Hydropower Sustainability Assessment Protocol

Official Assessment

E.ON

Semla IV

Sweden

Project Stage: Preparation

Assessment Dates: 10/11/2014 to 14/11/2014

Final

Report Date: 27/01/2015

Client: Dr. Klaus Engels, Head of Innovation Center Hydro, Global Unit Generation, E.ON Kraftwerke GmbH, Luitpoldstraße 27, D-84034 Landshut, Germany.

Lead Assessor: Douglas Smith, Senior Sustainability Specialist, International Hydropower Association

Co-assessors: Dr Jörg Hartmann, Independent Consultant

Project size: 3.5 MW

Cover page photo: Penstocks of the existing Semla plant, which are leaking badly and will be replaced by one new penstock with the construction of Semla IV.

Acronyms

Acronym	Full Text
BKK	Byggandets Konkraktskommitté
CSO	Chief Sustainability Officer
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EU	European Union
GHG	Greenhouse Gases
GM	EON SE Group Management
HR	Human Resources
HSE	Health, Safety and Environment
IRR	Internal Rate of Return
KPI	Key Performance Indicator
LTIF	Lost-time Incident Frequency
m.a.s.l	Metres above sea level
NPV	Net Present Value
OHS	Occupational Health and Safety
RIDAS	Kraftföretagens Riktlinjer för Dammsäkerhet" in Swedish, i.e. Power Industry Dam Safety Guidelines
SEK	Swedish Krone
SGC	Sustainability Governance Council
SMHI	Swedish Meteorological and Hydrological Institute
TRIF	Total Reported Incident Frequency
TWh	Tera-watt Hours
WFD	Water Framework Directive

Table of Contents

Executive Summary

This report presents the findings of an assessment of the Semla IV project using the Preparation Stage tool of the Hydropower Sustainability Assessment Protocol. The Semla IV project is a 3.5 MW project nearing the end of preparation, located on the Kolbäcksån River in the northwest of Fagersta Municipality in southern Sweden. Semla IV consists of a combination of the replacement and rehabilitation of existing facilities, which were initially built in the early 20th century.

This assessment was carried out over the period October to December 2014, with an on-site assessment encompassing a visit to the project site and interviews with stakeholders conducted in the week beginning 10 November 2014. This assessment meets the requirements of an official assessment, as set out in the Terms and Conditions for the Use of the Protocol.

Kolbäckens Kraft KB – hereafter referred to as Kolbäckens Kraft - is the owner of HPP Semla, in turn owned by E.ON Vattenkraft Sverige AB, which is part of the E.ON Group. The project will be part of a cascade of projects on this river, several of which are owned by E.ON. E.ON has a very close working relationship with local affected people and stakeholders.

Semla IV is a relatively small project, with limited environmental and social impacts. In many respects, maintaining the character of the river and its amenity value in this location requires the rehabilitation of the existing facilities. The performance of the project in relation to the Hydropower Sustainability Assessment Protocol reflects both E.ON's well-established corporate policies and processes, and the small size of the project. Corporate policies and processes ensure that the project meets or exceeds basic good practice in all but one topics, and in some meets proven best practice.

Semla IV meets or exceeds the Protocol's criteria of basic good practice on all Protocol topics except P-10 Project Benefits. The preparation of the project has not included an assessment of additional project benefits. P-10 attains a score of 2.

Semla IV meets basic good practice (a score of 3) on nine topics: P-3 Demonstrated Need, P-4 Siting and Design, P-5 Environmental and Social Impact Assessment and Management, P-6 Integrated Project Management, P-8 Infrastructure Safety, P-11 Economic Viability, P-17 Cultural Heritage, P-19 Biodiversity and Invasive Species, and P-23 Downstream Flow Regime.

On seven topics, Semla IV achieves a score of 4, due to one significant gap against proven best practice. These are: P-1 Communications and Consultation, P-2 Governance, P-7 Hydrological Resource, P-13 Project-affected Communities and Livelihoods, P-16 Labour and Working Conditions, P-18 Public Health, and P-20 Erosion and Sedimentation.

Significant gaps mainly concern criteria of Assessment and Outcomes: respectively, an absence of any assessment of 'broader considerations, risks or opportunities' on these topics, and no plans or prospects that the project will address issues beyond its own impacts. This may reflect the small size of the project. Other significant gaps relate to Management and Stakeholder Engagement criteria. There are no significant gaps concerning Stakeholder Support or Conformance/Compliance.

Semla IV meets proven best practice (a score of 5) on four topics: P-9 Financial Viability, P-12 Procurement, P-21 Water Quality, and P-22 Reservoir Planning.

Two topics, P-14 Resettlement and P-15 Indigenous Peoples, are Not Relevant to Semla IV. The scores for all topics are summarised in the following Sustainability Profile and Table of Significant Gaps.

Sustainability Profile

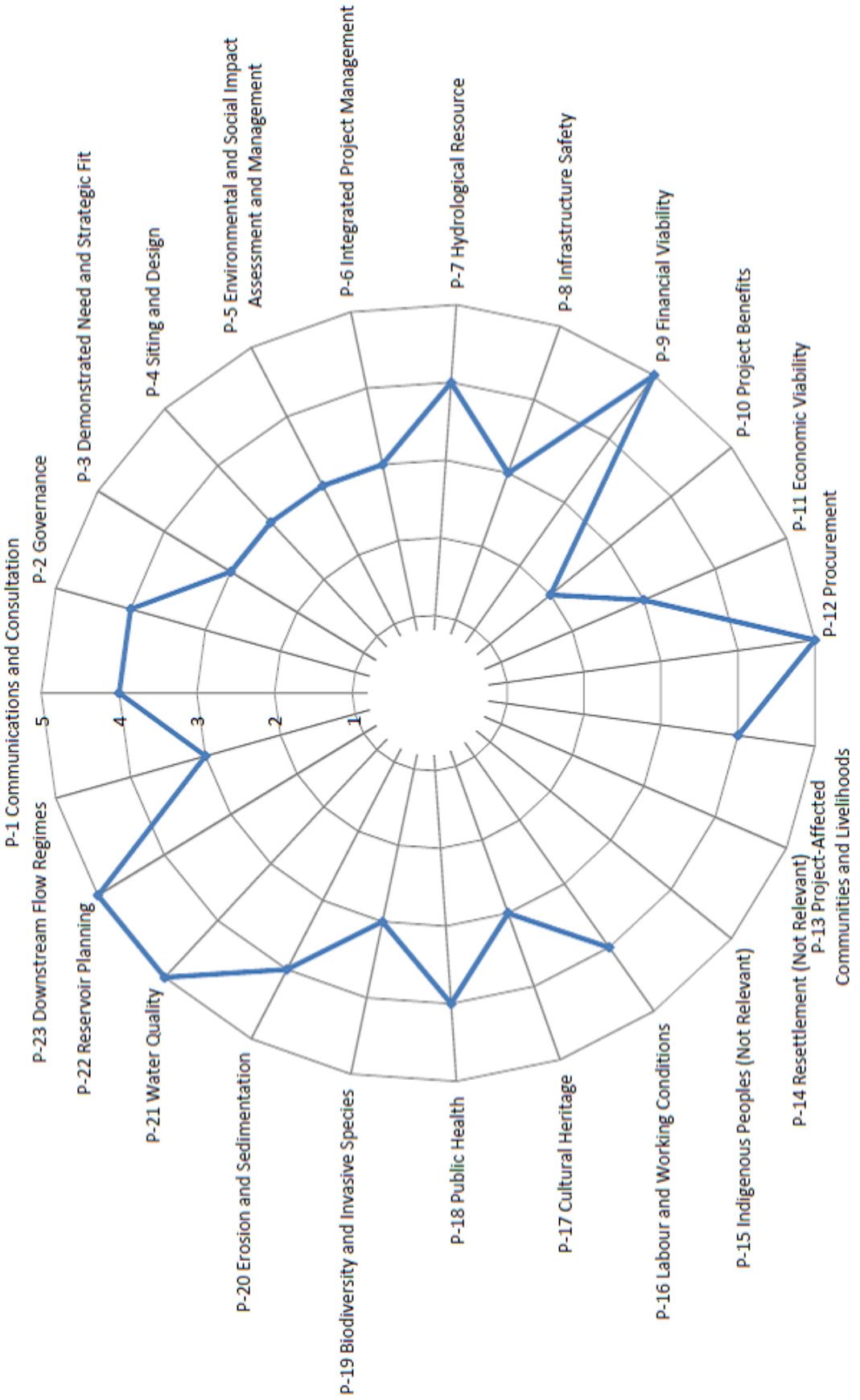


Table of Significant Gaps

Level 3: Significant Gaps against Basic Good Practice	Level 5: Significant Gaps against Proven Best Practice
Assessment	
P-10 The preparation of the project did not include an assessment of the potential to contribute to local development.	**P-3** There is no assessment of sustainable development of the river basin or integrated water resource management, or an assessment of alternative options for delivering increased hydropower production. **P-4** The absence of an assessment of siting and design options that analyses environmental and social considerations, not only technical and financial. **P-5** There is no assessment of potential opportunities relating to a range of environmental and social issues including opportunities to remedy existing impacts. **P-7** Assessment of issues that may affect water availability or reliability is not comprehensive as it does not consider the entire catchment or cascade or the long term including climate change. **P-8** No assessment of a broad range of scenarios, risks and opportunities, especially risks associated with public access. **P-11** The absence of an assessment of economic viability that incorporates all costs and benefits and is based on valuation in quantitative terms is a significant gap against proven best practice. **P-13** The indirect local socio-economic risks and opportunities have not been reviewed, and therefore there are also no plans to address them. **P-16** It is not clear how E.ON's broad human resources policies are applied in practice on a project level, including to contractors. **P-18** The assessment does not take broad public health considerations and risks into account. **P-19** There is no broader assessment of biodiversity and identification of longer-term risks and opportunities, for example from climate change, invasive species, and river restoration. **P-23** No field studies appear to have been undertaken to assess the impacts of the changes in flows in the bypass stretch, or to determine the permanent flow of 50 l/s for the trout brook. Visual considerations have not been assessed.
Management	
No significant gaps	**P-2** Contractors' limited application of consistent policies as E.ON's. **P-6** No identification of measures to manage interface and delay issues. **P-6** No construction management plans concerning environmental management and post-construction rehabilitation. **P-17** Neither E.ON or other agencies with heritage responsibilities are leading discussions on the future presentation of the heritage assets in the area. **P-19** It is uncertain at this stage how the management objective of 'good ecological status' is to be met by 2021and unclear whether Semla IV, as currently designed, would make future changes more costly.

Level 3: Significant Gaps against Basic Good Practice	Level 5: Significant Gaps against Proven Best Practice
Stakeholder Engagement	
No significant gaps	**P-1** E.ON could easily make information more accessible online and open up consultation meetings to the general public, to make its stakeholder engagement approach more inclusive. **P-4** Siting and design optimisation has not involved engagement with directly-affected stakeholders. **P-11** There is no public disclosure of any economic viability analysis.
Stakeholder Support	
No significant gaps	No significant gaps
Conformance/ Compliance	
No significant gaps	No significant gaps
Outcomes	
No significant gaps	**P-3** The project is not a priority option for addressing locally-established needs for increasing renewable energy production. **P-5** Impacts are largely avoided, minimised and mitigated, but not all remaining temporary negative impacts will be compensated. **P-6** The project is not highly likely to meet budget and timing requirements. **P-8** No plans to contribute to addressing some safety issues beyond those risks caused by the project itself, especially public safety risks around the canal and reservoir. **P-17** While the cultural resources in the area are not unique and will be well documented, some of them will be removed without compensation, because an alternative solution would be too costly. **P-20** There are no plans to contribute to addressing external issues, such as the remediation of contaminated sediments. **P-23** There are no indications for an optimization process in the determination of the flows, that would have looked at the costs and benefits of alternative flow arrangements.

Introduction

This report presents the findings of an assessment of the Semla IV Project using the Hydropower Sustainability Assessment Protocol. Semla IV is a 3.5 MW project under preparation in southern Sweden.

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, and 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:

5 Meets basic good practice and proven best practice;

4 Meets basic good practice with one significant gap against proven best practice;

3 Meets basic good practice with more than one significant gap against proven best practice;

2 One significant gap against basic good practice;

1 More than one significant gap against basic good 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.[1]

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

E.ON has defined four objectives for this assessment:

1. To build up capacity within E.ON to apply the Protocol in different environments and life cycle stages;
2. Calibration/benchmarking: to identify gaps in E.ON's approach to new build projects (using Semla IV as an example) to reach proven best practice for new build plants;

[1] Full details of the Protocol and its governance, are available on www.hydrosustainability.org.

3. To use the protocol assessment report to demonstrate E.ON's sustainability performance to external stakeholders; and
4. To support the case to promote hydropower in line with E.ON's 'Cleaner and Better' strategy.

Project Description

Semla III is an existing plant in Sweden with a capacity of 2.8 MW and production of 10.1 GWh/annum. E.ON plans to rebuild and modernise the plant as Semla IV to increase capacity to 3.5 MW and production to 14.8 GWh/annum. The modernised project will use the same flow and head, achieving increased generation from only the modernisation of the turbines and penstocks. E.ON decided to proceed with the modernisation on 18 December 2014.

The plant is located on the Kolbäcksån River, in the northwest of Fagersta Municipality (population 12 800), Västmanland County, in southern Sweden, approximately 170 km northwest of Stockholm. The Semla project is upstream of and on the outskirts of the town of Fagersta (see Figure 1). The Kolbäcksån River has its source in the Dalarna region of Sweden, and flows through the Bergslagen region, reaching Lake Mälaren to the west of Stockholm after approximately 200 km. The river is highly regulated, as there are a number of power plants in operation belonging to E.ON Vattenkraft Sverige and others both upstream and downstream of Semla (see Figure 2).

Kolbäckens Kraft KB – hereinafter referred to as Kolbäckens Kraft - is the owner of HPP Semla, in turn owned by E.ON Vattenkraft Sverige AB, which is part of the E.ON Group. E.ON is an experienced operator of a European hydropower portfolio totalling more than 5,400 MW in capacity. E.ON Vattenkraft Sverige AB has a total of 1,781 MW in capacity.

Semla III is the existing plant. It replaced two previous plants – Semla I and Semla II – and was commissioned in 1910 with two Francis turbines, and extended with one Kaplan turbine in 1988. Semla I was built in 1887 and Semla II was built in 1902. The nearby Strömsholm canal has operated since the 1700's. Figure 3 shows the layout of the Semla plants.

