant 40 m<sup>3</sup>/s in both critical and regulated sections, by the use of (i) a 3.5 km channel diverting water from the river to the bottom outlet (coordinated with the Angostura plant to ensure a flow in the river of at least 300 m<sup>3</sup>/s to ensure flow in the channel) in the very initial part of filling, (ii) the bottom outlet, and ultimately (iii) the ecological powerhouse;
- During operations, the provision of an environmental flow of a constant 15 m<sup>3</sup>/s in the critical section, provided by an ecological powerhouse at the foot of the dam. When the powerhouse is not operating, for example for maintenance, a diversion pipe will provide the environmental flow;
- During operations, an environmental flow of no less than 40 m<sup>3</sup>/s in the regulated section, provided by the minimum operating flow of one turbine or use of the spillway, augmenting flows from the critical section;
- Maximum planned spilling of 450 m<sup>3</sup>/s; and
- Maximum flushing from the bottom outlet of 450 m<sup>3</sup>/s.

In addition, ICE has developed a system for early warning for floods due to high rainfall/inflows. This sets out levels of alert with estimated time available for evacuation, from green (flows up to 500 m<sup>3</sup>/s), to yellow (500 to 1 022 m<sup>3</sup>/s, or 10 mm of rain per hour in a section of the catchment or a 2-year return-period of rainfall measured at stations within the catchment), to red (above 1 022 m<sup>3</sup>/s). The stated objective is to ensure that downstream communities are notified and may respond when there are regular or extraordinary flows or other emergency situations, but the detail concerns only extraordinary flows.

ICE applies an operational procedure for the management of the reservoir (NG-56-IT-90-006). This includes limitations on the rate of increase of spilling, rate of reservoir drawdown and filling of 1 m or 2 m per day depending on reservoir levels, and a 2 m “freeboard” to capture floods during the wet season. It requires that abrupt flow increments, greater than 100 m<sup>3</sup>/s, are avoided.

ICE has also made commitments to: provide rafting companies with independent access to the critical section, and maintain communications channels (a website or dedicated telephone line) to keep rafters updated on flows and forecasts; and implement a management Plan the middle and lower basin of the Reventazón (please refer to I-16 Erosion and Sedimentation for further details).

Plans for reservoir filling included communications for communities in directly and indirectly affected areas (posters and flyers, radio and press). Formal commitments to minimum downstream flows during operations also may have been publicly disclosed in community meetings in downstream areas. A commitment to maintain 15 m<sup>3</sup>/s in the critical section is disclosed in the ESIA, and commitments are mentioned in documents disclosed on the IDB website. However it is not clear where or how downstream flow commitments are formally disclosed in Costa Rica. The question of public disclosure of commitments is discussed further in I-2 Governance.

Criteria met: Yes

**Analysis against proven best practice**

**Scoring statement:** *In addition, processes are in place to anticipate and respond to emerging risks and opportunities.*

Two major programmes resulted from the additional studies required by lenders: an adaptive management plan, which will monitor changes in the downstream river and seek to mitigate emerging impacts; and an offset plan to compensate for biological impacts, which will preserve the status of the Parismina river. Please refer to I-15 Biodiversity and Invasive Species for details on the latter.

The adaptive management plan is a programme of regular monitoring to understand downstream dynamics, and expert interdisciplinary judgment on the results of the monitoring, using indicators of “functional quality” of the flow regime. For three defined zones – transitional, alluvial, and estuarine – functional quality of the hydrology, aquatic ecosystem, channel morphology, riverbanks, and social use will be compared to baseline conditions, and ranked poor, moderate, good, or very good quality. This is based on fortnightly hydrological, water quality and sedimentology data for 9 monitoring points along 5 sections of the river, from the dam to the river mouth. ICE expects the monitoring to continue for four years.

The plan sets out a series of actions that would be taken in response to lower functional quality, but the effectiveness of many of these actions may not be guaranteed – for example environmental education, and catchment management. Even hard infrastructure such as riverbank protection would be piecemeal in comparison to basin-scale erosive processes. Some interviewees during this assessment referred to flushing of sediment from the reservoir or planned spills as response measures, but they are not documented as measures for downstream erosion prevention. In addition, there is a risk that in a dry year, PHR may not be able to deliver a minimum flow of 40 m<sup>3</sup>/s – for example, assuming inflows from Angostura are 15 m<sup>3</sup>/s, the minimum flow alone (without generation) would deplete the live storage within 55 days. This may not be a realistic scenario, but there is no quantitative analysis or modelling to show that the minimum flow can be guaranteed. Also, it is not clear what options PHR has if there are emerging risks of variation in flows for biological or social values. The absence of analysis to anticipate or realistic measures to respond to these potential risks is a significant gap against proven best practice.

Criteria met: No

## 20.2.3 Conformance / Compliance

### Analysis against basic good practice

**Scoring statement:** *In the case that a need to address downstream flow regimes has been identified, processes and objectives in place to manage downstream flows have been and are on track to be met with no significant non-compliances or non-conformances, and downstream flow related commitments have been or are on track to be met.*

Most downstream flow-related commitments are met or on track to be met.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In addition, there are no non-compliances or non-conformances*

A commitment concerning the warning and alarm system included in the Environmental and Social Action Plan agreed with lenders, has not been fully addressed. This is discussed further in I-5 Infrastructure Safety, and is significant on that topic.

A minor non-conformance concerns an EsIA commitment (set out in the cumulative flows section) to make adjustments to the critical section channel every summer to maintain habitat diversity and ensure the flow and depth for rafting. This is described as partially completed in an internal ICE evaluation of EsIA/EMP commitments.

Non-conformances with EsIA/EMP commitments are addressed on I-3 (Environmental and Social Issues Management) and not considered significant here.

Criteria met: Yes

## 20.2.4 Outcomes

### Analysis against basic good practice

**Scoring statement:** *In the case that a need to address downstream flow regimes has been identified and commitments to downstream flow regimes have been made, these take into account environmental, social and economic objectives, and where relevant, agreed transboundary objectives.*

Downstream flow commitments take into account some environmental and social objectives. Downstream stakeholders have not reported any problems since impoundment, and consider any changes – less suspended sediment, more stable flows – to be an improvement.

During reservoir filling, flow in the critical and regulated sections exceeded the minimum flow of 40 m<sup>3</sup>/s. Data presented in the operational manual shows that flows were mostly well above the minimum, whilst they were at the minimum for the first day of filling, and again for 10 days in February 2016 and 17 days in March 16. Average flow over the 229-day reservoir filling period was 76.9 m<sup>3</sup>/s.

PHR will operate as a peaking plant, with peaks around lunchtime and in the evening from 6.00 to 9.00 pm. In theory flows could increase from 40 m<sup>3</sup>/s to 260 m<sup>3</sup>/s in the dry season (and this would be achievable within 15 minutes if necessary). Angostura is also provides peak generation in the evenings so, prior to PHR, dry season flows would have varied from Angostura’s minimum flow of 15 m<sup>3</sup>/s to 60 m<sup>3</sup>/s when operating. This is a large, potential, increase in variation, and underlines the need for the warning and alarm system described on I-5 Infrastructure Safety.

Criteria met: Yes

### Analysis against proven best practice

**Scoring statement:** *In the case that a need to address downstream flow regimes has been identified and commitments to downstream flow regimes have been made, in addition these represent an optimal fit amongst environmental, social and economic objectives within practical constraints of the present circumstances.*

ICE has not prepared any analysis to demonstrate that the flow regime is “optimal” for environmental, social and economic objectives, but initial monitoring of the adaptive management plan indicates that the flow regime to date balances environmental and social values with generation objectives. The initial report of the adaptive management plan in November 2016 reported unchanged conditions of all functional quality elements for all sections, with the exception of poor hydrological quality function due to a reduction in flow and minimal changes in channel morphology (with a requirement for actions to avoid bank erosion). The conclusions are still preliminary.

Criteria met: Yes

## 20.2.5 Evaluation of Significant Gaps

### Analysis of significant gaps against basic good practice

There are no significant gaps against basic good practice.

0 significant gaps



### Analysis of significant gaps against proven best practice

The absence of analysis to show that the minimum flow can be guaranteed at all times, and the risk that adaptive response measures will not be effective in avoiding downstream biological or social impacts.

1 significant gap

## 20.3 Scoring Summary

ICE assembled data on hydrology in the project's feasibility study and assessed some key downstream biological and social issues in the EsIA. ICE's lenders required an additional study on cumulative impacts which largely focused on downstream issues. However there is no quantitative assessment of the variations in flow resulting from generation, spilling and sediment flushing, and the implications of this for public safety and biological integrity.

The project has adopted a range of downstream flow measures, including environmental flows of 15 m<sup>3</sup>/s in the river section between the dam and powerhouse, and 40 m<sup>3</sup>/s downstream of the powerhouse. An adaptive management plan resulted from the additional studies required by lenders, and this will monitor changes in the downstream river and seek to mitigate emerging impacts (though it is not clear that it will be feasible for all biological or social values). Initial monitoring under the adaptive management plan indicates that the flow regime to date balances environmental and social values with generation objectives. However, ICE has not proven that the minimum flow can be guaranteed at all times, and there is a risk that adaptive response measures will not be effective in avoiding downstream biological or social impacts. There is one significant gap against proven best practice, resulting in a score of 4.

Topic Score: 4

## 20.4 Relevant Evidence

<b>Interview:</b>	6, 9, 30, 31, 32, 50, 51
<b>Document:</b>	75, 119, 132, 137, 151, 161, 179, 184, 186, 218, 275, 441, 442, 446, 452, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 471
<b>Photo:</b>	181-196

# Appendix A: Written Support of the Project Developer



2017-01-17  
0510-057-2017

Sr.  
Fabrizio Zarcone  
Country Manager Costa Rica  
World Bank  
[lgutierrez@worldbank.org](mailto:lgutierrez@worldbank.org)

Estimado señor

**Asunto:** Proyecto Piloto Aplicación Protocolo de Evaluación de la Sostenibilidad de la Hidroelectricidad en Latinoamérica.

En el marco del Proyecto Piloto impulsado por el Banco Mundial en coordinación con la Asociación Internacional de la Hidroelectricidad (IHA), para la implementación del Protocolo de Sostenibilidad de la Hidroelectricidad en América Latina, el Instituto Costarricense de Electricidad (ICE) desea manifestar su interés en participar del mismo y somete la candidatura al proyecto hidroeléctrico Reventazón (PHR).

Asimismo, externar nuestro interés en participar en los talleres de formación y capacitación sobre el Protocolo del IHA y las mejores prácticas internacionales para el desarrollo sostenible de la hidroelectricidad, incluidas dentro de la concepción del proyecto.

Sin duda alguna, para el ICE será una manera no solo de evaluar las acciones realizadas durante la fase constructiva del PHR, sino también incorporar las mejores prácticas de sostenibilidad que resulten del proceso de evaluación, de cara al desarrollo de los nuevos proyectos hidroeléctricos que impulsa la Institución.

Atentamente,  
**Gerencia Electricidad**

*CARTA FIRMADA DIGITALMENTE*

Luis Pacheco Morgan  
**Gerente**

Edgar Gutiérrez Esperleta	Ministro, Ministerio de Ambiente y Energía
Irene Cañas Díaz	Viceministra, Ministerio de Ambiente y Energía
José Francisco Pacheco	Viceministro, Ministerio de Hacienda
Christian Peter	Líder Sectorial, Centro América, Banco Mundial
Luis Gutiérrez	Banco Mundial Oficial Operaciones en Costa Rica, Banco Mundial
Ruth Tiffer	Gerente Asistencia Técnica Protocolo IHA, Latinoamérica, Banco Mundial
Javier Orozco Carossa	Director Planificación y Desarrollo Eléctrico, ICE

Apartado postal 10032-1000 San José, Costa Rica  
Teléfono: (506) 2000-7484  
Fax: (506) 2290-3780  
[LPacheco@ice.go.cr](mailto:LPacheco@ice.go.cr)  
[www.grupoice.com](http://www.grupoice.com)