The existing Semla dam creates a small headpond, which is connected immediately upstream to the Vevungen lake which is maintained by a natural barrier, which was slightly raised in the 18th century to facilitate boat traffic into the canal. The lake is connected to the much larger southern and northern Barken lakes, with a total surface area of 34 km^2. The Semla dam has only a very limited role in flood control, especially not over significant floods.

Semla IV would consist of: a new power station structure on the left bank, equipped with one Kaplan turbine, downstream of an existing road bridge; a new penstock, replacing the current three penstocks, and laid underground for 120 m before reaching the underground turbines; demolition of the Semla III extension housing its third turbine, and decommissioning of the other two turbines; an outlet channel of approximately 50 m to direct water back to the Kolbäcksån; reconstruction of the existing regulating dam in order to maintain the safety of the dam; a new intake; a road to the new power plant and repair of an existing road to the regulating dam. The Semla III building will be preserved, whilst the Semla II building will be demolished. There will be no change to the seasonally-adjusted maximum water levels permitted in 1904. Figure 4 shows some images of the existing facilities and Table 1 provides further details on Semla IV.

The total cost of construction is estimated to be SEK 81.5 million (USD 11 million). Construction is expected to take 1.5 years, with an additional 6 months for dam reconstruction. Works will include the establishment of work surfaces, temporary roads and ramps, and the majority of works will be located within the area belonging to Kolbäckens Kraft. The existing intake will be reinforced so that it can act as a cofferdam during construction of the new dam, and protective piling will be used around the area of the new station. Work is planned so the existing plant can continue to operate for as long as possible, but generation will not be possible for a period of about 4 months. Construction will require the temporary closure of the Ulvsbovägen road that crosses the river between the existing and new power stations.

Table 1. Salient Features of Semla IV

Items	Description
Location	Kolbäcksån River, Fagersta Municipality, Västmanland County
Type of development	Storage (very limited)
Catchment area at intake	2,200 km^2
100-year flood (Q_{100})	175 m^3/s
1000-year flood (Q_{1000})	-
Mean flow	22 m^3/s
Type of dam	Concrete dam
Full supply level (FSL)	100.1 m.a.s.l.
Crest elevation of dam	102.1 m.a.s.l.
Penstock	Fibre glass, 3.6 m diameter, 260 m length
Powerhouse	Building of approximately 110 m^2
Turbine	Kaplan
Gross head	10.5 m
Design discharge	35 m^3/s
Installed capacity	3.5 MW
Annual estimated energy production	14.8 GWh
Transmission line	Small overhead line will be replaced by an underground line for 1-2 km
Access roads	Existing road, but a short extension will be built to the new power house.

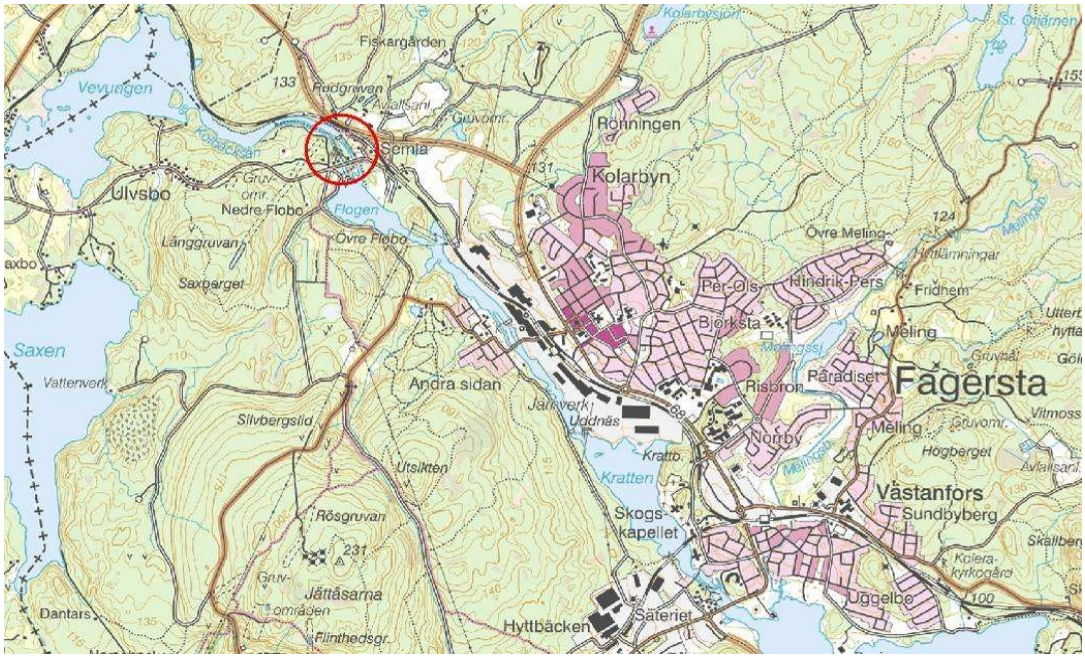


Figure 1. Location of Semla in relation to the town of Fagertsa. Map courtesy of ÅF Infrastructure.

Figure 2. Location of Semla (in the centre-right) in relation to E.ON's cascade of plants in Bergslagen, to the west of Stockholm. Map courtesy of E.ON.

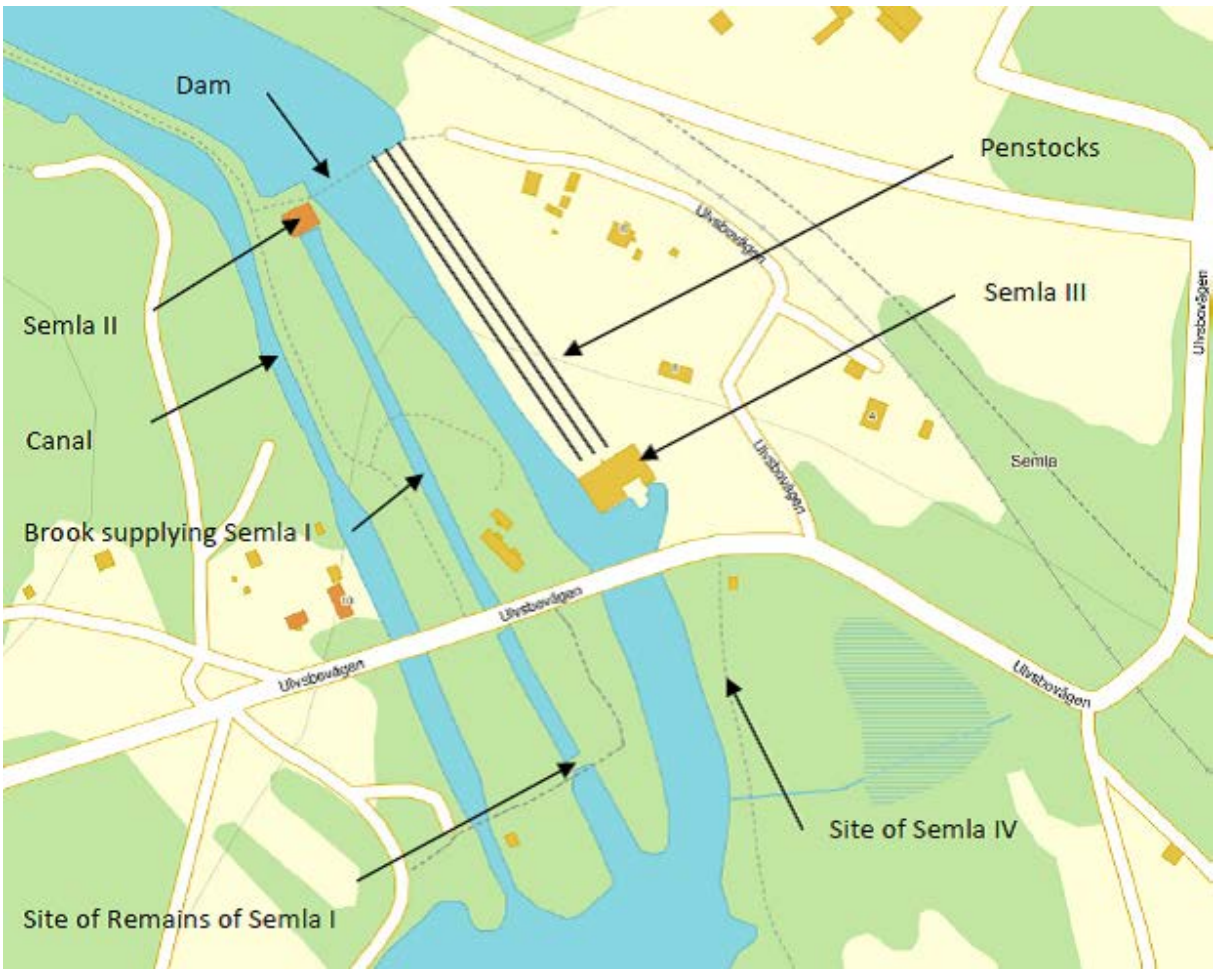


Figure 3. Schematic diagram of the existing facilities, and the new Semla IV powerhouse.

Semla III powerhouse which will be retained for its heritage value.

Semla II, which will be demolished for safety purposes.

Semla dam.

Semla penstocks.

Figure 4. Some Images of Semla

Assessment Process

The assessment has been conducted using the Preparation assessment tool, which contains 23 topics addressing governance, technical, financial, social and environmental issues.

It is important to note that this assessment addresses the new proposed Semla IV project only. It does not address Semla III, except where it will use the same facilities or structures.

This assessment was carried out as part of the IHA – E.ON Sustainability Partnership. IHA provided a team of two assessors to conduct the assessment. The on-site phase was conducted over 10-14 November 2014, and comprised a site visit, and interviews held in Malmö and in Fagersta, and also by videoconference and teleconference when necessary.

A draft report was delivered to E.ON in December 2014, and amended in response to comments received from E.ON in January 2015.

This is an official assessment. The assessment team are accredited by IHA, and the assessment was conducted with the full support of E.ON, as demonstrated by their written support, reproduced in Appendix A.

The assessment was supported by the Single Point of Contact, Florian Lieb in E.ON's 'Asset Governance Hydro' group, with assistance from Oliver Müssig. Interviews were carried out in English, with the exception of interviews with local stakeholders which were held in Swedish with translation to English. During the assessment process in Sweden two representatives of the E.ON SE Group Management (GM) Sustainability function took part as observers (GM-Corporate Communications, Bernhard Grünauer and GM-Corporate HSE Office, Irene de la Guerra Sierra).

Assessment Experience

This section addresses limitations and reflections relevant to this assessment.

The assessment was organised well by Florian Lieb and Oliver Müssig of E.ON. They assembled a substantial amount of documentary evidence, and arranged an appropriate number of interviews with external stakeholders. Where the assessment team identified the need for further evidence or clarifications, the single point of contact responded comprehensively in a timely fashion.

Most documentary evidence, with the exception of a range of corporate-level guidelines and directives, and some external reports, was in Swedish. E.ON provided translations of certain key documents, specifically the technical description, environmental impact assessment, and the project application to the Land and Environment Court. However the team relied on online automated translation services for the rest of documentation.

Semla IV is located in a developed country, and is a relatively small project, at 3.5 MW, meaning that some of the Protocol's proven best practice criteria, concerning opportunities have required careful interpretation. For some topics, there are no practicable opportunities, and for others, action would not be warranted by a project of the size of Semla IV. Where that is the case, any gap concerning opportunities could not be considered to be significant. A gap can only be considered to be significant where there are practicable opportunities.

IHA would like to thank all E.ON staff involved, and all E.ON interviewees and external interviewees for arranging the assessment process and providing their time to gather and provide a wealth of evidence.

Layout of this Report

This report consists of twenty-three sections numbered in direct correspondence with the twenty-three topics of the Protocol's Preparation 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 / 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 (P-1)

This topic addresses the identification and 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 establish a foundation for good stakeholder relations throughout the project life.

1.1 Background Information

External stakeholders include local communities in the county, in particular a few direct neighbours and users of the project area and the Kolbäcksån River, and government officials at different levels, and in the widest sense, other residents of Sweden, customers, and business partners of E.ON. External stakeholder interest in the project has been limited. Internal stakeholders within E.ON include operating units directly responsible for the Semla project as well as corporate units in the wider E.ON group, with a total of approximately 60,000 staff in several European countries.

1.2 Detailed Topic Evaluation

1.2.1 Assessment

Analysis against basic good practice

Scoring statement: *Stakeholder mapping has been undertaken to identify and analyse stakeholders, to establish those that are directly affected, and to establish communication requirements and priorities, with no significant gaps.*

Stakeholders in the Semla project are well known to E.ON. Semla is well known to local stakeholders, because the site has been used for hydropower generation for more than a century. The stakeholders for the new Semla IV project are largely the same as for the existing Semla III project.

E.ON Sweden has a generic stakeholder map that applies to all of its hydropower projects. For the Semla IV project, an invitation list for the first consultation meeting was drawn up based on research by the consultation coordinator. No additional stakeholders came forward and identified themselves either after a newspaper article, or through E.ON's general contact addresses. Most regional stakeholders are personally known to operational staff and to the team preparing the new project. Many belong to the Kolbäcksån Vattenförbund, an association of 53 municipalities, public and private businesses that affect the river, most of which are mandatory members. The association has a board and holds a general meeting once a year, at which E.ON is represented, and finances water quality monitoring and other joint efforts, such as flood management studies. The secretariat is provided by the County Administrative Board.

At the corporate level, E.ON identifies target groups for its communications efforts. Key external stakeholders include government, the media, NGOs, the emergency services (which may take over operations in emergency situations), and some counties and municipalities. The Sustainability Report of E.ON Nordic has sections for other important stakeholder groups such as customers, employees and suppliers. The Sustainability Report of the E.ON Group is based on a materiality analysis, for which stakeholders have been surveyed.

Criteria met: Yes

Analysis against proven best practice

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

Through its long presence in the Semla area, as well as drawing from decades of operational experience with multiple hydropower projects in Sweden, E.ON is well aware of all potentially interested parties. E.ON's main considerations in identifying external stakeholders are legal requirements and the company's reputation. The extent of stakeholder identification in the region is broad for a project of this size.

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, have been developed at an early stage applicable to project preparation, implementation and operation that outline communication and consultation needs and approaches for various stakeholder groups and topics.*

Communications processes are based on existing stakeholder relationships and will continue through all phases, and consultation processes during preparation are based on regulatory requirements for the construction permit. No separate communication and consultation planning documents or grievance mechanism have been developed for the project, which is appropriate given its small size and limited complexity.