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Lugar: San José, Costa Rica

## Appendix B: Verbal Evidence

Ref	Entrevista	Cargo	Organización /Comunidad	Fecha	Hora	Cita	Entrevistador principal
1	Mauricio Morales y Alexandra Sáurez y Allan Retana	Coordinación/Regencia	ICE	03/07/2017	09:00	San José	Doug Smith
2	Jorge Torre y Sergio Carboni y Eduardo Avilés y Ricardo Baldi y Hugo Salazar y Mauricio Varela	Especialistas estudios básicos	ICE	03/07/2017	09:00	San José	Margaret Trias
3	Erick Campos y David Nuñez y Fabián Arquín y Eugenia Gutiérrez	Especialistas diseño	ICE	03/07/2017	09:00	San José	Aida Khalil
4	Alexander Solís	Director Ingeniería y Construcción	ICE	03/07/2017	11:00	San José	Margaret Trias
5	Adelaida Acevedo Jiménez	Supervisora Ambiental	ICE	03/07/2017	11:00	San José	Helen Locher
6	José Alberto Zúñiga	Director CS Estudios Básicos	ICE	03/07/2017	11:00	San José	Doug Smith
7	Visita a modelo hidráulico del PH Reventazón		ICE	03/07/2017	13:00	San José	Margaret Trias
8	Andrea Alpizar Argüello, y Dunya Porras Castro Dunio Castro	Encargado de ASA y Comisión Plenaria SETENA	SETENA	03/07/2017	13:00	San José	Helen Locher
9	Gustavo Calvo (teleconferencia) y Aníbal Brenes	Área Sostenibilidad (seguimiento afectación aguas abajo), Especialista en Hidrología	ICE/ CS Ebi	03/07/2017	14:00	San José	Doug Smith
10	Luis Diego Baltodano	Coordinador Planeamiento y Control Reventazón	ICE	03/07/2017	14:00	San José	Margaret Trias
11	Ivan Gazel y Eugenia Gutiérrez y Aníbal Brenes	Especialista de Hidráulica	ICE	03/07/2017	14:00	San José	Aida Khalil
12	Milena Elizondo	Jefatura Comunicación PHR	ICE	03/07/2017	15:00	San José	Doug Smith
13	Yilbeth Muñoz	PHR employee from Siquirres	ICE	03/07/2017	15:00	San José	Helen Locher
14	Sara Méndez (Vice Alcaldesa)	Representante institucional	Ministerio Educación / Teniente de Alcalde	04/07/2017	08:30	Siquirres	Doug Smith
15	Rolando Murias	Contratista privado	Andremu (contratista)	04/07/2017	10:00	Siquirres	Doug Smith
16	Group of five workers, male and female	Trabajadores	ICE	04/07/2017	11:00	Siquirres	Helen Locher

17	Dr Ampie	Director médico	CCSS	04/07/2017	11:00	Siquirres	Doug Smith
18	Jorge Leiva y Miguel Vargas	Encargado de Biología	ICE	04/07/2017	11:00	Siquirres	Aida Khalil
19	Group of four workers, male and female	Trabajadoras	ICE	04/07/2017	11:30	Siquirres	Helen Locher
20	Gidget Alonso	Salud y Seguridad durante el llenado		04/07/2017	13:00	Siquirres	Helen Locher
21	Alexandra Sáurez Castro	Responsable Ambiental	ICE	04/07/2017	13:00	Siquirres	Aida Khalil
22	Rafael Sanabria	Miembro comunidad (ex-presidente)	ADI Bonilla	04/07/2017	14:00	Left bank (Bonilla)	Doug Smith
23	Juan Carlos Brenes	Coordinador del comité del Subcorredor Barbilla-Destierro	SCBD	04/07/2017	14:00	Siquirres	Aida Khalil
24	Gerardo Gilbert Rojas	Participante del programa SCBD, Programa de Ganadería		04/07/2017	15:00	Siquirres	Aida Khalil
25	Gerardo Aguilar y Nelly Brenes, y Fresi Brenes	Propietario reasentado (Vulnerable Alto)		04/07/2017	15:00	Left bank (Pascua)	Doug Smith
26	Juan Alfaro	Propietario reasentado (Vulnerable Alto)		04/07/2017	16:00	Left bank (San Antonio)	Doug Smith
27	Alexis Brenes y Darío Brenes	Propietario reasentado: grupo de pago de compensación del avalúo (Vulnerable Alto)		04/07/2017	17:00	Left bank (San Antonio)	Doug Smith
28	Edwin Cyrus	Jefe Regional SINAE	SINAC	04/07/2017	17:30	Guácimo	Aida Khalil
29	Adelaida Acevedo Jiménez	USAP	ICE	05/07/2017	08:00	San José	Aida Khalil
30	Mauricio Gonzales y Victoria Taylor	Asociación de Boteros Parismina y ADI Parismina	Comunidades aguas abajo	05/07/2017	08:00	Parismina	Doug Smith
31	Gustavo Calvo	Área de Sostenibilidad	ICE	05/07/2017	09:00	Parismina	Doug Smith
32	Raphael Hidalgo	Gerente	Compañía Banana, La Estrella, Monte Blanco	05/07/2017	11:00	San Alberto	Doug Smith
33	Carlos Echevarría y Susan Davis	BID - CII		05/07/2017	09:00	San José (BID)	Helen Locher
34	Arturo Hernandez Ruiz	Arqueólogo	ICE	05/07/2017	09:00	San José	Margaret Trias

35	Erick Campos y David Nuñez y Fabián Arquín y Ricardo Baldi	Coordinador Diseño Final PHR.	ICE	05/07/2017	10:00	San José	Margaret Trias
36	Oscar Sánchez Chaves (teléfono)	Representante institucional	FONAFIFO	05/07/2017	11:00	San José	Aida Khalil
37	Sandra Gamboa	Jefe de Operaciones Financieras	ICE	05/07/2017	11:30	San José	Helen Locher
38	Jeffrey Aguilar	Coordinador Oficina Técnica Reventazón	ICE	05/07/2017	13:00	San José	Margaret Trias
39	Roberto Salom Pérez (teleconferencia)	Director Ejecutivo	Panthera	05/07/2017	14:00	San José	Aida Khalil
40	Geovanny Picado y Silvia Víquez	Jefe de Recursos Humanos Reventazón	ICE	05/07/2017	14:00	San José	Helen Locher
41	Rosi Pereira	Representante comunal	ASADA La Alegría	05/07/2017	14:00	Left bank (La Alegría)	Doug Smith
42	Luis Roberto Rodríguez	Director Reventazón	ICE	05/07/2017	15:00	San José	Helen Locher
43	Elsie Otárola y Lidiette Vega	Miembro comunidad	AD Florida Siquirres	05/07/2017	15:00	Left bank (Florida)	Doug Smith
44	Alvaro Castillo	Riesgos	ICE	05/07/2017	15:00	San José	Margaret Trias
45	César Anderson y Alice Alfaro	Propietario reasentado (Vulnerable Alto) (Calle Nubes)		05/07/2017	16:00	Left bank (Florida)	Doug Smith
46	Mauricio Morales y Alexandra Sáurez	Coordinación/Regencia	ICE	05/07/2017	16:00	San José	Helen Locher
47	Jorge Nájera	Propietario reasentado (Vulnerable Alto)	El Coco	06/07/2017	07:00	Right bank (Coco)	Doug Smith
48	Sergio Mata	Director Gestión de Proyectos	ICE	06/07/2017	07:00	San José	Helen Locher
49	Edgar Calderón	Propietario reasentado (Vulnerable Alto)	El Coco	06/07/2017	08:00	Right bank (Coco)	Doug Smith
50	David Meza	Operador	ICE	06/07/2017	09:00	Casa de Maquinas	Doug Smith
51	David Ovando	Gerente de Operaciones	Rios Tropicales (Rafters)	06/07/2017	11:00	Squirres	Doug Smith
52	Luis Pacheco	Gerente Negocio Electricidad	ICE	06/07/2017	08:00	San José	Helen Locher
53	Ricardo Porras	Coordinador General de Proyectos	ICE	06/07/2017	08:00	San José	Margaret Trias
54	José Alberto Zuñiga	Estudios Básicos	ICE	06/07/2017	09:00	San José	Aida Khalil
55	Mauricio Hernández, Victor Julio González	Jefe Adquisiciones Ingeniería y		06/07/2017	09:00	San José	Helen Locher

		Construcción, Jefe Adquisiciones Reventazón					
56	Rodrigo Calvo, Ileana Mora, José Alberto Zuñiga, Alvaro Climent	Estudios Básicos	ICE	06/07/2017	09:00	San José	Margaret Trias
57	Mynor Solano	Jefe de Fideicomiso Reventazón Scotiabank	Scotiabank	06/07/2017	10:00	San José	Helen Locher
58	Jorge López / Mariam Rojas	aspectos fisicoquímicos Químico	ICE/ Lab. Químico	06/07/2017	10:00	San José	Aida Khalil
59	Arie Kersienzon	Proveedor	Valco SA	06/07/2017	11:00	San José	Helen Locher
60	Alejandro Fallas Castillo	Ing. Forestal PHR	ICE	06/07/2017	11:00	San José	Aida Khalil
61	Yetty Saldaña Brenes	Coordinadora SIGIR	ICE	06/07/2017	11:00	San José	Margaret Trias
62	Marvin Bonilla y Marieta Garita, Mauricio Hernández, Victor Julio González	Administrador de contrato de subestación	ICE	06/07/2017	13:00	San José	Helen Locher
63	Jorge Bonilla, Jorge Granados y Sergio Arce	Especialista de Geología	ICE	06/07/2017	13:00	San José	Aida Khalil
64	Miguel Víquez Camacho	Coordinador Proceso Planificación Ambiental	ICE	06/07/2014	14:00	San José	Helen Locher
65	Yeudin Chávez Rodríguez y Camilo Vargas	Encargado de obra	ICE	06/07/2017	14:00	San José	Aida Khalil
67	Luis Acuña	Jefe de Proveeduría ICE	ICE	06/07/2017	15:00	San José	Helen Locher
68	Yeudin Chávez Rodríguez, Camilo Vargas	Encargados de obra	ICE	06/07/2017	15:00	San José	Margaret Trias
69	Erick Picado	Director Legal	ICE, proceso de avalúos	06/07/2017	15:00	San José	Doug Smith
70	Alfonso Perez ( teléfono)	Representantes Cuenca	COMCURE	05/07/2017	15:30	San José	Aida Khalil
71	Snr Dagoberto	Siemens - INABENSA	Proveedor	06/07/2017	16:00	San José	Helen Locher
72	María Fernanda Camacho - Alex Arce	Gestores residuos	Madisa y GEEP	06/07/2017	16:00	San José	Margaret Trias
73	Gustavo Calvo y Fermín Vargas	Área de Sostenibilidad	ICE	07/07/2017	08:00	San José	Aida Khalil
74	Samantha Camacho	Coordinación Social	ICE	07/07/2017	08:00	San José	Doug Smith
75	Arbey Sánchez (Siquirres) Casa	Sindicato	ICE	05/07/2017	08:30	Siquirres	Helen Locher
76	Lilliana Hernández Martínez	Coordinación de Salud Ocupacional de Coordinación	ICE	07/07/2017	09:30	San José	Helen Locher

		General de Proyectos					
77	Aníbal Brenes Jimenez	Especialista en Manejo Sedimentos	ICE	07/07/2017	10:00	San José	Aida Khalil
78	Allan Retana	Jefatura Gestión Ambiental PHR	ICE	07/07/2017	10:00	San José	Doug Smith
79	Bjorn Somdalen	Consultor	Fichtner/ IE	07/07/2017	10:00	Teleconferencia (Alemania)	Margaret Trias
80	Miguel Víquez Camacho	Coordinador Proceso Planificación Ambiental	ICE	07/07/2014	11:00	San José	Helen Locher
81	Bayardo Materon	Consultor Presas CFRD	Independiente	07/07/2017	11:00	Teleconferencia (Brasil)	Margaret Trias
82	Alexandra Suárez Castro	Responsable Ambiental	ICE	07/07/2017	11:00	San José	Aida Khalil
83	Milton Kanji	Consultor	Independiente	07/07/2017	15:00	Teleconferencia (Brasil)	Margaret Trias
84	Luis Diego Baltodano	Coordinador Planeamiento y Control Reventazón	ICE	07/07/2017	15:30	San José	Helen Locher
85	Maureen Acosta	Coordinador de valoración de la propiedad	ICE	07/07/2017		San José	Doug Smith
86	Emmanuel Boulet	Principal Environment Specialist, Head of Operations	Inter-American Development Bank	12/7/2017	5:30 pm Washington	by phone	Helen Locher
87	Karla Vetrani Chavarria	Noise Specialist	PROCAME	12/7/2017		by phone	Margaret Trias
88	Zachary Hurwitz	Environmental Specialist	IDB	18-7-2017	10 AM EST	by phone	Margaret Trias
89	Wilson Valerio	Archaeologist	CAN	21-7-2017	4 PM EST	by phone	Margaret Trias
90	Juan Quintero	IESMC - environmental	Independent	24/7/2017		by phone	Aida Khalil
91	Pablo Cardinale	Principal Specialist, Sustainable Infrastructure	International Finance Corporation	27/7/2017	6 pm Sao Paulo	by phone	Helen Locher
92	Maria Clara Mejia	IESMC - social	Independent	3-8-2017	9 am Bogota	by phone	Doug Smith
93	Daniel Gross	Auditor de reasentamiento	Independent	16-8-2017	9 am Washington	by phone	Doug Smith
94	Adrian Navarette Castillo		Ministerio de Salud	04/07/2017		San José	Margaret Trias