The Land and Environment Court sent E.ON's application package for a permit to all interested parties, using the list provided by E.ON, and invited them to the court hearings. Additionally, E.ON published an article in the local newspaper to inform the broader community of the Semla IV project. Consultation meetings were held and the public was informed early enough in the preparation process to raise issues. One-on-one meetings were held with individual neighbours and stakeholder representatives.

Corporate communications is addressed at broader audiences at the national, Scandinavian and European level. E.ON Nordic produces an annual Sustainability Report, which generally follows Global Reporting Initiative (GRI) guidelines. Given that this covers all activities of a broad energy company, the focus on small hydropower is necessarily limited; however the 2013 edition has a section on E.ON's efforts to improve fish passage on a number of rivers.

There is a range of NGOs with an interest in hydropower, with some of which E.ON maintains communications. The new governmental strategy for hydropower, drafted jointly by different departments with broad input from stakeholders, is seen as a possible platform for consensus and practical cooperation. There is surprisingly little communication between the public agency Kammarkollegiet, which interprets its role as environmental advocate in a rather adversarial way, and the hydropower companies in Sweden.

E.ON will continue to participate in working groups at the national level and on the Kolbäcksån River where issues such as the introduction of the EU Water Framework Directive and flood management are discussed. Some communication on issues beyond the Semla project takes place in joint initiatives, for example on fish passage, which are undertaken with the regional Water Authorities and universities.

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.*

E.ON Vattenkraft Sverige has been sensitive in consultation to date, for example by holding a public meeting in the evening to enable people to attend. They have identified stakeholders, have planned consultation meetings with them, and are talking to many of them personally.

More broadly, E.ON Vattenkraft Sverige uses various surveys to elicit views from stakeholder groups. For example, to guide internal communications within E.ON Sweden, surveys are taken annually among employees. These test, among other things, whether employees feel they have access to all the information required for their functions. Internal communication pathways are, among others, the intranet (where minutes of management meetings are published) and staff meetings. There are also customer satisfaction surveys.

Criteria met: Yes

1.2.3 Stakeholder Engagement

Analysis against basic good practice

Scoring statement: *The project preparation stage has involved appropriately timed communications and engagement, often two-way, with directly affected stakeholders on topics of interest and relevance to them; engagement is undertaken in good faith; ongoing processes are in place for stakeholders to raise issues and get feedback.*

Stakeholder engagement is carried out by the responsible units at E.ON SE and E.ON Vattenkraft Sverige, supported by consultants and lawyers.

During the preparation process for Semla IV, consultation meetings and negotiations have been held with directly-affected stakeholders (such as neighbours, the road association, the canal company, and the snowmobile club), specifically with groups of invited local stakeholders at the power plant, with individual stakeholders separately, and with stakeholders convened by the Land and Environment Court, in Fagersta. Neighbours were also able to raise issues unrelated to the project, such as their wish that dead trees on E.ON property be removed and that they would be allowed to pass a sewage line through E.ON property and received verbal assurances that these would be taken into account. Local stakeholders and the County Administrative Board confirmed that they were satisfied with the ongoing communications with E.ON about the Semla project. Engagement was appropriately timed and often two-way, i.e. E.ON also received and took into account stakeholder comments. Some stakeholders have commented on the lack of updates on the status of the project during the long preparation process. In E.ON's perspective, all stakeholders were sufficiently informed about the general sequence of project implementation, and will be contacted again once there is relevant news.

During normal operations, there is a limited presence of E.ON staff and contractors in the area, but stakeholders are aware of staff telephone numbers and other ways to contact E.ON.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, engagement with directly affected stakeholders has been 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.*

Discussions and negotiations with local stakeholders have been productive and conducted in good faith, and there are several examples of agreements. Feedback on how issues raised have been taken into consideration has generally been thorough and timely.

While the permitting proceedings were available in hardcopies at the local library in Fagersta, they are not available on the Internet. Also, the initial consultation meetings were for invited participants only, as is required for projects classified as low impact by the county. E.ON could easily make information more accessible online and could have opened up consultation meetings to the general public. Engagement has not been inclusive and participatory. This is a **significant gap** against proven best practice.

Updates on project progress could also be simplified by an online presence with a regularly updated timeline for the project.

Criteria met: No

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 any communications related commitments have been or are on track to be met.*

There have been no noted non-compliances or non-conformances with regards to communications and consultation. The Land and Environment Court and the County Administrative Board have confirmed that E.ON fulfilled its stakeholder information and consultation obligations in the permitting process. There are plans to send letters to local stakeholders once E.ON takes its investment decision.

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.

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

E.ON could easily make information more accessible online and open up consultation meetings to the general public, to make its stakeholder engagement approach more inclusive.

1 significant gap

1.3 Scoring Summary

Stakeholders are identified and engaged in the issues of interest to them, and communication and consultation processes establish a foundation for continued good stakeholder relations throughout the project life. There is one significant gap at proven best practice level, resulting in a score of 4.

Topic Score: 4

1.4 Relevant Evidence

Interview:	1, 4, 5, 6, 7, 8, 9, 15, 18, 28
Document:	3, 4, 6, 23, 24, 60, 73, 84, 113, 118, 119
Photo:	38, 39

2 Governance (P-2)

This topic addresses corporate and external governance considerations for the project. The intent is that the developer 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

Kolbäckens Kraft is fully-owned by E.ON Vattenkraft Sverige S.A., a fully-owned subsidiary of E.ON Sweden, in turn, owned by the E.ON Group (E.ON S.E.) which is headquartered in Düsseldorf, Germany. E.ON Vattenkraft Sverige applies the corporate business structures, policies and practices of E.ON S.E. 'E.ON Nordic' is also used to refer to E.ON companies operating in the Nordic countries, as this also includes retail services outside of Sweden. E.ON S.E. is investor-owned, 72% by institutional investors and 28% retail investors. Investors in Germany hold about 41% of E.ON stock, and those outside Germany about 59%. E.ON S.E. is managed by a Board of Management and a Supervisory Board of twelve members, six of which are shareholder representatives and six of which are employee representatives.

External governance issues in the context of Semla IV mainly concern changing public policy at EU, Swedish and local levels, and regulatory risk. The context is politically stable, with high capacity amongst government agencies to fulfil their regulatory roles.

Sweden is divided into 21 counties, each with a County Administrative Board (County Board). This is a coordinating authority with supervisory and permitting responsibilities for environmental protection, cultural heritage, and a range of other issues. Decisions about permits are notified by the Land and Environment Court, or the Environmental Licensing Delegation of the County Administrative Board. Sweden has delineated five water districts across the country for river basin planning, and one county board in each district has been appointed River Basin District Authority. The lowest tier of government is the municipality. Sweden has 290 municipalities, which are responsible for local services, including social and environmental issues and emergency services.

2.2 Detailed Topic Evaluation

2.2.1 Assessment

Analysis against basic good practice

Scoring statement: *Assessments have been undertaken of political and public sector governance issues, and corporate governance requirements and issues, through the project development cycle with no significant gaps.*

E.ON has used a number of processes to assess governance issues during the preparation stage of Semla IV, specifically:

- The use of a lawyer to ensure E.ON's application is fully informed of Land and Environment Court requirements, and to make the application on their behalf (E.ON has no direct contact with the court);
- An initial meeting of E.ON's Specialist in Real Estate and Permits and Operations Manager with the County Administrative Board to discuss E.ON's intentions and seek the County Administrative Board's early view.

Governance issues at a local level and in Sweden will continue to be assessed through the project cycle by:

- The use of a service that provides regular automatic updates on regulatory and legal changes, from local to EU levels, which is reviewed by management at least once per year, and used to update the legal registers that are part of OHSAS 18001 and ISO 14001 management systems;

- Media and public relations as described in P-1 Communications and Consultation;
- The use of an external monitoring service to identify media reports on external views on E.ON Sweden;
- Membership of Swedish Association of Power Plants (Svenska Kraftverksföreningen);
- Close relations with the County Administrative Board, keeping them informed for work that does not require any permit.

The Managing Director of E.ON Vattenkraft Sverige plays an especially important role in the assessment of ongoing governance issues and of issues of greatest interest to the public, such as dam safety and environmental issues. E.ON Sweden also uses specialised consultants to predict political and regulatory trends.

Changes in corporate governance requirements determined at a group level are addressed by the local management team who consider the implications for E.ON Vattenkraft Sverige, and set targets for their business (e.g. dam safety targets). All individuals have targets linked to corporate targets.

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.*

E.ON has highly comprehensive systems for the assessment and management of governance issues and requirements, which apply at group, Sweden, Hydro-fleet, and project levels. There are no significant opportunities for improvement in the assessment of governance issues.

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, 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.*

E.ON Group, E.ON Sweden and E.ON Vattenkraft Sverige use extensive corporate governance processes to manage these issues. Group-level processes to manage corporate, political and public sector risks include:

- Incorporation of sustainability in management mechanisms, such as updating both Boards (Executive and Supervisory) regularly on sustainability initiatives and events and key performance indicators (KPIs), a Quarterly Board Report with KPIs (for safety, environmental protection, climate protection, and the percentage of women in senior management positions), and reports and briefings for the board from the Corporate Responsibility (CR) and Health, Safety, and Environment (HSE) departments;
- The appointment of a Board-level Chief Sustainability Officer (CSO) with senior CR and HSE leadership, to coordinate and oversee sustainability issues, and to report to the Board of Management on the latest developments in sustainability;
- A Sustainability Governance Council (SGC), chaired by the CSO and consisting of representatives of global units, regional units and support functions, to oversee a sustainability work program for 2012–2015, and apply an SGC Code of Conduct, which defines its purpose and objectives as well as its members' roles and responsibilities, and report to the Board at half-yearly intervals; SGC's representatives communicate the SGC's decisions and priorities to their respective units;
- Integration of sustainability into Board annual performance targets, such as E.ON's ranking in the Dow Jones Sustainability Index, and E.ON Vattenkraft Sverige management-level sustainability targets such as

gender-balance, TRIF (Total Reported Incident Frequency), zero dam safety accidents, and zero environmental accidents.

At the level of E.ON Sweden, two departments at E.ON Sweden's headquarters in Malmö are responsible for managing sustainability in the Nordic region: Corporate Sustainability (which is part of Stakeholder Management) and Health, Safety, and Environment (which is part of HR). These provide expert support on these issues to all E.ON entities in the region and work closely with other headquarters departments such as Compliance, Procurement, Diversity, Brand Insight, Sponsoring, and Corporate Culture. In addition, E.ON Sweden's political affairs unit considers changes in the legal framework and policies affecting hydropower, such as Sweden's national strategy on hydropower. E.ON Sweden applies a code of conduct, risk assessment and control activities (but please note that as the company is not listed on the Swedish Stock Exchange, it does not follow the Swedish Code of Corporate Governance).

E.ON Vattenkraft Sverige is managed by supervisory board meetings held four times per year, consisting of the E.ON Sweden Managing Director, Chief Operations Officer for the Hydro Fleet, Chief Financial Officer for E.ON Nordic, and Union Representatives, and focusing on budget planning and forecasts. The Managing Director has informal discussions with his direct reports (managers of the North and South regions and production manager) on a daily basis, and would consider Semla IV during these meetings.

Processes for ensuring compliance include the monitoring services referred to under Assessment above, and the above-mentioned management processes. Social and environmental responsibility is additionally managed through the application of management systems – please refer to P-5 for details. Basic reporting to line managers serves as a grievance mechanism (see P-16 Labour and Working Conditions), but E.ON also employs a 'whistleblower' mechanism with a telephone number publicised on the E.ON Sweden intranet. Ethical business practices are promoted through the use of a Code of Conduct, which all senior managers are trained in.

Regarding transparency, the E.ON Corporate Governance System is based on the German Corporate Governance Code, which is intended to ensure transparency in relations between the company's management and its stakeholders. E.ON has formally and publicly declared that it complies with this code.

Procedurally, E.ON uses 'Guidelines' that must be followed by all countries / companies, and 'Standards' that are recommendations which can be deviated from. Examples include the Project Handbook and the Investment Guideline, which are being actively used on Semla IV. Internal communication of corporate processes is ensured on a day-to-day basis by E.ON's intranet for the distribution of procedures and forms, and 'Centuri' for the storage of completed forms and reports. The intranet is described by staff as the means by which the gap between corporate requirements and the operational level is closed. A particular facility on the intranet is the Hydro Information Centre, which is compiled by the Global Hydro Fleet to bring together the Guidelines and Standards that are relevant to hydro projects. In addition, the intranet provides an E.ON Vattenkraft Sverige workspace, with links to a range of information (hydrological flows, management group minutes, finance codings, procurement procedures, standard presentations, HR, environment, occupational safety, dam safety etc). Finally there is also an E.ON Nordic Intranet (for all types of generation) with news, 'HR Online'; 'Our Work Methods', 'My Employment', Support, About E.ON. and the 'Development TalkTool' for storing staff development / appraisals.

Regarding external communications of policies and processes, E.ON Group's Communications team and E.ON Sweden's Corporate Sustainability (which is part of Stakeholder Management) communicate the above policies, targets and processes through their websites, the E.ON Group Sustainability Report (in English), the E.ON Nordic Sustainability Report (in Swedish), reporting to the Global Compact, and reporting against the German Corporate Governance Code. P-1 (Communications and Consultation) provides further details on communications, and P-12 (Procurement) provides details on communications with subcontractors.

Independent reviews are used in some cases: for example E.ON's dam safety policy requires independent review of dams above a certain size, environmental management systems and occupational health and safety

systems are independently certified, and international experts are used to carry out a review of how international standards are applied in dam safety practices.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, contractors are required to meet or have consistent policies as the developer; and processes are in place to anticipate and respond to emerging risks and opportunities.*

Contractors are required to have consistent standards in environmental, health and safety requirements. Contractors are required to comply with standards ABK-06 and ABK-04 concerning a construction company's responsibilities and legal liabilities, and legal compliance requirements. Full details are provided in P-12 Procurement.

E.ON Group Policy 3.28 on Procurement states that contractors employees involved in procurement are expected to meet its requirements. Also, E.ON has agreed, and made public, a 'Responsible Procurement Policy' which sets out a minimum standard of CSR performance expected from suppliers, concerning the human rights and working conditions of employees, minimising environmental impact, and maintaining high standards of ethics and business integrity. In addition, E.ON Vattenkraft Sverige has compiled detailed 'work environment demands' that must be adhered to by contractors. These 15 demands are used in a form that must be signed by both E.ON Vattenkraft Sverige and the contractor as part of the procurement process.