## Appendix C: Documentary Evidence

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
1			Certificación de no pueblos indígenas	español	
2	ICE/ PHR	2015	Análisis de sismisidad para PHR, durante los primeros meses de llenado	Español	Análisis de sismisidad
3	ICE		Bases de datos sobre rescate fauna	Español	
4	ICE		Informe de ensayos microbiológicos (Análisis de agua potable) 1,2,3,4,5,6	Español	
5	CSD/ ICE Eugenia Gutiérrez	2015	Capacidad del sistema de desvío durante 2015	Español	
6	ICE		Informes Sistema Gestion Integral de Residuos 1,2,3,4,5,6,	Español	
7	ICE		Minutas de reunión	Español	
8	Fideicomiso	2012-2017	Claúsulas contractuales	Español	
9	ICE		Código de Trabajo	Español	
10			Informe final de Estado de avance compromisos comunales	español	
11	ICE		Comunicados (Boletines, brochures, periodicos, etc) I-1 F 01 CAP CT04-02 Informe final de comunicación	Español	
12	CSD/ ICE Eugenia Gutiérrez	2015	Consideraciones hidráulicas del primer llenado de Embalse	Español	

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
13	ICE		FIDEICOMISO UNO P.H. REVENTAZÓN/ICE/SCOTIABANK/2013	Español	
14			CONTRATO FIDEICOMISO 22 MAYO 2013	Inglés	
15			Convenio 38911 con Municipalidad de Siquirres	español	
16	ICE		Estatuto de personal de proyectos	Español	
17	ICE	2012-2015	Metodos de Gestion Ambiental	Español	
18	ICE	2009-2017	Estudio de Impacto Ambiental	Español	
19	ICE		Dispositivos Aéreos 1 y Pasos de Fauna 2	Español	
20			Evaluación de reservas arqueológicas y mantenimiento	español	
21	ICE		Evaluaciones de desempeño de equipos preventivos 2016, 2017	Español	
22	ICE/CSES	2012	Fallamiento en la zona de incidencia del P.H. Reventazón: Un insumo hacia los estudios de detalle sismo tectónicos y de potencial de deslizamientos co-sísmicos	Español	Auscultación Sísmica
23	ICE		Fichas de rescate	Español	
24	ICE	2009-2015	Charlas de Inducción	Español	Presentación
25	CSD/ ICE	2015	Guia para Supervision del desempeño de obras civiles y ladera del embalse. Primer Llenado	Español	
26	ICE		Método de contratación de maquinaria alquilada	Español	
27	ICE		PHR-DIR-01 Procedimiento administración de riesgos	Español	
28	IC/ ICE	2016	Informe 1 llenado del embalse	Español	

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
29	IC/ ICE	2016	Informe 2 del llenado del embalse	Español	A cotas 196, 220 y 250 msnm
30	Alvaro Climent/ ICE	2005-2011	Informe Amenaza Sísmica 2005 y 2011	Español	
31	Ingeniería/ PHR Roy Ruiz	2016	Informes finales de ingeniería (Informe cierre de la obra de Presa)	Español	
32	Panel PHR (Milton, Bayardo)	2015	Informe cuarta visita del 09 al 13/01/2015	Español	
33	ICE/ PHR Fabian Arquín B	2016	Informes finales de ingeniería (Informe de Cierre Toma de Aguas)	Español	
34	Ingeniería/ PHR Roy Ruiz	2015	Informes finales (Informe de Cierre Túneles de Desvío)	Español	
35	CSD/ ICE Ricardo Baldi	2012	Informe de diseño Hidráulico Básico	Español	
36	IC/ ICE	2009	Informe de Factibilidad PH Reventazón	Español	Apartados de riesgo, sísmico e hidrológico- cap7, cap 8, cap4
37	ICE/ PHRJorge Bonilla	2016	Informe de inspección a infraestructura privada, comunidad San Antonio de la Alegría, Siquirres, provincia de Limón, denominada bajo código SA-47	Español	
38	Ing. Sergio Valenzuela Puga	2014	Informe de la 1° visita supervisor Hidromecánico	Español	
39	Ing.Nelson Serrano Solorza	2014	Informe de la 1° visita supervisor Metalmecánico	Español	
40	Ing. Sergio Valenzuela Puga	2016	Informe de la 10° visita supervisor Hidromecánico	Español	
41	Ing. Sergio Valenzuela Puga	2016	Informe de la 11° visita supervisor Hidromecánico	Español	

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
42	Ing. Sergio Valenzuela Puga	2014	Informe de la 2° visita supervisor Hidromecánico	Español	
43	Ing. Nelson Serrano Solorza	2015	Informe de la 2° visita supervisor Metalmecánico	Español	
44	Ing. Sergio Valenzuela Puga	2015	Informe de la 3° visita supervisor Hidromecánico	Español	
45	Ing. Nelson Serrano Solorza	2015	Informe de la 3° visita supervisor Metalmecánico	Español	
46	Ing. Sergio Valenzuela Puga	2015	Informe de la 4° visita supervisor Hidromecánico	Español	
47	Ing. Nelson Serrano Solorza	2016	Informe de la 4° visita supervisor Metalmecánico	Español	
48	Ing. Sergio Valenzuela Puga	2015	Informe de la 5° visita supervisor Hidromecánico	Español	
49	Ing. Sergio Valenzuela Puga	2015	Informe de la 6° visita supervisor Hidromecánico	Español	
50	Ing. Sergio Valenzuela Puga	2015	Informe Consultores (Informe de la 7° visita supervisor Hidromecánico)	Español	
51	Ing. Sergio Valenzuela Puga	2015	Informes finales de ingeniería - Informe de la 8° visita supervisor Hidromecánico	Español	
52	Ing. Sergio Valenzuela Puga	2016	Informes finales de ingeniería - Informe de la 9° visita supervisor Hidromecánico	Español	
53	Ing. Carlos Baisre	2016	Informes finales de ingeniería - Informe de la cuarta visita supervisor de Inyección	Español	

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
54	Ing. Marcelo Lavin B	2016	Informes finales de ingeniería - Informe de la cuarta visita supervisión de concretos Estructurales y Losa de concreto de la Presa	Español	
55	Ing. Marcelo Lavin B	2014	Informes finales de ingeniería -Informe de la primera visita supervisión de concretos Estructurales y Losa de concreto de la Presa	Español	
56	Ing. Carlos Baisre	2014	Informes finales de ingeniería -Informe de la primera visita supervisor de Inyección	Español	
57	Ing. Marcelo Lavin B	2015	Informes finales de ingeniería -Informe de la segunda visita supervisión de concretos Estructurales y Losa de concreto de la Presa	Español	
58	Ing. Carlos Baisre	2015	Informes finales de ingeniería -Informe de la segunda visita supervisor de Inyección	Español	
59	Ing. Marcelo Lavin B	2015	Informes finales de ingeniería -Informe de la tercera visita supervisión de concretos Estructurales y Losa de concreto de la Presa	Español	
60	Ing. Carlos Baisre	2015	Informes finales de ingeniería - Informe de la tercera visita supervisor de Inyección	Español	
61	G. Anhandale	2012	REVENTAZÓN HYDROELECTRIC PROJECT COSTA RICA Sedimentation and Sediment Management Study	Inglés	Empresa Golder. USA,
62	ICE/ PHR Keneyh Pérez	2015	Informe de situación de laderas debido al sismo del 11 junio 2015	Español	
63	Dr. Kanji	2009	Informes finales de ingeniería - Informe de Visita 1	Español	

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
64	Dr. Kanji	2010	Informes finales de ingenieria -Informe de visita 2 del 16 al 20/11/2010	Español	
65	Dr. Kanji	2011	Informes finales de ingenieria - Informe de Visita 3 del 11 al 18/08/2011	Español	
66	Dr. Kanji	2011	Informes finales de ingenieria -Informe de Visita 4 del 21 al 25/11/2011	Español	
67	Dr. Kanji	2017	Informes finales de ingenieria -Informe de visita del 20al 23/03/2017	Español	
68	Dr. Kanji	2016	Informes finales de ingenieria -Informe de visita del 22 al 25/08/2016	Español	
69	Dr. Kanji	2017	Informes finales de ingenieria -Informe de visita del 23 al 25/01/2017	Español	
70	Ing.Paulo Erbisti	2017	Informe de Visita supervisor Hidromecánico	Español	
71	Ivan Gazel/ ICE	2015	Informe Estudio de la ola producido por un deslizamiento en el Embalse.	Español	
72	ICE		Informe Fideicomiso Mensual	Español	
73	CSD/ ICE Marta Chaves	2016	Informes finales de ingenieria (Informe Final Auscultación Hidrogeológica)	Español	
74	ICE/ PHR Fabian Arquín B	2016	Informes finales de ingenieria (Informe final de cierre de auscultación y monitoreo de las obras civiles y laderas del embalse durante el primer llenado).	Español	
75			Informe Final LLENADO DEL EMBALSE PUESTA EN MARCHA	Español	

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
76			Informe final de reasentamiento	español	
77	ICE		Informe final de salud ocupacional	Español	
78	Ingeniería/ PHR Leonardo Mora Solano	2015	Informes finales de ingeniería (Informe final de seguimiento de ingeniería durante el proceso constructivo Casa de Máquinas Principal)	Español	
79	ICE/ PHR Fabian Arquín B	2016	Informe final de seguimiento de ingeniería durante el proceso constructivo de la Descarga de Fondo.	Español	
80	ICE/ PHR Fabian Arquín B	2016	Informes finales de ingeniería (Informe final de seguimiento de ingeniería durante el proceso constructivo de las Obras de la Central de Compensación Ecológica (CCE))	Español	
81	Ingeniería/ PHR Jorge A. Salazar Chacón	2015	Informes finales de ingeniería (Informe final de seguimiento de ingeniería durante el proceso constructivo del túnel de conducción.	Español	
82	Ingeniería/ PHR Leonardo Mora Solano	2016	Informes finales de ingeniería (Informe final de seguimiento de ingeniería durante el proceso constructivo del Vertedero de Excedencias	Español	
83	Ingeniería/ PHR Jorge A. Salazar Chacón	2015	Informes finales de ingeniería (Informe final de seguimiento de ingeniería durante el proceso constructivo de la Tubería Forzada y Tanque de Oscilación.	Español	
84	Ingeniería/ PHR Sergio Víquez Elizondo	2016	Informes finales de ingeniería (Informe final de seguimiento de ingeniería durante el proceso constructivo de la Subestación.	Español	

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
85	SRK/ Chile	2012	Informes finales de ingeniería -Informe final Ingeniería para el Análisis de Esfuerzos y Deformaciones, Estático y Sísmico de la Presa del P.H. Reventazón	Español	Evaluaciones de riesgo de seguridad
86	Ingeniería/ PHRLeonardo Mora Solano	2016	Informes finales de ingeniería (Informe final Líneas de Transmisión)	Español	
87	CSD/ ICEJoaquin B	2016	Informes finales de ingeniería (Informe final Tratamiento con inyecciones de cemento del Plinto)	Español	
88	CSD/ ICE Jorge Bonilla	2017	Resultados del monitoreo de laderas del embalse – Informe N°1	Español	
89	CS EBi/ ICE	2016	Informe Plan de manejo adaptativo. Sedimentos	Español	Informe interno ICE. Se entrega a Carlos Roberto (Negocio Generación)
90	ICE/ PHR David Núñez	2010-2016	Informes de BAE	Español	
91	ICE/ PHR Gitged Alonso	2014	Informe Plan de salud seguridad Ocupacional	Español	Planes de gestión de seguridad
92	Panel PHR	2015	Informes finales de ingeniería -Informe quinta visita del 07 al 1/09/2015	Español	
93	CS EBi/ ICE	2014	Informe Red sismológica del PH Reventazón: Actividad Sísmica del año 2013	Español	
94	ICE/ PHR	2015	Propuesta de zona de protección de embalse por inestabilidad de laderas	Español	
95	Panel PHR	2014	Informes finales de ingeniería -Informe segunda visita del 06 al 11/04/2014	Español	



	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
96	Panel PHR	2016	Informes finales de ingeniería -Informe sexta visita del 29 al 04/03/2015	Español	
97	CSD/ ICE	2015	Informe situación laderas debido a lluvias de Feb 2015	Español	
98	Panel PHR	2014	Informes finales de ingeniería -Informe tercera visita del 07 al 13/12/2014	Español	
99	ICE		Informe de resultados de análisis físicos y químicos del agua	Español	
100	ICE	2010-2016	Plan del Sistema de Gestión Ambiental	Español	
101	ICE	2010-2016	Plan de Construcción (estudio adicional)	Español	
102	CS EBi/ ICE	2012-2016	Informes de Descargas Atmosféricas	Español	En sitio con Sra. Gitged Alonso
103	ICE		Informe monitoreo de sedimentos 1,2,3	Español	
104	ICE		DIAGNÓSTICO Y MONITOREO DE FAUNA EN EL ÁREA DE INFLUENCIA DEL PROYECTO HIDROELÉCTRICO REVENTAZÓN	Español	
105	ICE		Rescate Fauna Llenado BID	Español	
106	ICE	2013-2016	Informes de Supervisión USAP	Español	
107	ICE		Restauración ecológica en las áreas de reubicación de fauna	Español	
108	ICE	2013-2016	Planes de Manejo Ambiental y Social (VER LISTA)	Español	
109	Panel PHR	2013	Informes finales de ingeniería -Informes del primer Panel del 08 al 14/12/2013	Español	
110			Informes finales de etapa arqueología (I - VI)	español	