However, ensuring that contractors implement consistent policies on the ground is a continuing concern at E.ON. This is identified as a challenge at the corporate level, and was identified as a problem on the recent Knisslinge project. Contractors' limited application of consistent policies as E.ON's is a **significant gap** against proven best practice, which E.ON needs to continue to work to achieve on Semla IV.

Concerning emerging risks and opportunities, many of the processes described above are able to address emerging risks (such as changing government policies). E.ON uses a guideline (Guideline 1) to conduct a review every 2 years of corporate processes, enabling opportunities for improvement to be taken.

Criteria met: No

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.*

The Managing Director of E.ON Vattenkraft Sverige has regular contact with stakeholders at a political level, including politicians, and political units of government departments in order to get an understanding of political priorities and stay abreast of upcoming regulatory changes. Examples of interactions at a corporate level include: E.ON's comments on an official Swedish Government Report (Statens Offentliga Utredningar) concerning proposed revisions to water law following the EU Water Framework Directive; contributions to discussions on the role of large versus small hydropower in Sweden, for example at Stockholm Water Week, as summarised in the E.ON Nordic Sustainability Report.

Regarding directly-affected stakeholders at a project-level, i.e. Semla IV, the business has continuing two-way interaction with neighbours and the community, the municipality and County Administrative Board to understand issues of interest to them.

E.ON has made significant project reports publicly available, including the project application, EIA and consultation paper, which incorporate project performance in a range of sustainability areas. The County Administrative Board will require a short report on Semla IV on an annual basis, but this is not made public. In

relation to the project's certificate as a renewable energy producer, E.ON will be required to report to the Swedish Energy Authority. Information of public interest is made available from time to time and stakeholders are able to bring forward issues and engage with the project.

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.*

Information of public interest is made available from time to time and stakeholders are able to bring forward issues and engage with the project. However, the project could improve continuity of communications on Semla IV and inclusivity: this gap is identified on P-1 Communications and Consultation.

Criteria met: Yes

2.2.4 Conformance / Compliance

Analysis against basic good practice

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

Compliance management is effective. Semla IV has no legal non-compliances.

Note that the court decision to grant the permit for Semla IV was appealed by Kammarkollegiet and environmental NGOs on procedural grounds. A conflict of interest was claimed because the technical court advisor had previously been engaged in the hydropower industry. The court denied the appeal. Appropriate expertise may be difficult to find without previous exposure to the industry.

Criteria met: Yes

Analysis against proven best practice

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

There is a potential legal non-compliance at the workshop of a shortlisted supplier to the Semla IV project. E.ON has identified this potential non-compliance, concerning a health and safety plan, and has asked the company to resolve the non-compliance prior to contracting. Assuming this will be resolved prior to contracting, the project has no non-compliances.

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.*

No significant unresolved corporate or external governance issues were identified.

Criteria met: Yes

Analysis against proven best practice

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

An indication of the effectiveness of corporate governance are the results of a staff survey carried out annually: this shows that 85% strongly agree or agree with the statement "I know the E.ON Group's strategy so well that I can explain it to new employees", and 79% with the statement "My group gets the support from other groups needed for us to achieve our goals".

No unresolved corporate or external governance issues were identified. It is notable that governance requirements – with several levels (Group, Sweden, Hydro Fleet etc) – are complex, and it can be difficult even for employees to have full knowledge of these systems. However, the Hydro Fleet has made significant efforts to make all directives and guidelines clear for hydro projects, through their dedicated intranet facility.

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

Contractors' limited application of consistent policies as E.ON's.

1 significant gap

2.3 Scoring Summary

E.ON has highly comprehensive systems for the assessment and management of governance issues and requirements, which apply at group, Sweden, Hydro-fleet, and project levels. There are no significant opportunities for improvement in the assessment of governance issues. The Managing Director of E.ON Vattenkraft Sverige has regular contact with stakeholders at a political level, local managers have excellent relatioinships at a local level, and project reports are made publicly available. There are no unresolved corporate or external governance issues, but ensuring that contractors implement consistent policies on the ground is a continuing concern at E.ON. Contractors' limited application of consistent policies as E.ON's is a significant gap against proven best practice, resulting in a score of 4.

Topic Score: 4

2.4 Relevant Evidence

Interview:	11, 12, 17, 24
Document:	23, 58, 59, 60, 61, 62, 63, 64, 65, 69, 74, 113, 123
Photo:	None

3 Demonstrated Need and Strategic Fit (P-3)

This topic addresses the contribution of the project in meeting demonstrated needs for water and energy services, as identified through broadly agreed local, national and regional development objectives and in national and regional policies and plans. The intent is that the project can demonstrate its strategic fit with development objectives and relevant policies and plans can be demonstrated, and that the project is a priority option to meet identified needs for water and energy services.

3.1 Background Information

Nationally-agreed objectives, policies and plans of relevance to this topic include:

- Sweden's environmental quality objectives, described by the Swedish Environmental Protection Agency in a 2012 document entitled Sweden's Environmental Objectives. These include: 'Reduced Climate Impact', and a target of zero net emissions of greenhouse gases by 2050, as adopted by the Swedish Riksdag (parliament); 'Flourishing Lakes and Streams' concerning the ecological sustainability of lakes and watercourses, and their biological and cultural heritage value and their recreational value; and 'A Rich Diversity of Plant and Animal Life' concerning the preservation of biological diversity, and people's access to a good natural and cultural environment that is rich in biological diversity.
- The Swedish Energy Authority's Electricity Certificate System, now in a common market with Norway, which is a market-based support system for renewable electricity production, with the objectives of increasing the production of renewable electricity in Sweden by 25 TWh by 2020 compared to 2002, and making production more cost-efficient;

Locally-agreed plans of relevance are:

- The Climate Strategy for Västmanlands County (Klimatstrategi för Västmanlands län), which highlights the need to increase renewable energy production, although it focuses on biomass, wind and solar, stating that opportunities to expand hydropower are severely limited; and
- Fagersta Municipality's Master Plan (Översiktsplan För Fagersta Kommun) which has broad environmental objectives and identifies the need for efficiency in the use of energy, water and natural resources.

EU-level policies, such as the Water Framework Directive (Directive 2000/60/EC), are also of relevance.

E.ON objectives and policies of relevance include the group-wide Cleaner and Better Strategy, and E.ON Vattenkraft's Annual Strategy, which includes several priority areas, one of which is to 'increase production in existing plants'.

Water and energy services in the context of Semla IV do not only include the provision of renewable energy, but also concern water management for recreational purposes, cultural heritage preservation, and public safety.

3.2 Detailed Topic Evaluation

3.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment has been undertaken of needs for water and energy services, of options to meet water and energy needs; and of national and regional policies and plans relevant to those needs, with no significant gaps.*

E.ON has assessed needs for the water and energy services that Semla IV will provide, and some national policies of relevance to these needs in the Environmental Impact Assessment. Needs are also briefly mentioned

in the application document and in the consultation paper. EIA Section 4.1 'Reason' and Section 5 'Zero Alternative' describe the needs as continued production of renewable energy, and dam safety, and Section 7 'Social Benefits' describes the increase in renewable energy production and its resulting reduction in GHG emissions. Section 7.1.2 describes measures to preserve the cultural heritage of Semla III power house and the Strömsholm Canal. The application document (Section 4.5 Management) describes the need as "a reduction in fossil fuels consumption in accordance with the objectives of the Environmental Code", and the consultation paper refers to "ensuring continued production of renewable energy".

E.ON has considered a number of design alternatives for the new plant (see P-4 Siting and Design), but these are design alternatives rather than entirely alternative project options for meeting water and energy needs. This is not a significant gap at the level of basic good practice, as this is a modernisation project, and there are no alternative options for continuing the recreational and public safety services that Semla IV will provide (see Outcomes below).

The EIA (Section 8) presents an assessment of fit with Sweden's environmental quality standards and quality requirements related to the Water Framework Directive and management of natural resources. The EIA also includes reference to local plans that are relevant to Semla IV. These are the 'Limestone Zone Norberg-Fagertsta' area, the "Semla Area" conservation programme, the "Strömsholm Canal Environment", and Fagersta Municipality's preservation of ancient monuments programme. The EIA does not refer to Västmanlands County's Climate Strategy or Fagersta Municipality's Master Plan.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, the assessment is based on dialogue with government planners, policy makers and key stakeholder groups; and the assessment shows a strong emphasis on social and environmental related needs, policies and plans including the need for sustainable development of the river basin and integrated water resource management.*

The assessment is based on dialogue with stakeholders amongst the local government (municipality and county) and the local community. Consultation for the EIA was conducted in accordance with Sweden's Environmental Code, and consisted of two consultation meetings on 17 May 2011 at Semla power station: one meeting for authorities and an evening meeting for co-operative associations and those living close by. A consultation paper and invitations were sent to Västmanland County Administrative Board, Fagersta Municipality, the Swedish Agency for Marine and Water Management, Strömsholms Kanal AB, Aspensjöarna and Barkensjöarna fish conservation associations, Fagersta Boat Club, Ulvsbo community association and neighbouring landowners. The application and associated EIA place strong emphasis on social and environmental needs, especially concerning the use of the river and surrounding area for recreation and cultural heritage preservation.

However there is no assessment specifically of 'sustainable development of the river basin' or 'integrated water resource management', or an assessment of alternative options for delivering increased hydropower production. In Sweden there is an ongoing discussion on the role of small hydropower: about 10 % of hydropower projects on 9 river-systems generate more than 90 % of energy and most of the regulating capacity; renewing larger hydropower stations can offer increases in production that are greater than generation from smaller stations, which can be removed to allow ecological restoration. There is no assessment of these issues for Kolbäcksån, which could have looked at this question alongside the needs for other services in an integrated approach, and possibly demonstrate the need for retaining smaller long-standing hydro projects for their amenity and recreational purposes. The absence of an assessment that considers all alternative options for meeting energy and water needs in an integrated, river basin-level approach is a significant gap against proven best practice. This issue is also discussed on P-19 Biodiversity and Invasive Species.

Criteria met: No

3.2.2 Stakeholder Engagement

Analysis against basic good practice

Scoring statement: *The results of the assessment of strategic fit are publicly disclosed.*

Although there is no separate document presenting an assessment of 'strategic fit', the above-described documents (application, EIA and consultation paper) include analysis of strategic fit (especially Section 8 of the EIA). These have each been publicly-disclosed at a local level, through the consultation meetings described above, and through their availability at the Fagersta Library as part of the EIA process (but see P-1 for findings on the adequacy of public disclosure in general).

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *No addition to basic good practice.*

Not applicable.

3.2.3 Outcomes

Analysis against basic good practice

Scoring statement: *The strategic fit of the project with needs for water and energy services, and relevant policies and plans can be demonstrated.*

The strategic fit of the project with needs for water and energy services, and relevant policies and plans can be demonstrated as follows:

- Semla has been used for a long time for hydroelectric generation. Semla IV will increase electricity production without any change to the water management provisions. The increase will be approximately 4.7 GWh annually, and an equivalent annual reduction in emissions of approximately 3,100 tonnes of carbon dioxide.
- With or without Semla IV, E.ON would be required to maintain the dam for the recreational and cultural heritage value of the area and for public safety. The maintenance of a dam in this location enables the preservation of the Strömsholm Canal and its associated recreational use (see P-17 Cultural Heritage), the maintenance of the reservoir and its recreational use (see P-13 Project-affected Communities), and the avoidance of any public safety risk that may arise from the failure of the existing dam (see P-8 Infrastructure Safety). In addition, public safety in the Strömsholm Canal will be improved through the addition of a new lock, a 'stop log' specifically for safety purposes, at the upstream end of the canal.

These services fit with Sweden's environmental quality objectives of 'Reduced Climate Impact', 'Flourishing Lakes and Streams', and 'A Rich Diversity of Plant and Animal Life', the Swedish Energy Authority's Electricity Certificate System, the Climate Strategy for Västmanlands County, and Fagersta Municipality's Master Plan.

In relation to the Water Framework Directive, Semla IV will not change the water management regime or the flow rate which are already authorised in the existing permit. Semla IV will not alter continuity and not therefore the present status. However there is a missed opportunity to improve prospects for improved continuity to satisfy WFD requirements in the future, as discussed on P-19.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition the project is one of the priority options to address demonstrated needs.*

Semla IV is the only option for meeting the cultural heritage, recreational and safety objectives described above. However, Semla IV cannot be concluded to be a priority option for renewable energy services, partly because there is no integrated assessment (as described above under 'Assessment') and partly because local plans such as the Climate Strategy for Västmanlands County prioritise other forms of renewables. This is a **significant gap** against proven best practice.

Criteria met: No

3.2.4 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 sustainable development of the river basin or integrated water resource management, or an assessment of alternative options for delivering increased hydropower production.

The project is not a priority option for addressing locally-established needs for increasing renewable energy production.

2 or more significant gaps

3.3 Scoring Summary

E.ON has assessed needs for the water and energy services that Semla IV will provide, and some national policies of relevance to these needs, including through dialogue with stakeholders. The strategic fit of the project with needs for water and energy services, and relevant policies and plans such as Sweden's environmental quality objectives can be demonstrated. However, there is no assessment of 'sustainable development of the river basin' or 'integrated water resource management', or an assessment of alternative options for delivering increased hydropower production, and Semla IV is not demonstrated as a priority option for renewable energy services. There are two significant gaps against proven best practice resulting in a score of 3.

Topic Score: 3

3.4 Relevant Evidence

Interview:	1, 11
Document:	3, 4, 7, 9, 66, 72, 89, 90, 98, 117, 118, 119
Photo:	1, 2, 3, 4, 5, 6

4 Siting and Design (P-4)

This topic addresses the evaluation and determination of project siting and design options, including the dam, power house, reservoir and associated infrastructure. The intent is that siting and design are optimised as a result of an iterative and consultative process that has taken into account technical, economic, financial, environmental and social considerations.

4.1 Background Information

The siting and design of modernisation of the Semla project have been discussed by E.ON for several years.

4.2 Detailed Topic Evaluation

4.2.1 Assessment

Analysis against basic good practice

Scoring statement: *Technical information has been analysed at an early stage alongside social, environmental, economic, financial, and regulatory considerations in order to develop a preliminary project design and some options around this.*

E.ON examined a range of alternative designs in 2011, as set out in a paper "Options Concerning the Conversion of Semla Power Station" dated January 2011. This paper sets out nine options and variations, including new turbine/generator units in the existing powerhouse, with and without rehabilitation of the third turbine, a new powerplant in the same location, and a new powerplant in a range of alternative locations. An important consideration was the minimisation of downtime in generation: a new powerplant in the same location would have 15 months downtime, and would have greater safety risks associated with coffer dam stability, whilst the chosen design has only 4 months of downtime. Financial considerations were addressed through the use of a standard E.ON model to compare discounted cashflow analysis and Net Present Value (NPV) for five options.