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
111	ICE		Informe inmisiones 1, 2	Español	
112			Ley 6313 de expropiaciones del ICE	Español	
113			Reglamento al Título II de la Ley de Fortalecimiento y Modernización	Español	
114			Ley de anticorrupción y enriquecimiento ilícito	Español	
115			Ley de arrendamiento urbanos y suburbanos	Español	
116	ICE		Ley N° 6727 Ley sobre Riesgos del Trabajo	Español	
117	ICE		PLAN DE MANEJO ADAPTATIVO DE SEDIMENTOS Y CALIDAD DE AGUA (PMAS-PMCA)	Español	
118	ICE	2010-2017	Informes de Responsabilidad Ambiental	Español	
119	CSD/ ICE	2016	Manual de Operación de Obras Hidráulicas PHR	Español	Resultado del modelo para operaciones del embalse
120			Manual de Normas de Seguridad para Uso y Operación de Vehículos y Maquinaria	Español	
121			Marco Estrategico restitucion de condiciones de vida	español	
122			Mecanismo de consulta de quejas comunales	español	
123			Mecanismo de consulta de quejas laborales(atencion de quejas de trabajadores y contratistas)	español	
124	Ingeniería/ PHR	2013	Geotecnia (Memorandum Casa de Máquinas)	Español	
125	Ingeniería/ PHR	2013	Geotecnia Memorandum Central de Compensación	Español	

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
126	Ingeniería/ PHR	2013	Geotecnia Memorandum Presa	Español	
127	Ingeniería/ PHR	2013	Geotecnia Memorandum Subestación	Español	
128	Ingeniería/ PHR	2013	Geotecnia Memorandum Toma de Aguas	Español	
129	Ingeniería/ PHR	2013	Geotecnia Memorandum Tubería de alta Presión	Español	
130	Ingeniería/ PHR	2013	Geotecnia Memorandum Túneles de Desvío	Español	
131	Ingeniería/ PHR	2013	Geotecnia Memorandum Vertedero de Excedencias	Español	
132	ICE/ PHR David Núñez	2017	Memorias ICE Proceso de Puesta en Marcha	Español	
133	ICE		Plan de realización de la obra escombrera del Proyecto reventazon	Español	
134	ICE		Informe trimestral condiciones ambientales		
135	ICE		Estudios ambientales adicionales ( ocho estudios adicionales )	Español	
136	ICE		Informe Responsabilidad Ambiental Abril Mayo 2011		
137	ICE		Nota técnica caudal ambiental		
138	ICE	2015	Nota para CNE. Estado Inventario Infraestructura	Español	
139	ICE/ PHR Gitged Alonso	2016	Plan de Actuación ante emergencias derivado por Pruebas Humedas	Español	Planes de gestión de seguridad
140	ICE/ PHR Alexander Muñoz	2015	Plan de calidad Tanque de Oscilación y tubería de Presión del PHReventazón	Español	
141	ICE		Lineamientos Ambientales Sector Electricidad	Español	

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142	ICE/ PHR Salomón Chaves-Joseph Cheung	2014	Plan de ejecución Cortina de Impermeabilización del PHReventazón	Español	
143	ICE/ PHR Alexander Muñoz	2014	Plan de ejecución de Obra del Proyecto Casa de Máquinas del PHReventazón	Español	
144	ICE/ PHR Minor Novo	2014	Plan de ejecución de Obra del Proyecto Presa del PHReventazón	Español	
145	ICE/ PHR Willian Solano	2014	Plan de ejecución de Obra del Proyecto Vertedero del PHReventazón	Español	
146	ICE/ PHR Gitged Alonso	2015	Plan de emergencias Primer llenado del embalse	Español	Planes de preparación ante emergencias
147	ICE		Política Ambiental Negocio Electricidad		
148	ICE		Plan de Gestión del Proyecto	Español	
149	IC/ ICE	2015	Plan de gestión del proyecto de Puesta en Marcha	Español	
150			Plan de Gestión Social	español	
151	ICE		PLAN DE MANEJO ADAPTATIVO DE SEDIMENTOS Y CALIDAD DE AGUA (PMAS-PMCA)	Español	
152	ICE		PLAN DE MANEJO DE LA CUENCA MEDIA Y BAJA DEL REVENTAZÓN	Español	
153			Plan de manejo de la cuenca del río Siquirres	español	
154	Acción ambiental y Social	2016	Plan de manejo desastres naturales	Español	Gestión de inundaciones
155	ICE/ PHR David Núñez	2017	Plan de Ordenamiento del embalse: Apartado Monitoreo de estabilidad de laderas y riesgos geotécnicos	Español	

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156	ICE/ PHR Willian Solano	2012	Plan de realización de la Toma de Aguas del PHReventazón	Español	
157	ICE/ PHR Salomón Chaves- Joseph Cheung	2012	Plan de realización del Túnel de Conducción PHReventazón	Español	
158			Plan de reasentamiento	español	
159			Plan de restitucion de condiciones de vida	español	
160	ICE		Plan de salud y seguridad ocupacional de las obras	Español	
161	ICE		Plan de Gestión Ambiental y Social Etapa Operativa en proceso	Español	
162	ICE		Informe de Cierre Comisión de Asuntos Ambientales y Laborales Temas: Tránsito vehicular, Emisiones de Polvo y Contaminación Sónica		
163	ICE		REGISTRO FOTOGRÁFICO LLENADO DEL EMBALSE		
164	ICE		Política de Gestión Integral del Riesgo y Continuidad del Negocio	Español	
165	ICE/ PHR Erick Campos	2012	Premisas de diseño final	Español	Doocumentos de diseño final
166	ICE		Manual de Normas y procedimientos de seguridad básicos	Español	
167	ICE		Procedimiento para asignacion de equipos de seguridad	Español	
168			Programa de Capacitación en Desarrollo Local		
169			Programa de Educación Ambiental Comunidades del AID		
170	ICE/ PHR	2016	Protocolos de recepción y entrega de obras	Español	Evidencia
171	ICE		Protocolos biológicos Sector Electricidad 12 mayo 2014	Español	

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172	ICE/ PHR David Núñez	2016	Reconocimiento geotécnico preliminar de la ruta cantonal 703014 en San Joaquín de Siquirres, Limón	Español	
173	ICE		VALORACION DE LA EMISION DE RUIDO GENERADO POR LA EXTRACCIÓN Y PRODUCCIÓN DE AGREGADOS, MARGEN IZQUIERDA	Español	
174	ICE		Plan de Manejo Ambiental y Social (PMAS) "Mantenimiento de la Red de Vial"	Español	
175	ICE		Informe de resultados correspondiente al análisis físico-químico de las aguas y los sedimentos, así como de las emisiones de GEI en el Embalse del Proyecto Hidroeléctrico Reventazón (ICE-PHR)	Español	
176	ICE		VALORACION DE RUIDO EN PUNTOS DE MONITOREO DE LAS COMUNIDADES DE GUAYACAN, LOMAS, LA ALEGRIA, FLORIDA Y SAN ANTONIO	Español	
177	ICE		Registro recolección sedimentos 1,2,3	Español	
178			Reglamento Interno de Contratación Administrativa	Español	
179	CSD/ ICE Marco Jiménez Chaves	2016	Reporte de Llenado del Embalse al 13/07/2016 y Esquema Óptimo de Operación de Turbinas	Español	
180	ICE/PH Reventazón	05/07/190 5	Reprogramación PH Reventazón	Español	
181	ICE		permisos de corta forestal 1,2,3	Español	
182			Resoluciones de la Comisión Arqueologica Nacional	español	
183	CSD/ ICE Joaquin B	2016	Resultado del proceso de Impermeabilización en las Margenes	Español	

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
184	CSD/ ICE Marco Jiménez Chaves	2015	Revisión hidráulica de una propuesta de manejo del caudal de compensación ecológico para el cierre de las obras de desvío mediante un canal	Español	
185	ICE		Evaluación del Plan de Salud y Seguridad Ocupacional de la Obra o Proceso	Español	
186	Acción ambiental y Social	2015	PAAS Sistema de Alerta Temprana ante Emergencias Hídricas - Reventazónv2	Español	Gestión de inundaciones
187	ICE		REPORTE OPERACIONAL DE AGUAS RESIDUALES 1,2,3,4 y 5	Español	
188	ICE/ PHR Fabian Arquín B	2013	Valoración general cualitativa de la estabilidad de laderas del embalse	Español	
189	ICE		Mapa 3. Sitios arqueologicos		
190			Ley de Creación del Instituto Costarricense de Electricidad		
191			Ley general de arrendamientos urbanos y suburbanos		
192			Base Case Financial Model, Financial Plan and Annual Budget		
193			PROCEDIMIENTO PARA LA ADMINISTRACIÓN DE PROYECTOS (AP)		
194			Pago de nómina		
195			Procedimientos de medicina ocupacional		
196			Minutas de reuniones con sindicato		
197			Acta de reunión comunal (lista de 400) una por comunidad		
198			Informe de cierre de reuniones comunales		

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199			Informes de comunicados (bancos,		
200			Finiquitos de obras comunales		
201			Mapeo de partes interesadas /actores sociales (ver EsIA) I-3 GEN 002		
202			Reporte de quejas comunales		
203			Minuta Reunión PHR-MINAE (22-3-2012)	Español	
204			Protocolo de responsabilidad socioambiental	español	
205			Parte I - Emisiones de Gases de Efecto Invernadero Febero 2012	Español	
206			Minuta Comisión Ambiental Enero 2015	Español	
207			Registro de reuniones con MINAE	Español	
208			Subcorredor Biológico Barbilla - Destierro Informe del Plan Integrado de Vigilancia Biológica y Ecológica (BEMP) 2016		
209			Informes de giras comunales PHR		
210			Estudio Lidar del PH Reventazón		
211	ICE	2017	Objetivos del Protocolo de Sostenibilidad hidroeléctrica en el PH Reventazón		
212			Informe de Cierre de la Revegetación de Taludes en el Proyecto Hidroeléctrico Reventazón. Diciembre, 2014.		
213			Plan ejecución obra del Proyecto Presa PH Reventazón		



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214			Informe PROCAME Ruido		
215			Método para la gestión integral de residuos en el PHR		
216			Ceritificados Disposición final de residuos 1,2,3,4,5,6,7,8,9,10		
217			PREMISAS DE DISEÑO		
218			Informe hidrológico de factibilidad		
219			PAAS-11-11.2-1 Plan De Manejo Desastres Naturales - PH- Reventazón-v4		
220			Informe ambiental recursos PGA y medidas de manejo ambiental 2017 final		
221			Plan de Expansión de la Generación Eléctrica 2016-2035		
222			Plan de Información, Consulta y Participación de la comunidad del AID		
223			Plan Nacional de Desarrollo 2015-2018		
224			Mecanismo de quejas laborales 002_F03-PHR-COM-03 Remisión de casos dispensario médico 003		
225			Mecanismo de quejas laborales 002_F02-PHR-COM-03 Remisión de casos RH 003		
226			Mecanismo de quejas laborales 002_F01-PHR-COM-03 Remisión de casos sitios de trabajo 003		
227			Parte F - Propuesta de Proyecto de Compensación de Biodiversidad Febrero 9 2012		

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228			Parte C - Estudio de sedimentos Febrero 9 2012		
229			Parte B Estudio de Calidad de agua febrero 9 2012		
230			EFECTOS ACUMULATIVOS		
231			Emisiones de gases efecto invernadero		
232			Informe equipos MET Planta arbau		
233			Informe de Hallazgos Negativos sobre Caminos (Seguimiento ambiental)		
234			Anexo 9.6 Proceso participativo resultados de la tercera fase del proceso		
235			Análisis de sismicidad para el PH Reventazón		
236			Memorias IC proceso de puesta en marcha		
237			Manual de operación reventazon versión 3		
238			RESULTADOS DEL MONITOREO DE LADERAS DEL EMBALSE		
239			PROPUESTA DE ZONA DE PROTECCIÓN DEL EMBALSE POR INESTABILIDAD DE LADERAS		
240			Informes Sistemas de Gestión Integral de Residuos 1,2,3,4,5,6		
241			Informe de inmisiones 1,2		
242			CALIDAD DE AGUA CONSUMO HUMANO 1,2,3,4,5,6		
243			PHR-DIR-01 Procedimiento administración de riesgos		

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244			CONTRATO DE FIDEICOMISO		
245			PLAN DE GESTION AMBIENTAL Y SOCIAL ETAPA OPERATIVA		
246			REGLAMENTO AL TITULO II DE LA LEY DE FORTALECIMIENTO Y MODERNIZACIÓN		
247			LEY DE CREACIÓN DEL INSTITUTO CONSTARRICENSE DE ELECTRICIDAD		
248			LEY CONTRA LA CORRUPCION Y ENRIQUECIMIENTO ILICITO		
249			7527 LEY GENERAL DE ARRENDAMIENTO URBANOS Y SUBURBANOS		
250			Base Case Financial Model, Financial Plan and Annual Budget		
251			Informes finales de etapa arqueologica		
252			Fechas de radiocarbono PHR Etapa II		
253			Guión Museográfico reventazón		
254			Mecanismo de quejas laborales 002_F01-PHR-COM-03 Remisión de casos sitios de trabajo 003		
255			Mecanismo de quejas laborales 002_F02-PHR-COM-03 Remisión de casos RH 003		
256			Mecanismo de quejas laborales 002_F03-PHR-COM-03 Remisión de casos dispensario médico 003		
257			I- 1 A01-PHR-COM-03 Política para seguimiento de quejas de colaboradores de c...		

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258			I-1 012 Registro de quejas de trabajadores_ 0018_ EXPEDIENTE LINEA 7800 207		
259			I-1 A01-PHR-COM-01 Normas de seguridad para visitantes		
260			I-1 Anexo 2. Listado comunicados oficiales		
261			I-1 Anexo 3. Análisis de monitoreo de medios PH Reventazón 2010 - 2016		
262			I-1 F01-CAP-CT04-02 Informe Final Comunicación - P H R última versión		
263			I-1 F01-PHR-COM-01 Registro Visitas Externas al Proyecto Hidroeléctrico Reventazón		
264			I-1 F01-PHR-COM-03 Remisión de casos sitios de trabajo		
265			I-1 F02-PHR-COM-01 Registro Visitas Internas al Proyecto Hidroeléctrico Reventazón		
266			I-1 F03-PHR-COM-01 Registro Visitas Familiares al Proyecto Hidroeléctrico Reventazón		
267			I-1 F03-PHR-COM-03 Remisión de casos dispensario médico		
268			I-1 F04-PHR-COM-01 Registro Visitas a la Maqueta del Proyecto Hidroeléctrico Reventazón		
269			I-1 Método para la gestión de la comunicación para el manejo de crisis del Proyecto Hidroeléctrico Reventazón		

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270			I-1 PHR-COM-01 Método para ingreso y atención de visitas al Proyecto Hidroeléctrico Reventazón		
271			I-1 PHR-COM-03 Método para la atención de quejas y sugerencias de los trabaj...		
272			I-1-Finiquito de obra comunal 010		
273			I-1_Archivo de comunicados de prensa y noticias sobre PHR 011 (2010 - 2016)		
274			I-1_Estrategia de comunicación PCFP-OFFSET 16-12-2015		
275			I-1_INFORME CONSULTA COMUNAL OFFSET DIC 2014		
276			I-1_Informe de Cierre Reuniones Comunales_ 008		
277			I-10 FINIQUITO Caseta Policial		
278			I-10 Firmas Finiquito Caseta Policial		
279			I-10 Acuerdo VULNERABLE MEDIO Ejecución medidas PRCV 11-07-13		
280			I-10 Areas disponibles para reasentamiento 26-10-12		
281			I-10 Informe_identificación_terrenos_para_reposición_PRCV_may2014		
282			I-12 Contratos de trabajo		
283			I-12 2017-08-08 14-35-44 NUMERO DE EMPLEADOS DESPEDIDOS POR EL PHR		

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284			I-12 Base de Datos PHR		
285			I-12 CONTRATO POR AÑO Y COMUNIDAD		
286			I-12 DEMANDAS LABORALES 24-08-2016 (ANEXO 02)		
287			I-12 Evaluaciones de desempeño de equipos preventivos Minuta Equipo SYSO 02-02-2017		
288			I-12 Evaluaciones de desempeño de equipos preventivos Minuta Equipo SySO 22-01-2016		
289			I-12 EVIDENCIAS SOBRE LA APLICACIÓN DE POLÍTICAS DE GESTIÓN LABORAL		
290			I-12 INDICES DE CALIDAD DICIEMBRE 2013		
291			I-12 LISTADO DE NOMBRES DE LAS POLÍTICAS DE RRHH Y PROCEDIMIENTO		
292			I-12 Nota de cumplimiento de requerimientos del empleador		
293			I-12 SALIDA DE PERSONAL 2014		
294			I-12_ Información sobre campamentos (reportes) 016 CAP-CT23-04 Normas Campamentos		
295			I-12_Minutas reuniones sindicato ASDEICE-Comisión de Enlace PHR-2011_017-1		
296			I-13 convenio ICE-INCOFER		
297			I-15 Acta # 88 Subcorredor Barbilla Destierro 19 Abr 17 Tres Equis		

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298			I-15 Acta #89 Subcorredor Barbilla Destierro 21 Junio 17 Siquirres		
299			I-15 avance de obras proyecto reventazón		
300			I-15 áreas remanentes Proyecto Hidroeléctrico Reventazon		
301			I-15 Datos anexos a las figuras		
302			I-15 evidencia de limpieza del embalse 1		
303			I-15 evidencia de limpieza del embalse 2		
304			I-15 Indice de resoluciones de corta		
305			I-15 Informe Anual de COMCURE 2016		
306			I-15 Informe pago servicios ambientales del SCBBD		
307			I-15 Informe seguimiento PSA del SBBD -I semestre 17 final		
308			I-15 Presentación Offset julio 2017 GAC		
309			I-15 Presentación SBBD 2017 GAC		
310			I-15 Resumen de todos los arboles permisionados 07_07_2017		
311			I-15 Seguimiento a compromisos ambientales en el Offset julio 2017		
312			I-15 Unidades de Manejo Forestal y Ambiental para Limpieza del Embalse		
313			I-16 InformeExtraccionSedimentos2007		
314			I-17 Lirio Mantenimiento Embalses		

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315			I- 17 PAAS-8-8.2-1 Programa Lirio Embalse-Reventazón		
316			I-17 2015_Riocat_1 hidrologia		
317			I-17 Informe Cierre Quebrada Sibon - Dic 14		
318			I-17 Informe compensación fluvial Parismina ene 2016		
319			I-17 Informe de Resultados ICE-PHR 2016 v2		
320			I-17 PAAS-3-3.2-1 Plan de Manejo Adaptativo - PMAv6		
321			I-17 PAAS-8-8.2-1 Programa Lirio Reventazón v1		
322			I-17 Perfil embalse		
323			I-17 PLAN DE MANEJO ADAPTATIVO DE SEDIMENTOS Y CALIDAD DE AGUA (PMA)		
324			I-17 Informe Manejo de lirio acuatico.		
325			I-17 Programa_piloto__manejo_lirio_acuatico_embalses_Cachi_y_Angostura		
326			I-19 2015_Riocat_1 hidrologia		
327			I-19 Decretos 33903-MINAE-S-Reglamento para Evaluación y Clasificación de Cue...		
328			I-19_GEN 016 PAAS-10-10.2-1 Sistema de Alerta Temprana ante Emergencias ...		



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329			I-19_GEN 017 PAAS-11-11.2-1 Plan De Manejo Desastres Naturales - PH-Reve...		
330			I-19 Informe de Resultados ICE-PHR 2016 v2 Mayo a noviembre		
331			I-19 InformePMA_Trim_I-2017		
332			I_19 OBRA DE EMBALSE		
333			i-19 PAAS-8-8.2-1 Programa Lirio Embalse-Reventazón		
334			I-19 Programa de compensación fluvial Parismina		
335			I-2 permisos PH reventazon		
336			I-2 Análisis individual - Riesgo Climatológico - Versión 5		
337			I-2 Estudio de vulnerabilidad, adaptación y mitigación al Cambio Climático para proyectos hidroeléctricos		
338			I-2 18093. Ley N° 7508		
339			I-2 Adenda 1		
340			I-2 Adenda 2		
341			I-2 Caso de corrupción A		
342			I-2 Caso de corrupción B		
343			I-2 Caso de corrupción C		
344			I-2 Caso de corrupción D		
345			I-2 Contrato de interconexión		

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346			I-2 CONTRATO LLAVE EN MANO EPC		
347			I-2 Código de Etica		
348			I-2 Declaración de principios éticos del ICE CNFL y RACSA		
349			I-2 Dirección página WEB SETENA		
350			I-2 Estudio Aud Interna PHRCI N° 19-2016 Revisión Fondo de Trabajo N° 417		
351			I-2 Incorporación de la planta al Sistema Electrico Nacional		
352			I-2 Ley Generacion Electrica Autonoma o Paralela (Ley 7200)		
353			I-2 Ley-contra-la-corrupción		
354			I-2 Memoria Institucional ICE 2015		
355			I-2 Notas de Prensa P.H. Reventazón		
356			I-2 OP 710 Política Reasentamiento Involuntario BID		
357			I-2 Organigrama Negocio Electricidad		
358			I-2 Organigrama Planta reventazon		
359			I-2 OrganigramageneralGrupoICE		
360			I-2 Plan Gestión Ambiental PHR		
361			I-2 Politica ambienta IFC		
362			I-2 Política ambiental BID		

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363			I-2 Resol 1778-09-Setena Viabilidad Ambiental PH Reventazón		
364			I-2 Resumen de fechas de informes finales julio 2016 (Resp nota C072)		
365			I-2 Sistema Integrado de Gestión Seguimiento de proyectos		
366			I-2. Análisis individual - Riesgo Financiero 1 - Versión 6		
367			I-2_GEN_022_Gerencia Electricidad		
368			I-20 Caudales horarios estación Hamburgo		
369			I-20 Compilación de información Reventazón		
370			I-20 Caudales Operación Planta PHR		
371			I-20 Informe de avance datos hidrometeorológicos PMAS enero-noviembre 2015		
372			I-3 PMAS Quebradores y Plantas Concreto Final 01-05-13		
373			I_20 Informe_meteorológico_final_13_04_2015		
374			I- 3 archivo fotografico gestion forestal		
375			I-3 archivo fotografico escombrera 3		
376			I-3 informes regencia		
377			I-3 lagunas lancaster		
378			I-3 reporte monitores ambientales		
379			I-3 Supervision ambiental USAP		

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380			I- 3 Convenio CON-389-11 PE_Munic Siquirres 23_Agosto_2016_V3		
381			I-3 áreas de influencia COMUNIDADES DEL AID		
382			I-3 ACLAC SITADA PENDIENTES 3-7-17		
383			I-3 CON-10-15 ICE - FONAFIFO		
384			I-3 D-1 actualización Linea transmisión RES-2248-2014		
385			I-3 Declaración de Impacto Ambiental PH Reventazón		
386			I-3 GEN_002 PROCEDIMIENTO PARA LA REFORESTACIÓN Y REVEGETACIÓN DE SITIOS LIBERADOS POR OBRA DE CONSTRUCCIÓN		
387			I-3 Informe ambiental recursos PGA y medidas de manejo ambiental 2017 final		
388			I-3 informe de cierre Supervisión Ambiental y Social de la Fase de Construcción		
389			I-3 Informe seguimiento BEMP-I semestre 17 final		
390			I-3 PAAS-14-14-6-b prueba ejecución PGP-v1-15-12-2015		
391			I-3 Perfil profesional y experiencia de algunos miembros del equipo Ambiental del PH Reventazón		
392			I-3 Permisos Actualizados		
393			I-3 Permisos Sanitarios PHR		

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394			I-3 Plan de gestión ambiental y social etapa operativa v4 2017		
395			I-3 Plan_de_Gestión_Ambiental_Social_Etapa_operativa_v1 oct_2015		
396			I-3 PMAS Quebradores y Plantas Concreto Final 01-05-13		
397			I-3 Presentación Plan Manejo Cuenca 2017		
398			I-3 Resolución 1778-09-Setena Viabilidad Ambiental PH Reventazón		
399			I-3 Resolución 448-2010 aprobación de optimización del PHR		
400			I_3 Evaluación PGA PH Reventazón		
401			I_3 Setena Viabilidad Ambiental PH Reventazón		
402			I-3 PAAS-3-3.2-1 Plan de Manejo Adaptativo - PMAv6		
403			I-4 informes riesgos		
404			I-5 4201-071-2017 Anexo 1, Informe labores Ingeniería		
405			I-5 Consulta sobre requerimientos de diseño en el contrato EPC		
406			I-5 Manual de Operación PH Reventazón		
407			I-5 Manual operacion Reventazon - version 4 - octubre 2016 vf_firmado		
408			I-5 OBRA DE EMBALSE puesta en marcha		

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409			I-5 Solución General Margen Derecha Ingeniero Independiente_abril_2017		
410			I-2 Seguimiento de riesgos		
411			I-6 (Dictámenes Reventazón y Cachí Financieros)		
412			I-6 Aprobación BID		
413			I-6 Aprobación Préstamo BCIE 12 dic 2012		
414			I-6 Carta Propuesta Final de BID 6 octubre 2011		
415			I-6 Certificado de Recepción de la Planta		
416			I-6 Certificado de Recepción preliminar IE		
417			I-6 Esquema de figura de financiamiento		
418			I-6 Estudio Aud Interna PHRCI N° 19-2016 Revisión Fondo de Trabajo N° 417		
419			I-6 Imprevistos		
420			I-6 Indicadores financieros para bancos		
421			I-6 Nota de Aprobación IFC 12 Dic 2012		
422			I-8 Acta de reuniones con proveedores locales 23 de septiembre, 2009		
423			I-8 Contratación de Maquinaria Alquilada		
424			I-8 Cuadro de proveedores de la zona de Siquirres		