An idea of replacing the entire cascade with one plant was considered at a very early stage but discarded without assessment because it was hardly economically, legally or environmentally realistic. The cost of tunnelling would have been prohibitive and downstream plants had been recently renovated.

In addition E.ON commissioned a construction consultant (from the Kadesjös company) with previous experience of the rehabilitation of two plants of a similar age to advise on the feasibility of rehabilitation of Semla III. This concluded that the modernization of Semla III would have significant risks during construction, including erosion, flooding of the work site, the possible collapse of the building affecting employee safety, and safety of the required coffer dam. This consultant recommended ruling out the modernisation of Semla III on the basis of these risks and their associated cost implications (it will be considerably more complex and risky and the cost of rebuilding will be significantly higher).

Some environmental and social considerations were considered in the selection of the chosen design, specifically in the need to minimise the public safety risks associated with a larger coffer dam (required for modernising the Semla III powerhouse), to minimise turbidity due to construction (which would be lowered by constructing the new powerhouse on land), and by the need to buy land (required for the new powerplant). In addition, options for siting and design were considered within the regulatory constraint of the existing permit, which establishes reservoir levels and flow rates necessary for downstream users. For example, reservoir levels are managed to enable transport of recreational boats through the Strömsholm Canal and boating and fishing activities in general in the reservoir, and flows are managed to ensure sufficient water availability for a cascade of downstream plants.

E.ON subsequently, in 2012, developed a technical description of the project, including technical information on hydrological conditions, limitations of current permits (for reservoir height and flows rates), and brief descriptions of the design of the water intake, additions to the dam, new plant, new penstocks, and tailrace, and a preliminary work schedule.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, options take into consideration sustainable river basin design and integrated water resource management.*

The option of removing the entire cascade or replacing it with one plant, as part of a 'sustainable' river basin design is not environmentally or legally feasible (see above). Within these constraints, the consideration of options has accounted for some aspects of integrated management, specifically the cultural heritage value of the existing plants, which will contribute to the cultural and recreational value of the complex. However, the breadth of environmental and social considerations were not fully analysed alongside technical considerations: the 2011 paper referred to above is entirely technical and financial. Integrated water resource management was not taken into consideration in siting and design options, and the range of design options assessed was relatively narrow. The absence of an assessment of siting and design options that analyses environmental and social considerations, not only technical and financial, is a **significant gap** against proven best practice. Please also refer to topics P-19 and P-23 (Downstream Flows) in relation to river continuity and flows.

Criteria met: No

4.2.2 Management

Analysis against basic good practice

Scoring statement: *An optimisation process has been undertaken to assess the project siting and design options.*

An optimisation process has been followed by iteratively assessing technical, environmental and social considerations and stakeholder views, from the initial identification of options, through technical assessments, and through the EIA process, with stakeholder consultation. As described above, existing permits preclude the use of more of the water resource owing to the needs of other water users.

Optimisation will continue through the detailed design of the chosen option which will occur through the bidding process and oversight of construction. For example this may concern minimising the amounts of construction materials required, and optimising building design.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *No addition to basic good practice.*

Not applicable.

4.2.3 Stakeholder Engagement

Analysis against basic good practice

Scoring statement: *The siting and design optimisation process has involved appropriately timed, and often two-way, engagement with directly affected stakeholders; ongoing processes are in place for stakeholders to raise issues and get feedback.*

Stakeholder engagement under this topic concerns only siting and design optimisation.

The above processes have included stakeholder dialogue with local government (municipality and county) and engagement of directly-affected stakeholders in the local community through letters and a consultation meeting. This is detailed under P-1 Communications and Consultation, and P-3 Demonstrated Need and Strategic Fit. A good example of dialogue in optimisation is the ongoing dialogue with the County Administrative Board on cultural heritage.

Directly-affected stakeholders in the local community (for example neighbours) have not been engaged specifically in design options or optimisation, and siting alternatives were not mentioned in the consultation paper, although they have had an opportunity to comment on the overall design. They do not hold strong views on the project, and they are more focused on the mitigation of any impacts (for example by the inclusion of parking facilities so the road will not be blocked, and the preservation of the Semla III) rather than on the detailed design of the project. This is not surprising for a small project, and the level of consultation carried out is sufficient to meet basic good practice.

There is a gap concerning ongoing stakeholder engagement, but this is general to engagement on all issues, not only siting and design and is addressed under P-1.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, engagement with directly affected stakeholders has been inclusive, and participatory; and feedback on how issues raised have been taken into consideration has been thorough and timely.*

Engagement in general has been inclusive and participatory, with prompt and thorough feedback (see P-1 Communications and Consultation). However, Siting and design optimisation has not involved engagement with directly-affected stakeholders. This is a **significant gap** against proven best practice.

Criteria met: No

4.2.4 Outcomes

Analysis against basic good practice

Scoring statement: *The final project siting and design has responded to many sustainability considerations for siting and design.*

The final siting and design responds to a range of sustainability considerations, including technical, the minimisation of downtime in generation, public safety, erosion, and cultural heritage. The use of the existing permit ensures that needs of other water users, for recreation and cultural heritage and for downstream generation, are taken into account. A further example is the design of the powerhouse to have low visual impact.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *The final project siting and design is optimal with respect to sustainability considerations for siting and design.*

The Protocol defines 'optimal' as 'best fit once all identified sustainability considerations have been factored in, based on the outcome of a consultative process'. The design of Semla IV meets this definition owing to the range of sustainability considerations. Examples of optimisation are: a new and more efficient intake could be built, but the existing intake will remain functional for 30-40 years and a new intake structure cannot be justified financially; cultural heritage will be preserved to some extent by the preservation of Semla III, but does not overrule safety considerations, as demonstrated by the demolition of Semla II. Although the siting and

design is not based on the outcome of a consultative process, i.e. a consultative process that has specifically addressed siting and design, this gap is addressed under 'Stakeholder Engagement' above.

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

The absence of an assessment of siting and design options that analyses environmental and social considerations, not only technical and financial.

Siting and design optimisation has not involved engagement with directly-affected stakeholders.

2 or more significant gaps

4.3 Scoring Summary

E.ON examined a range of alternative designs in 2011 and has optimised siting and design through iteratively assessing technical considerations, and some environmental and social considerations through the EIA. However, the breadth of environmental and social considerations were not fully analysed alongside technical considerations: the 2011 paper referred to above is entirely technical and financial. Directly-affected stakeholders in the local community (for example neighbours) have not been engaged specifically in design options or optimisation, and siting alternatives were not mentioned in the consultation paper. There are two significant gaps against proven best practice, resulting in a score of 3.

Topic Score: 3

4.4 Relevant Evidence

Interview:	1
Document:	1, 2, 3, 4, 7, 67, 117, 118, 119
Photo:	None

5 Environmental and Social Impact Assessment and Management (P-5)

This topic addresses the assessment and planning processes for environmental and social impacts associated with project implementation and operation throughout the area of impact of the project. The intent is that environmental and social impacts are identified and assessed, and avoidance, minimisation, mitigation, compensation and enhancement measures designed and implemented.

5.1 Background Information

The existing Semla III project is operating under a license from 1908 (modified in 1987, when a third penstock and generating unit was added) and is subject to E.ON's environmental management systems. The hydropower business of E.ON Sweden, E.ON Vattenkraft AB, which operates 69 power plants, is ISO 14001 certified. Many features of the existing project, including operational conditions of the license, will remain in place.

The Semla IV project does not require a new license, as it will operate within the license conditions. It does require a permit from a Land and Environment Court, however, in a simplified procedure as prescribed under the 1999 Swedish Environmental Code. (Projects which require a new license, a modification of their license, or whose license is reviewed upon request by a public authority, undergo more complex proceedings.) The responsible court is one of five in Sweden, attached to the Nacka District Court. The courts were established in 2011 and comprise both legal and technical expertise. They invite comments from a number of public agencies and identified stakeholders before issuing a ruling. All court proceedings are public. Court rulings can be appealed. The Semla IV permit was granted in August 2013.

Supervision both of operating projects such as Semla III and of projects under construction, such as the future Semla IV, is the responsibility of the County Administrative Board.

5.2 Detailed Topic Evaluation

5.2.1 Assessment

Analysis against basic good practice

Scoring statement: *Assessments of project environmental and social impacts have been undertaken for project implementation and operation, 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 with no significant gaps; and a baseline has been established and well-documented for the pre-project condition against which post-project changes can be compared.*

An Environmental Impact Assessment (EIA) according to Swedish regulations, which also covers social impacts, has been produced by the experienced consulting company ÅF-Industry AB. It is relatively short, at 25 pages, compared to EIAs for larger projects. It contains appropriate and relevant information, such as the level of contamination in the soils that need to be excavated for the underground portion of the penstock, the foundations of the powerhouse, and the tailrace. Some of this soil will be used to infill the area around the current third generating unit in Semla III. It has been established that soil contamination is not beyond regulatory limits.

A number of criteria of the scoring statement are not met. There is an associated facility, namely a new transmission line to the sub-station in Fagersta, which is not included. This is not a significant gap because the line will be short, laid underground and through an industrial area, and is not expected to have relevant impacts. Cumulative impacts have not been scoped, but this is not a significant gap because the Semla IV

project will not change anything about the existing cumulative impacts of the hydropower cascade on the Kolbäcksån River, consisting of 23 projects. (Cumulative impacts are not explicitly mentioned in Swedish EIA legislation, but it is implicitly understood by stakeholders that they need to be assessed where important.) The role and capacity of third parties have not been evaluated, but this is not a significant gap because their roles are well known to stakeholders, and because there are no concerns about the capacities of Swedish public agencies. Impacts associated with primary suppliers, such as suppliers of building materials, the fiberglass penstock, and the electro- and hydro-mechanical equipment have not been evaluated. This is not a significant gap because the scale of supplies is small and because E.ON maintains an effective sustainable procurement program.

The baseline has not been systematically documented but is sufficiently well known from the on-going operation of the Semla III project and from official statistics kept by various authorities.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition the assessment takes broad considerations into account, and both risks and opportunities; and the social impact assessment incorporates assessment of human rights.*

The EIA is focused on the immediate, local impacts of the project. It did not review risks or opportunities from potential medium- and long-term changes, such as regulatory developments or climate change. It also did not review some long-existing impacts or issues, for example the blocking of upstream fish passage (see P-19) or contamination of sediments (see P-20), to consider whether the reconstruction project presents an opportunity to improve the situation. The absence of an assessment of potential environmental and social opportunities, affecting a range of issues (biodiversity, sedimentation, public health etc) and including opportunities to remedy existing impacts, is a **significant gap** against proven best practice.

The continuous water quality and ecological monitoring and the process for developing river basin management plans should be able to identify emerging risks and opportunities. E.ON engages with different agencies and experts on management of the watercourses on which it operates hydropower plants, including the Kolbäcksån River. A planning process is underway which will result in public and binding commitments. Among the various river basin management plans for the 2015-2021 period recently submitted for consultation, there is a specific action plan for the Kolbäcksån River, which is proposing a wide range of measures to address eutrophication, acidification, heavy metal and chemical contamination, environmental flows, migration barriers, and other problems. Among these measures, actions to restore migration at 106 barriers and environmental flows at 37 dams are listed. However, in many cases 'excessive costs' and 'technical impossibility' are given as reasons for postponing the achievement of 'good ecological status'.

Human rights are not addressed in the EIA, although the permitting process covers some social issues, including human health. In the Swedish context, where human rights are well protected, it is highly unlikely that any rights could be affected by this project.

Criteria met: No

5.2.2 Management

Analysis against basic good practice

Scoring statement: *Environmental and social issues management plans and processes have been developed with appropriate expertise (internal and external) for project implementation and operation with no significant gaps; in addition to key social and environmental issues relating to the hydropower project, plans address construction related waste, noise, air quality, land disturbance and rehabilitation; the environmental and social impact assessment and key associated management plans are publicly disclosed.*

E.ON's environmental management systems for operating projects like Semla III include generic environmental policies, the "Prevent" incident reporting system for environmental, health, safety and reputational issues, as well as a short environmental management guideline for each individual project.

The design of the project incorporates a number of environmental and social issues that were identified during the options assessment and impact assessment process. E.ON and their consultants have appropriate expertise based on their considerable experience with multiple hydropower projects at comparable scales. As for all these projects (for example, in the recently concluded Knislinge project), site environmental impacts concerning waste, noise and air quality would be addressed in an Environmental Management Plan; an EMP is not required at the permitting stage. The EMP basically refers back to standard Swedish regulations for construction. Please refer to topic P-6 Integrated Project Management concerning a construction management plan for land disturbance and rehabilitation.

The EIA is publicly available. The EMP is not disclosed, which is not a significant gap because the underlying Swedish regulations are public documents.

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; plans are embedded within an internationally recognised environmental management system which is third party verified, such as ISO 14001; and independent review mechanisms are utilised.*

E.ON is well aware of broader risks and opportunities, through its corporate public affairs, environmental and other departments. These could arise, for example, from changes to fish passage requirements as a result of the implementation of the EU Water Framework Directive, as addressed under P-19 and P-21.

At the project level, staff and contractors are required to report any incidents to E.ON. E.ON's own project management and the County Administrative Board supervise construction; E.ON reports to the County Administrative Board on compliance with the EMP. The project location is also visible and partly accessible to the public, and local stakeholders are aware of the plans, providing another means of identifying risks.

E.ON's Swedish hydropower operations maintain a systematic environmental management system that is third-party certified against ISO 14001 since 2001. The Semla III plant was visited by internal or external auditors in 2003, 2009 and 2014. There were no significant findings during these visits, nor are there any significant environmental or social incidents at Semla recorded in the incident reporting system. Any incidents and accidents also would need to be reported to the County Administrative Board, which is not aware of any non-compliances.

No independent review mechanisms have been utilised in the EIA and the development of plans for social and environmental issues. This is appropriate for the low complexity of the project and the significant experience of the owner, consultants, and regulatory agencies, and not a significant gap.