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
425			I-8 Información varia		
426			I-8 Lista de Proveedores asistentes a reunión 23 de septiembre 2009 1,2,3 JPG		
427			I-8 Listado de Licitaciones PHR		
428			I-8 Requisitos Adquisición BID Ley N8722_CCLIP_1908_2747		
429			I- 9 acuerdo firmado NO VULNERABLE San Joaquín- Francisco Ureña Ortega 19-07-12 Acuerdo con propietarios		
430			I-9 Acuerdo VULNERABLE MEDIO Ejecución medidas PRCV 11-07-13		
431			I-9 Caso_Karls Grunninger _IHA		
432			I-9 Plan de mitigación para los operadores de rafting MAYO 2017		
433			I-9-Finiquito de obra comunal 010		
434			I-9_Quejas comunales_ 003		
435			I-7 002 Convenio Instituto Costarricense de Electricidad-Municipalidad de Siquirres		
436			I-7 Concejo Municipal Siquirres - SC 435-17 - Acueducto La Florida		
437			Anexo 1. Comunicados de Prensa - PH Reventazón - Junio de 2015 a setiembre de 2016		
438			Anexo 2. Fotografías enviadas a medios de comunicación - PHR		
439			Anexo 4. Hecha por costarricenses para Costa Rica - La República		

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
440			Comunicación público nacional 2016		
441			PLAN DE SOCIALIZACIÓN manejo de desastres y alerta temprana		
442			Caudales BM		
443			Evidencia Hidrología I-16		
444			Informe de avance datos hidrometeorológicos PMAS diembre-diciembre 2016...		
445			Informe3PMDN-SATJul2017 I-20		
446			InformePMA_Trim_I-2017		
447			Niveles aguas abajo de CM PHR		
448			OS Calidad Agua Reventazón PMA-OFFSET I-16		
449			PAAS-3-3.1-1 Línea Base PMA		
450			PAAS-3-3.1-2 ProtocoloMonitoreoPMAv2		
451			PAAS-3-3.2-1 Plan de Manejo Adaptativo - PMAv6		
452			Plan SocializaciónPMD_Vero_V4 I-20		
453			Análisis ambiental dragado de fondo del embalse de Angostura Version 1		
454			ESTUDIO DE LA CONTAMINACIÓN Y ECO-TOXICOLOGIA		
455			Informe de avance datos hidrometeorológicos PMAS diembre-diciembre 2016...		



	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
456			INFORME INTEGRADO limnologia angostura y calidad de agua		
457			Niveles aguas abajo de CM PHR		
458			17 Caracterización climática e hidrológica de la cuenca media-baja del río Reventazón-Parismina ver		
459			cap 4 - hidrologia y meteorologia 18-8-09 ok		
460			Casa de Máquinas PHR		
461			Estación Hamburgo		
462			Matriz de Identif Emergencia (v2)		
463			NG-3014-2017-9-Nota recibido CNE		
464			NG-56-IT-90-006 Operación del Embalse Planta Hidroeléctrica Reventazón		
465			Niveles Codo Hamburgo		
466			PAAS-11-11.2-1 Plan De Manejo Desastres Naturales - PH-Reventazón-v4		
467			PLAN DE MANEJO DE MANEJO DE DESASTRES NATURALES Y SISTEMA DE AVISO HIDROLÓGICO (SAH)		
468			Plan Respuesta ante Emergencia (v2)		
469			Respuesta CNE a Nota solicitud de colaboración		
470			RV Toma de carga Planta Reventazón_ Evidencia para apartado I-20		

	Author / Organisation	Year	Title	Language	Description / Notes / Weblink
471			Ubicación Codo-Hamburgo		
472			Laguna viabilidad financiera		
473			13.4 Plan_de_Reasentamiento_y_Restitución_de_Condiciones_de_Vida_ICE_PHR_NOV_2014		
474			Recibo conforme de oba. Acueducto comunal de Lomas.		
475			Caso 279 Reporte deslizamiento S Antonio		
476			Caso 231- El Coco Miguel Nájera		
477			Caso 239 Elsi Otarola		

## Appendix D: Visual Evidence

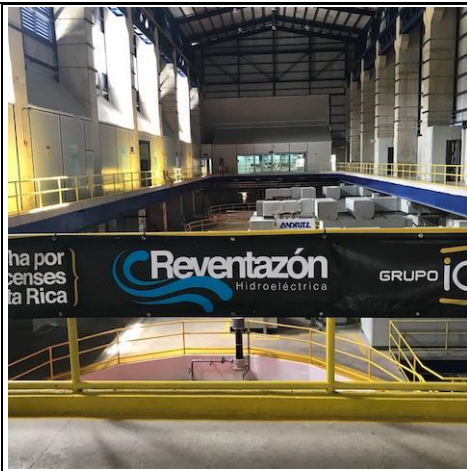


Photo 1: I-1 Banner in the power house

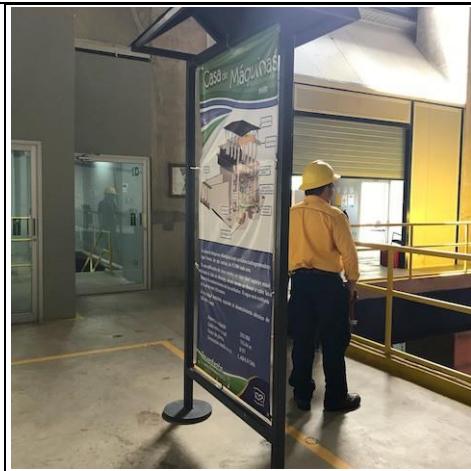


Photo 2: I-1 Explanatory notice board in the powerhouse



Photo 3: I-1 Financers' notice board on entrance to the camp



Photo 4: I-1 Welcome notice board on entrance to the camp



Photo 5: I-1 Communications / visitor centre under preparation at the power house site



Photo 6: I-1 Communications / visitor centre under preparation at the power house site

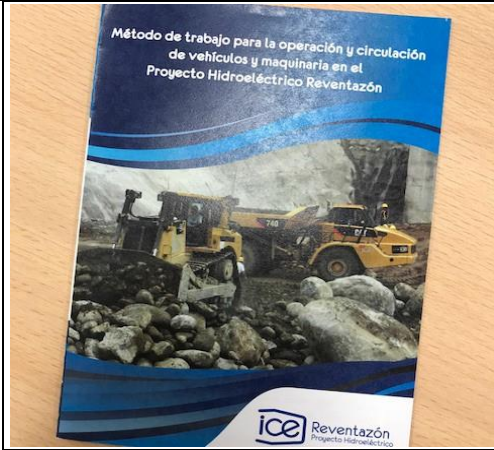


Photo 7: I-1, I-12 Method of working for the operation and circulation of vehicles and machinery (for operators of machinery and vehicles)



Photo 8: I-1 DVD on Reventazón



Photo 9: I-1 I-9, I-10 DVD on the process of property acquisition

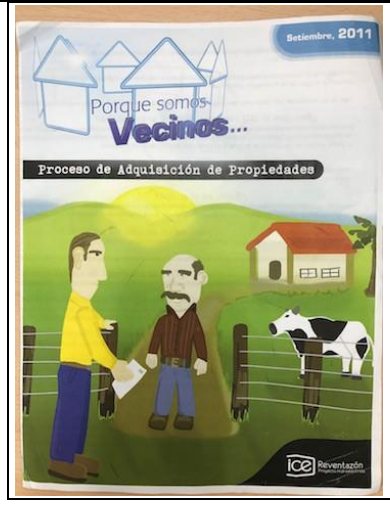


Photo 10: I-1, I-9, I-10 Folded A3 leaflet on process of property acquisition, with series of questions

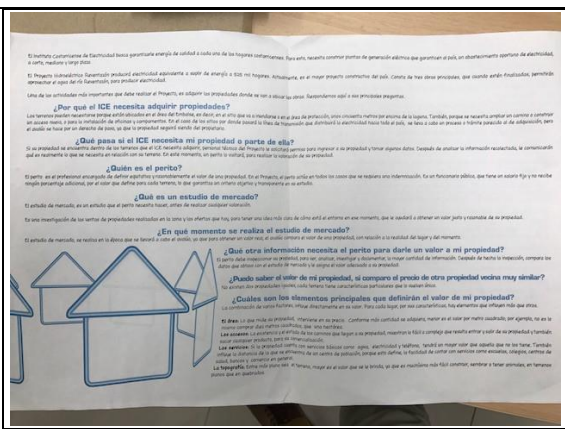


Photo 11: I-1, I-9, I-10 Folded A3 leaflet on process of property acquisition (inside)

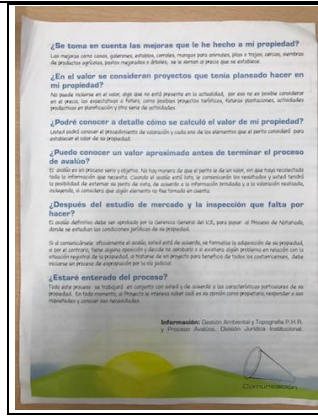


Photo 12: I-1, I-9, I-10 Folded A3 leaflet on process of property acquisition (back cover)





Photo 13: I-1 Socio-environmental management – Environmental communication and community participation (glossy folded A3)

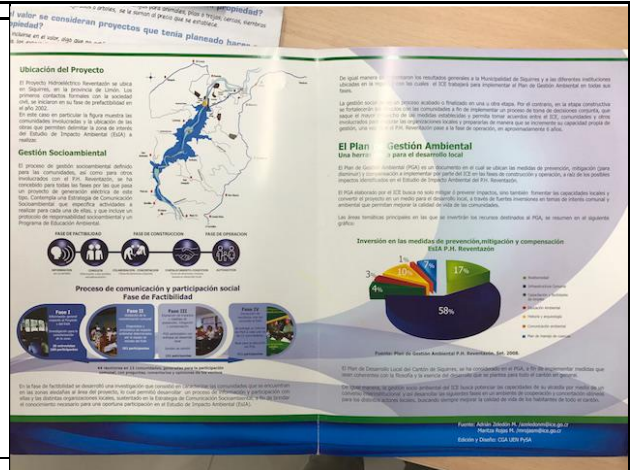


Photo 14: I-1 Socio-environmental management (inside)



Photo 15: I-1 Value for the national and local economy (A4 glossy)

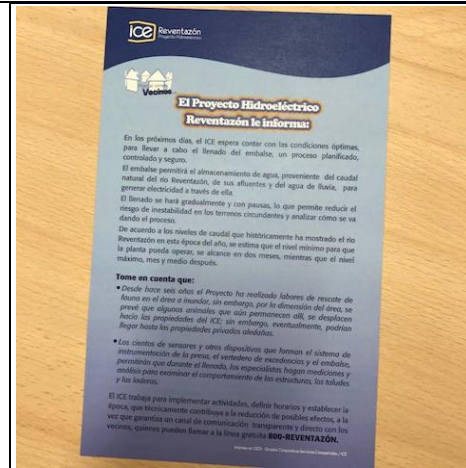


Photo 16: I-1 Basic leaflet on the project

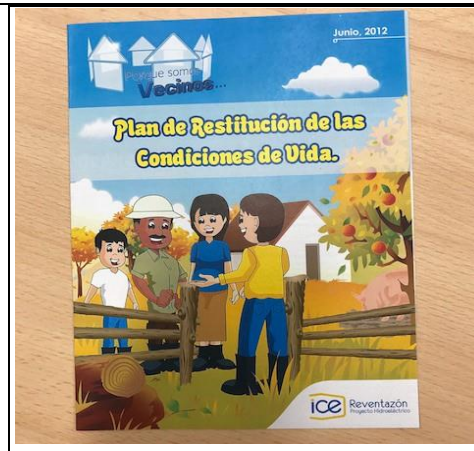


Photo 17: I-1, I-9, I-19 Warning for surrounding communities on reservoir filling; small coloured one-sided leaflet

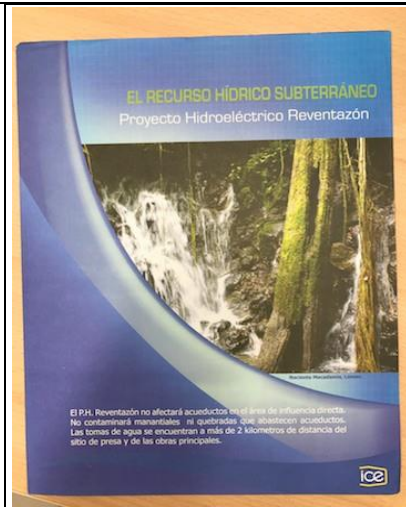


Photo 18: I-1, I-9, I-10 Plan for the Restoration of Living Conditions (small leaflet, very small writing, with 3 categories of vulnerability and entitlements)