Criteria met: Yes

5.2.3 Stakeholder Engagement

Analysis against basic good practice

Scoring statement: *The environmental and social impact assessment and management planning process has involved appropriately timed, and often two-way, engagement with directly affected stakeholders; ongoing processes are in place for stakeholders to raise issues and get feedback.*

Stakeholder communications and consultations during the impact assessment and permitting process have been described under P-1. The process included and continues to include appropriate engagement opportunities. While there was limited interest from stakeholders, it is E.ON's policy to acknowledge, and if possible, respond to every comment. Stakeholders were explicitly asked for suggestions during the consultation meetings. For example, some neighbours suggested that if Semla III were to be converted into a museum, an appropriate parking lot and trash collection would be required. Other stakeholders have not yet sought specific agreements, although they know that they will be affected. For example, the boat club members use the footpath across the dam to access their lake cabins. They are confident from experience that solutions will be found in due course; during previous works at the dam, an alternative path across the canal locks was used.

Ongoing processes include the next steps planned by E.ON, after the investment decision is taken:

- Discussions with the County Administrative Board on requirements regarding the reconstruction of the dam, without affecting the protected Strömsholm canal, and on the future use of the Semla III building; and
- Negotiation of detailed contracts with the road association and the canal company.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, engagement with directly affected stakeholders has been inclusive and participatory; and feedback on how issues raised have been taken into consideration has been thorough and timely.*

Stakeholders have been able to discuss issues with E.ON and to develop mutually acceptable solutions. It was E.ON's approach to try to come to as many voluntary agreements with stakeholders as possible, before the court proceedings began. However the engagement could have been more inclusive, and more regular updates could have been provided. This gap has already been identified under P-1.

Criteria met: Yes

5.2.4 Outcomes

Analysis against basic good practice

Scoring statement: *Environmental and social plans avoid, minimise and mitigate negative impacts with no significant gaps.*

During project implementation, environmental and social impacts are avoided (for example, through the maintenance of the Semla III building) and minimized and mitigated, through the siting, design and construction methods. Some temporary impacts such as noise and access restrictions will remain.

During project operation, the environmental and social performance of the new Semla IV project will be equal or better than that of the existing Semla III project in all regards, with the exception of a slightly longer bypass stretch.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, environmental and social plans avoid, minimise, mitigate and compensate negative project impacts with no identified gaps; and plans provide for enhancements to pre-project environmental or social conditions or contribute to addressing issues beyond those impacts caused by the project.*

Impacts are largely avoided, minimised and mitigated, and temporary impacts on fishing are compensated by a one-time payment of a SEK 30,000 fee. No compensation of remaining temporary negative impacts is foreseen,

for example compensation for the residual noise impacts even after mitigation. This is a **significant gap** against proven best practice.

The project enhances pre-project conditions in some regards. It also has some positive impacts on issues outside its own control, such as the canal company's ability to regulate inflows into the canal.

Criteria met: No

5.2.5 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 potential opportunities relating to a range of environmental and social issues including opportunities to remedy existing impacts.

Impacts are largely avoided, minimised and mitigated, but not all remaining temporary negative impacts will be compensated.

2 or more significant gaps

5.3 Scoring Summary

E.ON's approach to the impact assessment and permitting process is to act and to be perceived as a good neighbour by the local stakeholders. The EIA is rather basic, which may be appropriate for the minor and mostly temporary impacts of the Semla IV project. However, it does not address some opportunities to restore the river quality, and compensation for impacts remaining after mitigation. These are considered two significant gaps against proven best practice, resulting in a score of 3.

Topic Score: 3

5.4 Relevant Evidence

Interview:	1, 4, 5, 6, 7, 8, 9, 19, 21, 28
Document:	3, 4, 6, 7, 8, 22, 27, 28, 29, 30, 31, 32, 33, 44, 79, 80, 81, 84, 114, 115, 116, 117, 118, 119
Photo:	29, 37, 49

6 Integrated Project Management (P-6)

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.

6.1 Background Information

Semla IV will be a relatively small project. It will be implemented through three components: a design and build contract for civil works, a supply and installation contract for a turbine and generator, and a supply and installation contract for automation. Operation and maintenance will be carried out through E.ON's contract with a service provider, which is currently held by Maintpartner. There are few critical issues during implementation, but examples could include the transportation of large components such as penstocks on small rural roads, and avoiding damage to the heritage value of Semla III during its decommissioning.

The project management structure consists of a Project Manager (for implementation), supported by a Project Administrator, Purchasers from the Procurement Department, Turbine and Dam Safety Experts and support from the Operations Manager. The project manager will oversee a contracted consulting engineer, architect, civil works contractor, turbine supplier, and other suppliers (automation, penstocks, cranes).

6.2 Detailed Topic Evaluation

6.2.1 Management

Analysis against basic good practice

Scoring statement: *An integrated project management plan and processes have been developed that takes into account all project components and activities with no significant gaps; and a construction management plan has been developed that identifies construction risks and describes processes that contractors and others are required to follow to manage these risks.*

E.ON has comprehensive processes and procedures for project management, and can demonstrate their application on similar projects to Semla IV. These are set out in the Project Handbook, which describes the steps to be taken from beginning to closure, for any project of more than € 0.5 million.

The project handbook is a practical tool with easily-navigable links to steps in the project life cycle, and links to the E.ON workspace where guidelines and standards are provided. It includes project governance and reporting, and details the steps to be taken, responsibilities and authorisations required during stages of: Initiation and Planning; (Phase 1) Project Structure; Designing; Tendering; (Phase 2) Contract Management and Implementation; Trial operation and Approval; and Clearance. The steps are detailed and can't all be described here, but examples of steps or tasks that are included in the handbook are: (during tendering) prepare a work environment plan; prepare a project control plan; define a strategy for risk sharing; (during implementation) manage signed contracts; monitoring and updating of risks; (during Clearance) final inspection to be held; and handover to operations staff. Documents produced for project management are controlled and stored in an online 'Centuri' system. The implementation project manager is required to report to the 'leading group' on a monthly basis, and a principal document is the Phase 2 'Charter' that will be completed after the decision is made to proceed with Phase 2.

Semla IV is approaching the end of Phase 1, with a project management structure in place, a schedule prepared (Huvudtidpan), and tender specifications for the main components developed and distributed with invitations to tender (to 12 firms for the civil works).

Reference to a 'construction management plan' in the scoring statement means a plan to put into practice plans to manage environmental and other risks on-site during construction. An initial Work-Environment Plan is included in the tender documents for the civil works contractor. This includes the identification of construction risks, but they mainly relate to safety risks. The contractor will be required to develop the Work-Environment Plan in due course. A note from E.ON Sweden's Specialist on Real Estate and Permits, sent to the project implementation team concerns the court judgement's requirements, and considerations for managing local stakeholder's interests: this refers to avoiding increased turbidity in the river, restoring the road following the laying of the penstocks under the road, payment for wear or damage to the road, and avoiding erosion at the new outlet channel. In addition items 13.9 and 13.10 in the tender documents for the civil works contractor set out general and local environmental instructions, which include responsibilities to dispose of construction waste responsibly, and areas for storage of excavation waste are designated in plans.

During operation, a similar arrangement as the current contract with Maintpartner will be used. Maintpartner are employed through a 3 year contract, and provide a 4-person team working across the E.ON-owned cascade, spending approximately a third of their time on the E.ON projects on water management and maintenance.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, the integrated project management plan sets out measures to manage interface and delay issues without impinging on overall project timetables and budgets; 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; and processes are in place to anticipate and respond to emerging risks and opportunities.*

The assessors have not seen any evidence of measures to manage interface and delay issues, other than the general schedule. There is no specific reference to interface issues in the tender specifications for the civil works contractor or the consulting engineer. E.ON has stated that the civil contractor will be required to prepare measures to manage interfaces. However, no identification of measures to manage interface and delay issues is a **significant gap**.

Plans for construction as set out in the tender specifications for the civil works contractor do not set out plans to manage land disturbance or waste generation activities in order that rehabilitation of the site after construction can be undertaken efficiently or effectively. It is not clear whether E.ON has identified 'construction risks and describes processes that contractors and others are required to follow to manage these risks' as required in this scoring statement. The absence of construction management plans concerning environmental management and rehabilitation is a **significant gap** against proven best practice.

E.ON standard processes will enable risks and opportunities to be anticipated, avoided and managed. For example: provisions are included in contracts to avoid over-runs; payments are made on the basis of fixed prices by volume of materials; 'extra jobs' will be listed and each item will require approval; standard contracts will be used, divided into steps, with signed E.ON approval required at stages; changes in contract budgets, timing or quality must be requested through change requests form; and the Phase 2 decision to proceed will not be made until tenders, with actual prices, have been received. On site, a Control Plan will be used to direct inspections and oversight, and a Quality Plan to inspect materials and quality of construction (as used on the Knisslinge project). An 'after-analysis' form is also used, providing a means of identifying lessons learned on the project for future construction project management.

Criteria met: No

6.2.2 Outcomes

Analysis against basic good practice

Scoring statement: *The project is likely to meet overall budget and timing objectives and targets, and plans avoid, minimise and mitigate construction risks with no significant gaps.*

The procedures described above provide confidence that the project is likely to meet budget and timing targets, and avoid, minimise and mitigate construction risks. The after-analysis report, from January 2014, for a recent project of a similar size, Knisslinge, reports that construction was well-managed, despite a series of unexpected challenges related to geology, changes in the building structure, an extended construction period due to a harsh winter, and more extensive work than expected on the intake channel and the outlet channel. A lesson identified in this analysis is that the project leader must have sufficient time to process all the issues that come up at the stage that works are the most intense.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, the project is highly likely to meet overall budget and timing objectives and targets; and plans avoid, minimise, mitigate and compensate construction risks with no identified gaps.*

However, the report on Knislinge, which was managed through the same project manager and architect as is planned for Semla IV, indicates numerous unexpected issues, a budget over-run of approximately 10%, delays, and the difficulty of getting contractors to adhere to safety and environmental requirements. Based on this experience, using the same corporate procedures as Semla IV will use, it cannot be said that Semla IV will be 'highly likely' to meet budget and timing requirements. This is a **significant gap** against proven best practice.

It is not clear what plans there are to compensate for construction risks. This is a gap, but is the same gap as under 'Management' above.

Criteria met: No

6.2.3 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

No identification of measures to manage interface and delay issues.

No construction management plans concerning environmental management and post-construction rehabilitation.

The project is not highly likely to meet budget and timing requirements.

2 or more significant gaps

6.3 Scoring Summary

E.ON has comprehensive processes and procedures for project management, as set out in a Project Handbook, and can demonstrate their application on similar projects to Semla IV. They include processes to anticipate and manage risks and opportunities. Some construction impacts will be managed through a standard Work-Environment Plan, but plans set out in the tender specifications do not include measures to enable rehabilitation of the site after construction. In addition, there is no evidence of measures to manage interface

and delay issues, other than a general schedule, and the assessors do not consider that Semla IV is 'highly likely' to meet budget and timing requirements.

Topic Score: 3

6.4 Relevant Evidence

Interview:	14, 23
Document:	5, 22, 31, 32, 34, 35, 36, 38, 39, 40, 41, 53, 56, 57, 120, 121, 122
Photo:	None

7 Hydrological Resource (P-7)

This topic addresses the level of understanding of the hydrological resource availability and reliability to the project, and the planning for generation operations based on these available water inflows. The intent is that the project's planned power generation takes into account a good understanding of the hydrological resource availability and reliability in the short- and long-term, taking into account other needs, issues or requirements for the inflows and outflows as well as likely future trends (including climate change) that could affect the project.

7.1 Background Information

The Kolbäcksån River is highly regulated, as there are a number of power plants in operation belonging to E.ON Vattenkraft Sverige and others both upstream and downstream of Semla. The river flows through the regulated lakes Väsman and Barken (upstream) and Åmänningen (downstream of Semla). E.ON owns and operates Morgårdshammars plant upstream of Semla, and Fagersta, Uddnäs and Västanfors, downstream. VB Energie owns and operates plants upstream of Morgårdshammars. There is one plant between Semla and Morgårdshammars by the name Smedjebacken, which is owned and operated by another company.

Average annual flow in the river at the Semla dam is 22 m^3/sec. The downstream plants are designed for exactly the same flow, of 35 m^3/sec as Semla. The Kolbäcksån's catchment basin is over 3,100 km^2 in area, or 2,200 at Semla km^2.

7.2 Detailed Topic Evaluation

7.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment of hydrological resource availability has been undertaken utilising available data, field measurements, appropriate statistical indicators, and a hydrological model; issues which may impact on water availability or reliability have been identified and factored into the modelling; and scenarios, uncertainties and risks have been evaluated.*

E.ON collects data on flows in the Kolbäcksån at Semla Dam. Owing to the existing plant's long-standing operation at this site, the availability of the hydrological resource is fully understood: the resource is determined by the regulation of flows by Morgårdshammars. Flow duration curves based on 1965 to 2000 data are presented in an appendix of the technical description.

E.ON has not assessed issues which may impact on water availability and reliability, or evaluated scenarios, uncertainties and risks, with the exception of climate change (see proven best practice, below). However this is not a significant gap because flows are highly reliable owing to their upstream regulation, and there is long term experience of operating the plant in this location.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, issues that may impact on water availability or reliability have been comprehensively identified; and uncertainties and risks including climate change have been extensively evaluated over the short- and long-term.*

Issues have not been comprehensively identified, and uncertainties and risks have not been extensively evaluated over the long term, with the possible exception of climate change. E.ON has referred to results from climate research of the Swedish Meteorological and Hydrological Institute (from the Rossby Centre, which are

available online). This presents climate scenarios on maps, as diagrams, and as downloadable data, and compares precipitation for the basin of the Norrström river (i.e. the basin flowing into Lake Maelaren, encompassing the Kolbäcksåns basin) (during the years 1961-2100) with the normal (mean for 1961-1990), using four scenarios (RCP 2.6, RCP 4.5, RCP 8.5, and SRES A1B). However it is not clear how these are used in the assessment of the hydrological resource over the long term. Whilst flows at Semla are highly reliable because they are regulated, there is an opportunity to assess the long term trends for the entire catchment or cascade, especially since E.ON owns and operates a series of plants on the cascade. Assessment of issues that may affect water availability or reliability is not comprehensive as it does not consider the entire catchment or cascade or the long term including climate change. This is a **significant gap** against proven best practice.

Criteria met: No

7.2.2 Management

Analysis against basic good practice

Scoring statement: *A plan and processes for generation operations have been developed to ensure efficiency of water use, based on analysis of the hydrological resource availability, a range of technical considerations, an understanding of power system opportunities and constraints, and social, environmental and economic considerations including downstream flow regimes.*

Plans for generation operations are determined by the water levels set out in a 1904 judgement for the existing plant, which are determined for the purposes of preparedness for spring floods, and will continue as for the existing plant. The judgement sets the following limits of the level of the reservoir: maximum levels 101.1 masl in January and February, 99.95 m from the beginning of March to the beginning of the spring flood, and 100.40 m from the end of the spring flood to end of December; minimum levels of 99.65 m during the navigation period (which seems to be the entire year). Generation operations are also determined by the commitment to provide flows for E.ON's downstream plants.

Processes for generations operations to ensure efficiency of water use are: the use of a coordinated control centre for the E.ON-owned cascade, based at Västanfors; regular contact by email and teleconference with VB Energie which manages the plants upstream, and Maelarenergie which manages the plants downstream of the E.ON cascade.

The new turbine will allow management to respond to technical considerations and an understanding of power system opportunities and constraints. The new turbine will be able to start and stop more readily, which will allow better use of the resource, of most use in the day-time during the winter when electricity spot prices are higher. However, this will be limited by the permitted reservoir levels and downstream flows, which reflect social and environmental considerations.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, generation operations planning has a long-term perspective; takes into consideration multiple uses and integrated water resource management; fully optimises and maximises efficiency of water use; and has the flexibility to adapt to anticipate and adapt to future changes.*

Generations operations planning does not have a long-term perspective or the flexibility to adapt to future changes, but the uncertainties and risks in the long term are likely to be minimal. E.ON has not assessed the broader long term changes, but this is described under 'Assessment' above.

Multiple uses and 'integrated water resource management' in this context can be considered to be: the use of the reservoir and woodlands surrounding the plant/reservoir for recreation and tourism; similar recreation and tourism throughout the cascade; and the use of the hydrological resource for power generation by all plants

through the cascade. Permit restrictions ensure that multiple uses for recreation and tourism are taken into consideration, and sufficient downstream flows are provided for downstream generation.

E.ON is part of a Kolbäcksåns Vattenförbund (Water Management Association), formed in 1986, and consisting of members from municipalities around the river and companies and businesses that are authorized to use or affect river water. Their website states that the purpose of the Association is to ensure that the water in Kolbäcksån used in an appropriate manner. However, there is no indication that this group is used for the coordination or long term planning of generations operations.

Criteria met: Yes

7.2.3 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

Assessment of issues that may affect water availability or reliability is not comprehensive as it does not consider the entire catchment or cascade or the long term including climate change.

1 significant gap

7.3 Scoring Summary

Owing to the existing plant's long-standing operation at this site, the availability of the hydrological resource is fully understood. Plans for generation operations are determined by the water levels set out in a 1904 judgement for the existing plant, and will continue as for the existing plant, and E.ON coordinates processes to maximise efficiency of water use within these constraints. Permit restrictions ensure that multiple uses for recreation and tourism are taken into consideration, and sufficient downstream flows are provided for downstream generation.

However, E.ON has not assessed issues which may impact on water availability and reliability in the long term, or evaluated scenarios, uncertainties and risks, with the exception of climate change. There is one significant gap against proven best practice, resulting in a score of 4.

Topic Score: 4

7.4 Relevant Evidence

Interview:	10
Document:	3, 4, 45, 95, 96, 97
Photo:	7, 8, 9, 10, 11, 12

8 Infrastructure Safety (P-8)

This topic addresses planning for dam and other infrastructure safety during project preparation, 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.

8.1 Background Information

Dam safety in Sweden is managed using voluntary guidelines, 'RIDAS' (Kraftföretagens Riktlinjer för Dammsäkerhet" in Swedish, i.e. Power Industry Dam Safety Guidelines) which set out requirements for dam safety and how to address it. In legislation, the Swedish Environmental Code makes limited reference to dam safety, but has been strengthened recently with regard to dam safety.

RIDAS establishes that the dam owner is responsible for "safety against the occurrence of uncontrolled outflow from the dam". In addition, a Law on Protection Against Accidents, concerning emergency response, includes tasks for the dam owner. County Administrative Boards are the supervising authority for dam safety, whilst the relevant municipality holds responsibility for rescue services. Svenska Kraftnät (the state-owned transmission company) and its Dam Safety Council are responsible for promoting dam safety and Svenska Kraftnät also supports County Administrative Boards in their supervisory roles.

Semla dam is a Design Flood Class II dam, requiring that it is designed to withstand a flood with a 100-year return period. By RIDAS categorisation, Semla is consequence class 3, i.e. the probability of loss of life or serious injury is negligible.

8.2 Detailed Topic Evaluation

8.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment has been undertaken of dam and other infrastructure safety risks with appropriate expertise during project preparation, construction and operation, with no significant gaps.*

E.ON has not yet carried out an assessment of dam safety for the planned rehabilitated Semla dam. This will be carried out in advance of construction, and it will be prompted by E.ON dam safety guidelines and the E.ON Vattenkraft Sverige dam safety team.

E.ON contracted appropriate experts at EnergoRetea AB, an engineering consultant, on two occasions in 2008 to assess the safety of the current dam according to RIDAS guidelines. Firstly this was to determine the maximum flows at a range of downstream locations associated in the event of dam break (on the basis of hydrological calculations, map material, and field investigations on terrain and dams condition). Secondly, it was to compile hydrologic data, the maximum volume of water released on dam failure, design flow, dam failure assumptions and flows, consequences of dam failure, identified damage and valuation of damage, loss of life or serious injury, damage to the environment / community etc, and consequence classification. This assessment is relevant to the preparation and implementation stages, as the current dam remains as it is through these stages until it is rehabilitated. During operation, E.ON will contract similar expertise to assess safety of the rehabilitated dam. Regarding the implementation stage, E.ON has considered safety risk during implementation of alternative project options, as described in P-4 Siting and Design, and the civil works contractor will assess safety when securing the site for implementation works.

The flood design category and RIDAS consequence classification were recorded in a standard E.ON form, in August 2011. This is prepared in accordance with RIDAS, RIDAS application instructions, and E.ON Vattenkraft

Sverige AB's statement of its departure from, clarifications and expansion of RIDAS. The rehabilitated dam will have the same flood design category and consequence classification.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, the assessment includes consideration of a broad range of scenarios, and includes both risks and opportunities.*

E.ON is part of a Kolbäcksåns River Coordination Group (Älvsamordningsgruppen) which consists of 22 organisations including dam operators, affected municipalities, rescue services, transport administration, SMHI and other stakeholders and meets twice per year. The group occasionally commissions a Flood Risk Assessment (i.e. flooding from high precipitation and flows, not from dam failure), which was most recently carried out by SWECO. This is one example of a broad approach to safety assessment.

Other than this, the assessment of the existing dam and expected future assessments of the rehabilitated dam do not consider a broad range of scenarios, risks or opportunities. The rehabilitated dam will consist of older and newer parts of the dam, but it is not clear how this structure of the dam will pose specific risks for dam safety or whether this will be assessed. In addition, assessment could encompass broader risks such as public safety arising from open access to the dam, public safety in the rehabilitated Semla III powerhouse, and the implications of climate change for the probability of dam-breaking floods, or opportunities for improvements in public safety around the dam and reservoir (currently there are no warning signs of drowning hazards, life-saving equipment, or warnings around the dam, the canal locks and the pedestrian bridge upstream of the Semla dam. Construction traffic risks and access to emergency services during implementation have not been considered (see P-18 Public Health).

The absence of a broad approach to the assessment of safety risks, and especially risks arising from public access, is a **significant gap** against proven best practice.

Criteria met: No

8.2.2 Management

Analysis against basic good practice

Scoring statement: *Dam and other infrastructure safety management plans and processes have been developed for project implementation and operation in conjunction with relevant regulatory and local authorities with no significant gaps and provide for communication of public safety measures; emergency response plans include awareness and training programs and emergency response simulations; and dam safety is independently reviewed.*

Semla has a 'DTU Manual' for operation, status control and maintenance, so it can be assumed that this will be updated for the rehabilitated dam. However, as the Semla dam is of negligible consequence, RIDAS does not require 'status control' plans concerning operational supervision, dam monitoring, function testing, inspections, and dam safety evaluation. However E.ON has decided to apply RIDAS to class 3 dams in all respects except extensive dam safety reviews and monitoring.

E.ON normally carries out dam inspections every 6 years, but interviewees during this assessment were not sure this would be done for Semla, owing to its negligible consequence (however note that the existing dam was inspected in 2007 and 2013). There are no requirements concerning instrumentation for category 3 projects. However, E.ON has been discussing the possibility of monitoring the join between the old and new parts of the dam. E.ON does not expect to carry out an extensive review every few years (as for category 1 and 2) but expects to do some analysis, for example stability calculations.

Concerning ice, RIDAS includes guidelines on design load, including ice pressure. E.ON is considering using icebreaking equipment (which uses compressed air, or stirrers), to avoid sub-zero temperature water leading to frazzle ice which is bad for equipment.

E.ON is now developing a dam safety Business Directive (a 10 page Dam Safety Policy), based on ICOLD dam safety management systems, which uses a format similar to ISO 9001. The initial draft will be developed by early December 2014.

The structural safety of the dam will be analysed as part of the design prior to construction. The consultant engineers will need to prove all calculations. The design of the new part of the rehabilitated dam has been discussed with E.ON's dam safety team, and a concrete dam selected. This team will continue to follow the design process, and project management procedures (see I-6 Integrated Project Management) will ensure that works are carried out to meet specifications. The design flow of the current dam is 190 m^3/sec, and the rehabilitated dam is expected to match this.

During implementation, the Work Environment Plan will list safety risks and include emergency plans.

Regarding communication and emergency response plans, Semla has existing contingency plan and crisis management procedures. The contingency plan will be updated following construction, and the operations/maintenance contractor will continue to use this. It is based in part on the assessment and consequence classification carried out in 2008, and relates to four scenarios:

- High risk of dam failure / identified dam failure due to overflow of the dam at extremely high flows;
- High risk of dam failure / identified dam failure due to overflow of the dam at full or partial loss of the hatch opening;
- High risk of dam failure / identified dam failure due to abnormal leakage through the dam; and
- Communication breakdowns and high risk of dam failure / identified dam failure.

The contingency plan includes: organization and management; alarm plan and alarm lists; action plans; equipment and documentation resources; communications requirements, and exercises / training. This states that exercises are to be conducted once every 10 years.

'Emergency Procedures' concerning crisis management are also set out for E.ON Vattenkraft Sverige. This includes internal contact details and checklists for different levels of risk. This is triggered when there is a risk for the business, personal injury, environmental damage or property damage, damage to the company's reputation or brand, or risk of a massive media attention. Crises can be escalated to the level of the E.ON Nordic Crisis Management Team if necessary.

Regarding regulatory oversight and independent review, E.ON expects the County Administrative Board to review the consulting engineer's designs, and E.ON will keep them informed. There is no other form of independent review, but this is not significant owing to the negligible consequence of dam failure.

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; plans provide for public safety measures to be widely communicated in a timely and accessible manner; and emergency response plans are independently reviewed.*

The work of the Operations Manager and operations and maintenance contractor in regularly inspecting the dam and other infrastructure provides a means to anticipate and respond to emerging risks during operation. For example, they test the link between alarms and the SOS system once per month. Semla has two alarm systems, one direct to an SOS system and one via radio to Vasterhas station and from there to SOS. The contingency plan includes measures for wide and rapid communication through this SOS alarm to emergency services, and alarm lists of E.ON personnel, and other companies and organisation and plants in the local area.

During construction, the contractor's adherence to their Work-Environment Plans and regular inspections by E.ON's Implementation manager will enable emerging risks to be identified and responded to. Emergency response plans are not independently reviewed, but this is not a significant gap owing to the negligible consequence of dam failure.

There is no process for anticipating and responding to opportunities for improvement. This is a **significant gap**, but is the same as under 'Assessment' above.

Criteria met: No

8.2.3 Outcomes

Analysis against basic good practice

Scoring statement: *Plans avoid, minimise and mitigate safety risks with no significant gaps.*

The above plans avoid, minimise and mitigate safety risks. Semla has a consequence class of 3 because failure would not result in any flooding of homes, as the floods would not reach them. Failure would occur at flows of 240 m^3/sec according to the analyses referred to above, which would result in an increase in the water level below the dam of 0.3 m. "No dam accidents" is an Key Performance Indicator of E.ON Vattenkraft Sverige, achieving zero in 2013.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, plans contribute to addressing safety issues beyond those risks caused by the project itself.*

There are plans to contribute to some safety issues, for example the construction of the 'stop log' at the upper end of the canal, to enable flows into the canal to be controlled during emergencies and for repairs. E.ON will also continue to participate in the Älvsamordningsgruppen for risk assessment and coordination along the entire river. However, there is a clear opportunity to improve public safety issues around the canal and the reservoir, which currently has no safety signage or life-saving equipment at all. The absence of plans to contribute to improved public safety is a **significant gap** against proven best practice.

Criteria met: No

8.2.4 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

No assessment of a broad range of scenarios, risks and opportunities, especially risks associated with public access.

No plans to contribute to addressing some safety issues beyond those risks caused by the project itself, especially public safety risks around the canal and reservoir.

2 or more significant gaps

8.3 Scoring Summary

Failure of the Semla dam would be of negligible consequence, and E.ON will apply appropriate monitoring and management of dam safety and emergency response. This includes analysis of the structural safety of the dam

as part of detailed design, status control and maintenance during operation, communication and emergency response plans, and contingency planning and crisis management procedures. E.ON has not yet carried out an assessment of dam safety for the planned rehabilitated Semla dam, which will be carried out in advance of construction.

The assessment of the existing dam and expected future assessments of the rehabilitated dam do not consider broader risks or opportunities especially on public safety around the site. Although there are plans to contribute to some safety issues, there are no plans to contribute to improved public safety beyond the risks caused by the project itself. There are two significant gaps against proven best practice, resulting in a score of 3.

Topic Score: 3

8.4 Relevant Evidence

Interview:	10, 25
Document:	7, 25, 42, 43, 70, 71, 88, 120
Photo:	13, 14, 15

9 Financial Viability (P-9)

This topic addresses both access to finance, and the ability of a project to generate the required financial returns to meet project funding requirements, including funding of measures aimed at ensuring project sustainability. The intent is that projects proceed with a sound financial basis that covers all project funding requirements including social and environmental measures, financing for resettlement and livelihood enhancement, delivery of project benefits, and commitments to shareholders/investors.

9.1 Background Information

The cost of the planned measures is estimated at SEK 81.5 million. The annual cost for capital and depreciation and ongoing operations is estimated at SEK 4.6 million.

Semla III has been able to generate financial returns over a long period. Semla IV will be fully financed by E.ON Vattenkraft Sverige AB, and will be owned and operated by E.ON Vattenkraft Sverige AB, which has long term sales agreements with E.ON Global Commodities at fixed prices. Additional revenue will be gained from the sale of power as renewable power under the Swedish Energy Authority's Electricity Certificate System. Annual revenues not including revenues from green certificates are estimated to be approximately 5.5 million SEK.