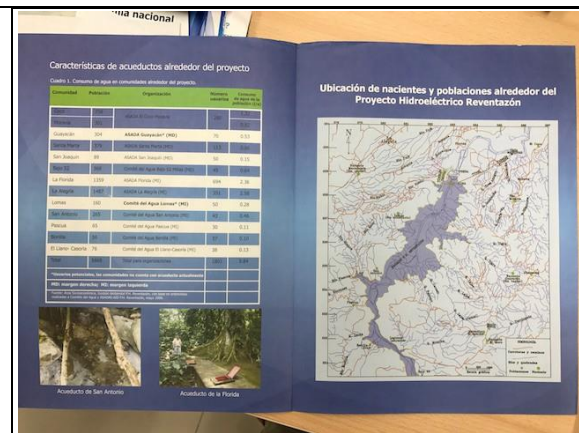


Photo 19: I-1 Coloured brochure on the project

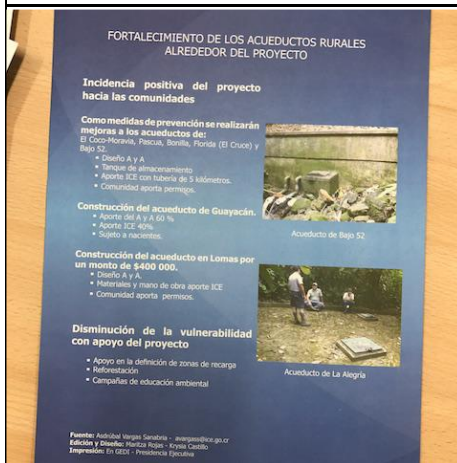


Photo 20: I-1 (Inside) coloured brochure on the project



Photo 21: I-1 I-7 Strengthening of rural water supplies around the project

Photo 22: I-1 'Dardo' newsletters/bulletins, coloured A4





Photo 23: I-1 'Dardo' newsletters/bulletins, coloured A4

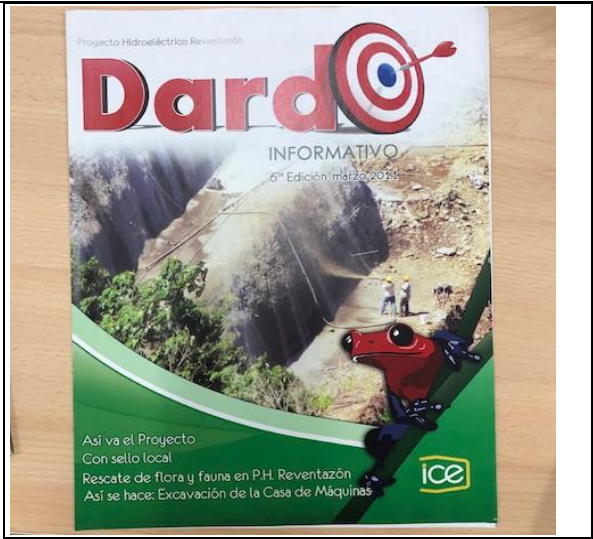


Photo 24: I-1 'Dardo' newsletters/bulletins, coloured A4

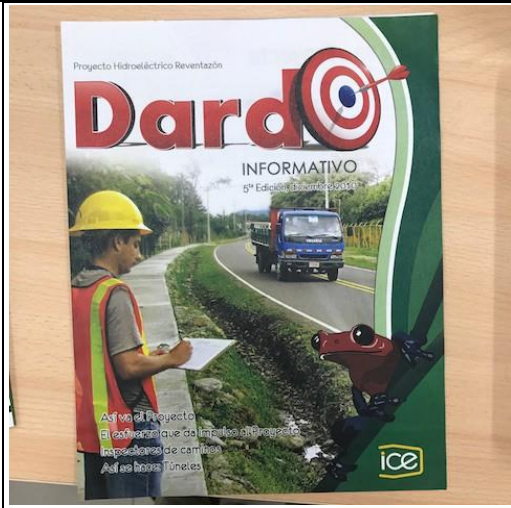


Photo 25: I-1 'Dardo' newsletters/bulletins, coloured A4



Photo 26: I-1 Small leaflet on the project (A4 folded coloured leaflet, describing location, project description, socio-environmental management)

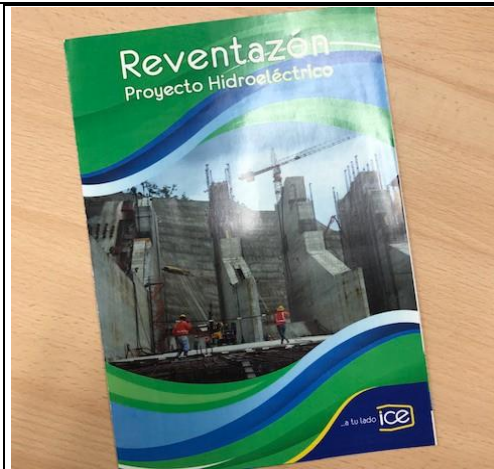


Photo 27: I-1, I-12 Por una ruta segura para todos! – small coloured leaflet for drivers

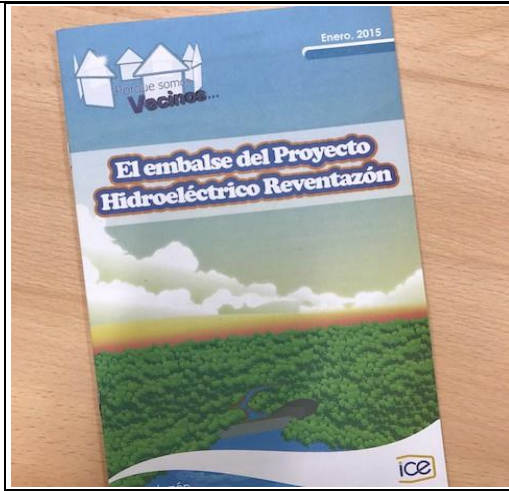


Photo 29: I-1 General leaflet for neighbours

Photo 28: I-1 Small leaflet on the project (A4 folded coloured leaflet)

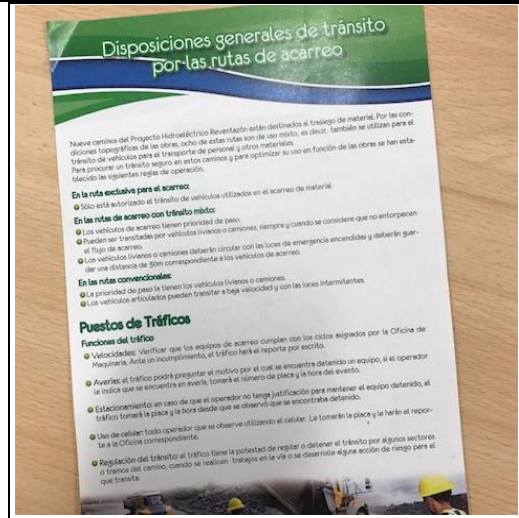


Photo 30: I-1, I-12 General road traffic regulations (small coloured leaflet)

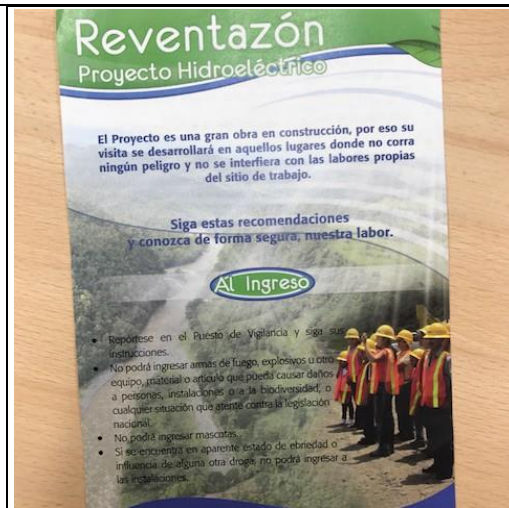


Photo 31: I-1 Leaflet for visitors/entrants to the site

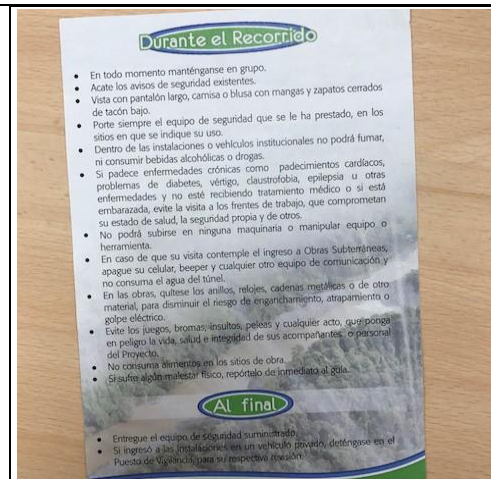


Photo 32: I-1 Leaflet for visitors/entrants to the site (reverse)



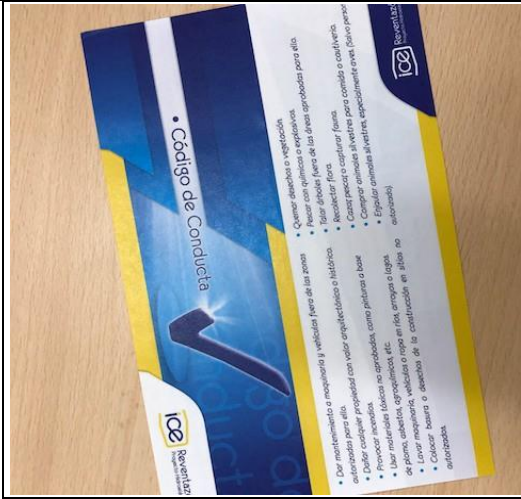


Photo 33: I-1, I-12 Code of conduct small folded leaflet, coloured

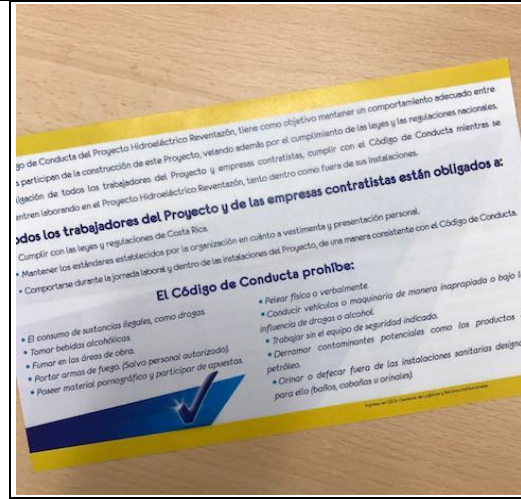


Photo 34: I-1, I-12 Code of conduct small folded leaflet, coloured (reverse side)

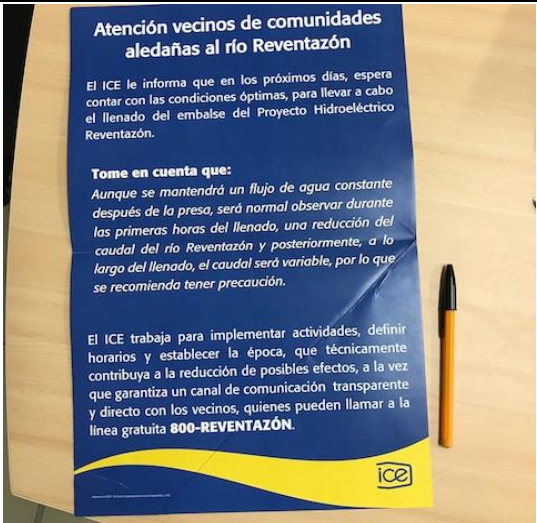


Photo 35: I-1, I-9, I-19 Another A3 coloured posted on reservoir filling

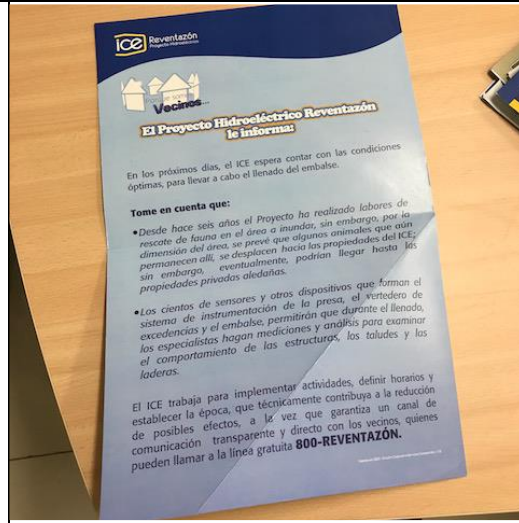


Photo 36: I-1, I-9, I-19 A3 coloured posted on reservoir filling



Photo 37: I-3, I-18 Waste separation stations



Photo 39: I-3 Promotion of energy efficiency



Photo 41: I-3 Site stormwater management



Photo 43: I-3, I-12, I-18 Water and liquid waste management in kitchen area

Photo 38: I-3 Fuel storage showing safety and drainage measures



Photo 40: I-3 Hazardous materials storage at camp



Photo 42: I-3, I-4 A rehabilitated old spoil dump



Photo 44: I-3, I-4 Spare construction materials storage area





Photo 45: I-3, I-12 Drainage in camp kitchen building



Photo 46: I-3, I-18 Stockpiled waste



Photo 47: I-3, I-18 Wastewater treatment plant



Photo 48: Inside of remotely operated ecological flow power house (I-4).



Photo 49: Dismantled parts of the model of the gated spillway at ICE offices in San Jose (I-5)



Photo 50: ICE physical model workshop with pieces of the dismantled model used for the Reventazón project (I-5).

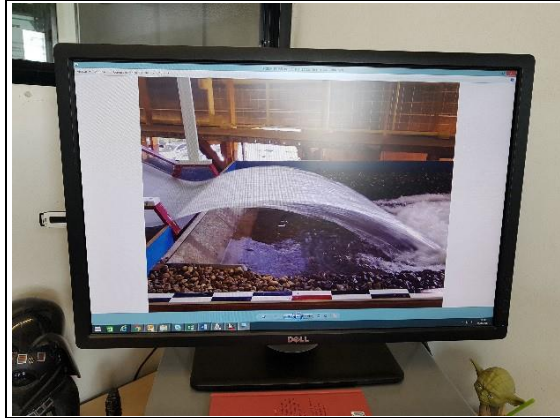


Photo 51: Video recording of the physical model being used (I-5)



Photo 52: Gated entrance to the construction camp (I-5)



Photo 53: Video surveillance at security gates at the construction camp (I-5)



Photo 54: Water pipeline for fire at the construction camp. (I-5)



Photo 55: Protective fencing in need of repair at the surge chamber (I-5)





Photo 56: Muster point at construction camp (I-5)



Photo 57: Incident Management Poster at construction camp (I-5)



Photo 58: Gated location of the explosives magazine during the construction phase (I-5)



Photo 59: Slope stabilizing on right bank above spillway (I-5)



Photo 60: View of spillway with leak in left-most bay (I-5)



Photo 61: View of upstream concrete face of dam (I-5)





Photo 62: Monitoring of instrumentation installed at the dam using “Dam Data” (I-5)



Photo 63: View of leak between concrete blocks in left-most bay of spillway (I-5)



Photo 64: Downstream face of dam with instrumentation hoses and weeds treated with pesticides (I-5)



Photo 65: Signage downstream of dam adjacent to ecological flow power station and river (I-5)



Photo 66: Downstream from spillway, right bank erosion (I-5)



Photo 67: Energy dissipators downstream of spillway and low level outlet. Seepage flow from dam galleries is discharged towards the right hand of photo (I-5)



Photo 68: Dam gallery and seepage flows near right side of the dam adjacent to spillway (I-5)



Photo 69: Outlets of diversion tunnels on left bank (I-5)



Photo 70: I-5, I-12 Security booth at the dam



Photo 71: I-7 Bridge built over Rio Peje, between Florida and El Cruce



Photo 72: I-7 All-weather sports pitch at Florida





Photo 73: I-7 Sports and community hall at Florida



Photo 74: I-7 Police station at La Alegría



Photo 75: I-7 Multipurpose hall at la Alegría



Photo 76: I-7 Part of the re-surfaced road, Ruta 415, from El Cruce to Bonilla on the left bank



Photo 77: I-7 School classroom built at Pascua (the blue building)



Photo 78: I-7 Community hall at Bonilla





Photo 79: I-7 Water storage and supply for El Cocco and Moravia



Photo 80: I-7 EBAIS building at Santa Marta



Photo 81: I-7 Part of the re-surfaced road to San Joaquin



Photo 82: I-7 End of the resurfaced road to San Joaquin





Photo 83: I-7 Small section of road to San Joaquin collapsing, under repair



Photo 84: I-8 Food supply



Photo 88: I-8 Machinery

Photo 89: I-8 Power station major equipment



Photo 90: I-9 General view of a street in Siquirres town

Photo 91: I-9 Sidewalk built in Florida to minimize public exposure to project traffic, with railing to minimize falling hazard



Photo 92: I-9 Sidewalk built in Florida to minimize public exposure to project traffic



Photo 93: I-9, I-8 General view of La Alegría, with resurfaced Ruta 415



Photo 94: I-9 General view of agricultural landscape on the left bank

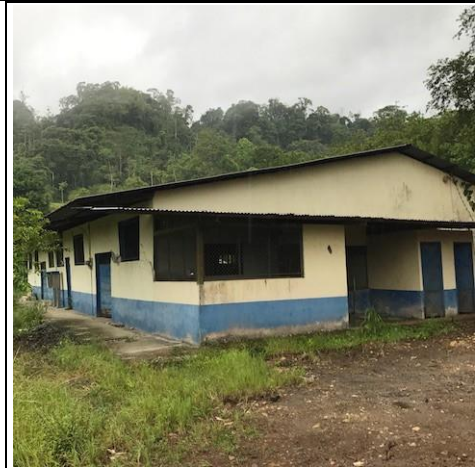


Photo 95: I-9 Old community hall in Bonilla



Photo 96: I-9 Area near reservoir, now in buffer zone, that was a playing field



Photo 97: I-9 Disused changing rooms adjacent to the former playing field in Bonilla





Photo 98: I-9 Farmer's land with drainage problem following terracing in El Coco



Photo 99: I-9 Farmer's land with collapsing terraces in El Coco



Photo 100: I-9 Farmer's land with collapsing terraces in El Coco



Photo 101: I-9 Gas pipeline section near Santa Marta; the line runs from Limón to San Jose and passes close to PHR



Photo 102: I-10 Replacement housing at Calle Nubes



Photo 103: I-10 Replacement land with dairy (in background) at Calle Nubes





Photo 104: I-10 Road surfacing on road to Calle Nubes



Photo 105: I-10 Basic self-built dwelling of elderly man displaced from the river valley



Photo 106: I-10 Land plot of the elderly man displaced from the river valley



Photo 107: I-12 Camp kitchen - PPE plus coffee making facilities for crowds



Photo 108: I-12 Camp kitchen with back up generator out front

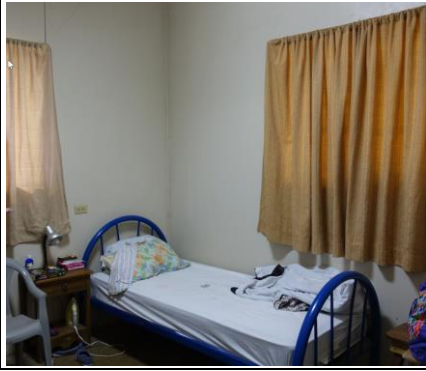


Photo 109: I-12 Example accommodation room for professionals



Photo 110: I-12 Ministry of Health certificate at accommodation



Photo 111: I-12 New safety signage at ecological power house



Photo 112: I-12 Staff recreation building



Photo 113: I-12 Safety signage - risk of electric shock

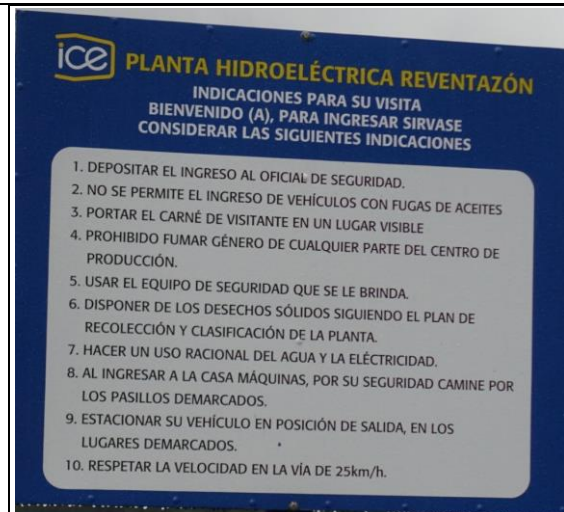


Photo 114: I-12 Safety signage at power station entrance





Photo 115: I-12 Safety signage at wastewater treatment plant



Photo 116: I-12 Safety signage in accommodation



Photo 117: I-12 Site offices with emergency gathering point



Photo 118: I-12 Smoking area near accommodation



Photo 119: I-12 Workers accommodation

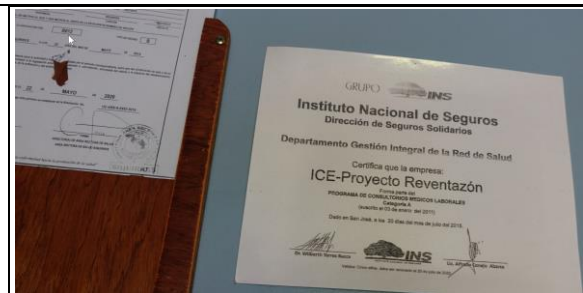


Photo 120: I-12, I-14 Forms and certifications for health facilities





Photo 121: I-12, I-14 Health centre on site



Photo 122: I-12, I-14 Health centre for staff - 3 beds



Photo 123: I-12, I-14 On-site ambulance



Photo 124: "La Isla" archaeological reserve (I-13)



Photo 125: Archaeological exhibit station located at the construction camp (I-13)



Photo 126: Archaeological excavation preserved at the construction camp visitor station (I-13)



Photo 127: Information on archaeological artefacts found during the Reventazon project archaeological studies (I-13)





Photo 128: I-13 Protection for a site of several petroglyphs nearby the construction site camp



Photo 129: I-13 One of the petroglyphs by the construction site camp



Photo 130: I-13 Remains of the historical railway in Siquirres



Photo 131: I-13 Remains of the historical railway in Siquirres



Photo 132: Visitor Centre adjacent to power house where the archaeological exhibit will be located (I-13)



Photo 133: Historical railway crossing the town of Siquirres (I-13)





Photo 134: Health clinic and ambulance at the Reventazón construction camp (I-14)



Photo 135: Facilities at the Reventazón health clinic (I-14)



Photo 136: Ministry of health certificates at Reventazón health clinic (I-14)



Photo 137: ICE Project OHS Policy and preventative information regarding zika virus at Reventazón health clinic (I-14)



Photo 138: EBAIS, El Coco (I-14)



Photo 139: Ministry of health office in Siquirres (I-14)



Photo 140: Public health care centre, Siquirres (I-14)



Photo 141: Entrance to new hospital in Siquirres (I-14).



Photo 142: I-15, I-12 Wildlife warning signs on internal roads



Photo 143: I-15 Vulture above powerhouse



Photo 144: I-15 Sign to forbid the extraction of plants and animals in ICE's land



Photo 145: I-15 Area of fauna relocation during the filling





Photo 146: I-15 Evidence of bobo presence downstream of the dam



Photo 147: I-15 Wetland area chosen for fauna relocation near the site in ICE's land



Photo 148: I-15 Measures to prevent birds collision



Photo 149: I-15 Measures to prevent birds collision on transmission lines



Photo 150: I-15 Disused nursery on site



Photo 151: I-15 Area of protected tree species kept intact during construction





Photo 152: I-15 Toucan near Quebrada Tres Amigos



Photo 153: I-15 White-headed capuchin near the dam site



Photo 154: I-16 View of the bottom outlet



Photo 155: I-16 Boulders and cemented alluvial materials downstream



Photo 156: I-16 Banks erosion downstream before the tailrace





Photo 157: I-5 I-19 I-17 Piezometer in a fauna relocation area in ICE's land



Photo 158: I-16 I-17 Quebrada Tres Amigos



Photo 159: I-16 I-17 View of the road along Quebrada Tres Amigos



Photo 160: I-16 I-17 Quebrada Sibon



Photo 161: I-16 I-17 Quebrada Sibon



Photo 162: I-17 Wastewater treatment plant on site





Photo 163: Waste sorting at office area at the construction camp (I-18)



Photo 164: Area used for sorting of kitchen waste during construction phase (I-18)



Photo 165: Waste classification, kitchen area (I-18)



Photo 166: Intermediate storage area for scrap metals awaiting final transportation and disposal (I-18)



Photo 167: Waste rock spoil area, revegetated (I-18)



Photo 168: Storage of equipment waiting to be allocated to other projects (I-18)



Photo 169: Main waste sorting and storage area (I-18)



Photo 170: Waste certificates issued by certified waste management and transportation providers (I-18)



Photo 171: Old transformers from the temporary distribution lines that were used throughout the construction areas (I-18)



Photo 172: View of waste rock soil areas revegetated (I-18)



Photo 173: Waste sorting at the Reventazón power house (I-18)





Photo 174: I-19 View of the reservoir shore from the dam and safety buoys



Photo 175: I-19 Water hyacinth at the tail of the Reventazón reservoir



Photo 176: I-19 Uncut vegetation at the tail of the reservoir



Photo 177: I-19 Entrance to the Mirador PH Reventazón Resort overlooking the dam



Photo 178: I-19 Vegetation remaining at the reservoir shore near San Joaquin



Photo 179: I-19 Vegetation remaining at the reservoir shore near San Joaquin





Photo 180: I-19 Safety signage near the reservoir shore in Bonilla



Photo 181: I-20 View of the spillway from downstream, with bottom outlet to the right



Photo 182: I-20 Ecological powerhouse



Photo 183: I-20 Ecological powerhouse (view from above)



Photo 184: I-20 View downstream from immediately above the powerhouse









Photo 191: I-20, I-16 Monitoring site at Hamburgo for flow and sediment monitoring



Photo 192: I-20 Warning sign at the entrance to the track to the monitoring site



Photo 193: I-20 Ferry port at Cano Blanco, Parismina, almost at the mouth of the Reventazón river



Photo 194: I-20 Boat at Cano Blanco, Parismina, almost at the mouth of the Reventazón river



Photo 195: I-20 View of Reventazón River at Cano Blanco / Parismina



Photo 196: I-20 View of Reventazón River at Cano Blanco / Parismina