9.2 Detailed Topic Evaluation

9.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment of corporate financial viability, including potential project costs and likely revenue streams, has been undertaken using recognised models with no significant gaps; analyses include risk assessment, scenario testing and sensitivity analyses.*

Initially E.ON Vattenkraft Sverige considered the financial cost of the alternative options for upgrading Semla in 2011. They subsequently assessed the financial viability of Semla IV using an E.ON financial template, which contributed to their 'Phase 1' decision to invest in project preparation (see P-6 Integrated Project Management). The template generates a discounted cashflow model on the basis of various inputs including details of revenue structures and revenue streams including green certificates, project costs (lost revenues, capital expenditure by year, and operating expenditure), the cost of outages and repairs adjusted by risk, and 'embedded opportunities' such as additional green certificates.

Risk assessment is associated with the model, and the annual cost of risk reduction is included in the model. For Semla's model, a number of technical risks, such as 'guide vane malfunctioning unit 1', are identified. Interviewees stated that the model incorporates the reduced risk to revenues that arise from upgrading Semla III to Semla IV, but it is unclear in the model which of these technical risks apply to Semla III and which to Semla IV.

The model includes scenarios, based on inflation for fixed costs, revenue inflation, electricity prices, certificate prices, and exchange rates. These are summarised in six scenarios with names such as 'green world', 'conservative view', or 'slow recovery', for example. In addition, sensitivity of IRR to electricity prices, green certificate prices, and CAPEX was analysed.

The model delivers EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization), EBIT, Operating Cash Flow, IRR (internal rate of return) and Net Present Value (NPV).

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.*

Project costs are fully detailed, with an estimate of each component of the civil works and electro-mechanical works, of administration / project control, unforeseen costs and interest. Project revenue streams include revenues from conventional revenues from sale in the electricity market, and green certificates.

The analysis of financial viability is comprehensive. Risks and the mitigation of risks are fully assessed, for example considering how profitable it is to mitigate each risk. Through these analyses, the financial viability of Semla IV is optimised.

Criteria met: Yes

9.2.2 Management

Analysis against basic good practice

Scoring statement: *Financial management plans and processes have been developed for project implementation and operation with no significant gaps, and opportunities for project financing have been evaluated and pursued.*

The E.ON Group's detailed financial management procedures and controls will be used for Semla IV implementation and operation. These include processes for: planning and budgeting; financial management during implementation; follow-up (economic reports and status reports), and project closure reports.

Planning of project investments includes: Long Term Planning; budgeting for 3 year-periods; Medium Term Planning; Project Prioritization; and project budgeting at the year-start and adjusted four times per year. At the level of E.ON Vattenkraft Sverige, financial closure is managed on a quarterly basis, and forecasts are updated quarterly. An "Accounting Business Partner" within E.ON's Accounting Department leads the process, delivering a financial report for the Management Board of E.ON Vattenkraft Sverige and E.ON's Hydro Fleet. This process uses standardised Status Reports and Closure Reports set out in E.ON's project management handbook. Procedures for financial controls include: authorisation levels concerning approval of expenditure; the use of contractual agreements for larger items of expenditure to fix costs within manageable limits; and purchase orders.

All financial data is stored in a SAP-based financial management system, which is used to generate reports. E.ON's Centuri management system is then used to store documentation, such as phase 1 or 2 decisions, and purchase orders.

All production is sold to E.ON Global Commodities according to an agreement for the next three years. Revenue is apportioned to a project on the basis of production, and operating units, including E.ON Vattenkraft Sverige, are not informed of actual sales or revenues for reasons of confidentiality. However, according to their Managing Director they have an approximate idea of how competitive their plants are.

E.ON will internally finance Semla IV, so opportunities for project financing were evaluated through E.ON's decision to internally finance the project.

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.*

The project implementation budget includes a contingency amount of SEK 5.9 million. E.ON's financial analysis incorporates risk analysis to a detailed level, incorporating the cost of risk reduction. The budget's contingency is not restricted to contingency for additional environmental and social measures. However environmental and social mitigation plans and commitments are well-considered, and are incorporated into the contractual costs of the civil works, and other contracts which will be controlled by contractual agreements. Impacts are minimal and environmental and social issues are unlikely to result in significant additional costs which E.ON would not be able to readily address. The reporting systems described above can be used to anticipate and respond to emerging risks and opportunities: for example Status Reports include 'chances' (i.e. fortuitous events) and risks.

Criteria met: Yes

9.2.3 Outcomes

Analysis against basic good practice

Scoring statement: *The project can manage financial issues under a range of scenarios, can service its debt, can pay for all plans and commitments including social and environmental, and access to capital can be demonstrated.*

E.ON's requirements for the approval of the project are that it meets a minimum return above the weighted average cost of capital, and meets a minimum IRR. E.ON's financial analysis indicates that the Semla IV project will meet these requirements. The project will be able to cover all commitments including social and environmental.

Semla IV will be fully financed by E.ON without recourse to external financing, so access to capital is easily demonstrated. E.ON will manage this through a loan from an 'internal bank', with an interest rate of 2.5%. The financial analysis indicates that it will be feasible to service this internal debt.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, the project can manage financial issues under a broad range of scenarios.*

The range of scenarios included in the financial analysis is broad. Semla IV will be able to manage financial issues under a broad range of scenarios.

Criteria met: Yes

9.2.4 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

9.3 Scoring Summary

E.ON assessed the financial viability of Semla IV at initial stages of considering project options and subsequently through a detailed cashflow model. Project costs and project revenue streams are fully detailed. The analysis of financial viability is comprehensive, incorporating risk analysis. E.ON Group's detailed financial

management procedures and controls will be used for Semla IV implementation and operation. The project can manage financial issues under a broad range of scenarios, and will be able to cover all commitments including social and environmental

Topic Score: 5

9.4 Relevant Evidence

Interview:	20
Document:	26, 46, 47, 48, 49, 50, 51, 52, 68
Photo:	None

10 Project Benefits (P-10)

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.

10.1 Background Information

The Semla IV project creates a number of public benefits, which are described under other topics. These include increased generation of renewable energy, increased dam safety, improved ability to control flows into the Strömsholm canal, improved survival rates for fish passing through the turbine, reduced risk of oil contamination, increased employment during construction, increased tax payments, and the potential to use the Semla III building as a museum and visitor centre, thus increasing the area's attractiveness for local residents and for tourists.

This topic is not about those benefits that are an inherent result of E.ON's investment, i.e. which would be implemented in any case. For example, the Kaplan turbine to be installed in Semla IV will have environmental benefits compared to the existing machinery in Semla III. These are not the result of discussions about additional benefits for the community, but the result of choosing state-of-the-art technology, which is in the own interest of E.ON. This topic is only about benefits that may result from additional initiatives by E.ON, and from longer term sharing of benefits.

10.2 Detailed Topic Evaluation

10.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment of opportunities to increase the development contribution of the project through additional benefits and/or benefit sharing strategies has been undertaken; and the pre-project baseline against which delivery of benefits can be evaluated post-project is well-documented.*

The baseline has not been systematically documented but is sufficiently well known from the on-going operation of the Semla III project and from official statistics.

The preparation of the project did not include an assessment of the potential to contribute to local development, which is a **significant gap** against basic good practice. The EIA is oriented towards mitigating potential negative impacts, and only mentions increased power generation as a community benefit. The opportunity to preserve the Semla III building arose from discussions with stakeholders during the assessment process; however it will only add value for local stakeholders if it is developed into a museum or visitor centre, the feasibility of which has not yet been assessed. The opportunity to rebuild the stop log at the entrance to the canal arose from discussions with the canal company during the assessment process. Other additional benefits were not identified.

Criteria met: No

Analysis against proven best practice

Scoring statement: *In addition, broad considerations have been taken into account in identifying opportunities.*

Not Assessed

10.2.2 Management

Analysis against basic good practice

Scoring statement: *Project benefit plans and processes have been developed for project implementation and operation that incorporate additional benefit or benefit sharing commitments; commitments to project benefits are publicly disclosed.*

There some plans for project benefits, which are limited in their extent but commensurate with the small size of the project. There is currently a discussion about a possible project benefit from the Semla III powerhouse building, which was originally to be torn down. After consultation with the County Administrative Board it was agreed to keep the building, and this commitment has been made in the public court proceedings. Discussions are on- going about converting it into a museum or visitor centre, and plans for this conversion – which probably requires a partnership between private and public partners – will be developed if there is sufficient interest from stakeholders. There is no particular urgency in developing such plans as long as the building and its original machinery are kept intact. In addition, the construction of the stop log on the canal, instead of a cheaper alternative (a temporary cofferdam) will provide additional benefits for canal operations and maintenance. Any additional commitments by E.ON would be publicly disclosed.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, processes have been developed to anticipate and respond to emerging risks and opportunities.*

Not Assessed

10.2.3 Stakeholder Engagement

Analysis against basic good practice

Scoring statement: *The assessment and planning process relating to project benefits has involved appropriately timed, and often two-way, engagement with directly affected stakeholders; ongoing processes are in place for stakeholders to raise issues and get feedback.*

Additional project benefits for the community have not been a focus of engagement during the project preparation, but requests could and can be raised at any time in the process. P-1 sets out details of stakeholder engagement in general during project preparation. E.ON has responded positively to ideas about a power generation museum or a visitor centre for the Strömsholm canal. It is understood by stakeholders that this requires their contributions and cannot rely on E.ON's initiative alone.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, engagement with directly affected stakeholders has been inclusive and participatory; and feedback on how issues raised have been taken into consideration has been thorough and timely.*

Not Assessed

10.2.4 Outcomes

Analysis against basic good practice

Scoring statement: *Plans deliver benefits for communities affected by the project.*

As mentioned above, a range of benefits will be delivered which are integral parts of the project, and not counted again under this topic.

There are initial discussions about the potential future use, operational arrangements, and funding for the Semla III building. If these go ahead, they could result in relevant additional benefits for the community. The stop log at the entrance to the canal is not considered an integral part of the project, as it could have been avoided by E.ON, and thus will deliver an additional benefit.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, plans deliver significant and sustained benefits for communities affected by the project.*

Not Assessed

10.2.5 Evaluation of Significant Gaps

Analysis of significant gaps against basic good practice

The preparation of the project did not include an assessment of the potential to contribute to local development.

1 significant gap

Analysis of significant gaps against proven best practice

Not assessed.

10.3 Scoring Summary

Even in the context of a small, long-established Swedish hydropower project, there can be simple, easily identifiable, and not overly costly opportunities that improve project sustainability, create support and improve the reputation of the owner in the community. According to E.ON, where such benefits are identified, they are regularly considered, on a case-by-case basis. In the Semla project, there was no systematic assessment of potential benefits, but as a result of stakeholder consultations, one additional benefit will be provided, and another is under discussion. There is one significant gap against basic good practice, resulting in a score of 2.

Topic Score: 2

10.4 Relevant Evidence

Interview:	1, 4, 5, 6, 7, 8, 9, 15
Document:	3, 84, 87, 112
Photo:	30, 48

11 Economic Viability (P-11)

This topic addresses the net economic viability of the project. The intent is that there is a net benefit from the project once all economic, social and environmental costs and benefits are factored in.

11.1 Background Information

Please note that this topic differs from P-9 Financial Viability because economic viability incorporates external costs and benefits that do not accrue to the owner.

Sweden's Environmental Code explicitly includes a requirement on economic viability for projects that concern water resources. Chapter 11, Section 6, entitled "Special Conditions Applying to Water Operations" states that water operations may only be undertaken if the benefits from the point of view of public and private interests are greater than the costs and damage associated with them"

11.2 Detailed Topic Evaluation

11.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment of economic viability has been undertaken with no significant gaps; the assessment has involved identification of costs and benefits of the project and either valuation in monetary terms or documentation in qualitative or quantitative dimensions.*

E.ON's application document includes the conclusions of a brief analysis to demonstrate that the requirements of Chapter 11, Section 6 of the Environmental Code are met. The application provides the total cost of the project, annual costs of capital and depreciation and ongoing operation, and a cost per KWh of SEK 0.32. It states that this is less than the average value of the power generated, and that the project is therefore economically viable. As the project's impacts are minimal, it argues that the advantages for the public outweigh the costs. In addition, the EIA presents the GHG emissions reductions corresponding to the increased production of Semla IV. These assessments are sufficient to meet the above requirements of the identification of costs and benefits, and documentation in qualitative terms.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, the assessment takes broad considerations into account, and includes sensitivity analyses.*

Whilst the conclusion of the application document are correct, because impacts are minimal or transient as described in P-5 (Environmental and Social Impacts Assessment and Management), the analysis is extremely limited, and could not be said to 'take broad considerations into account'. The valuation of benefits of recreational opportunities or heritage preservation, or the economic cost of demolishing Semla I which is also of heritage value, is not attempted in qualitative or quantitative terms. There is no valuation of GHG emissions reductions. The analysis of economic viability does not include sensitivity analysis (although the financial viability analysis does – see P-9 Financial Viability). The absence of an assessment of economic viability that incorporates all costs and benefits and is based on valuation in quantitative terms is a **significant gap** against proven best practice.

Criteria met: No

11.2.2 Stakeholder Engagement

Analysis against basic good practice

Scoring statement: *The results of the economic viability analysis are publicly disclosed.*

The brief conclusion provided in the application report, as described above, was made publicly available during the application process at the library in Fagersta and on-line at the website of the County Administrative Board.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *The economic viability analysis is publicly disclosed.*

No analyses that delivered the figures that are presented in the application document or the GHG emissions reduction analysis are publicly disclosed. No economic viability analysis of the level of detail described under Assessment / Proven Best Practice above is available for public disclosure. The absence of public disclosure of an economic viability analysis is a **significant gap** against proven best practice.

Criteria met: No

11.2.3 Outcomes

Analysis against basic good practice

Scoring statement: *From an economic perspective, a net benefit can be demonstrated.*

Although there has not been a detailed economic viability assessment, a net economic benefit can be expected owing to the net financial return combined with very limited environmental and social costs, and the benefit of reduced GHG emissions. The Nacka court judgement agrees with the conclusion set out in the application report, that the cost is less than the average value of the produced power, and that it finds no barrier [regarding] Chapter 11 of the Environmental Code. The increase in renewable energy delivered by the project is equivalent to an emissions reduction of 3100 tonnes of CO_2 equivalent per year compared to emissions from generation in Northern Europe.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, the project benefits outweigh project costs under a wide range of circumstances.*

The benefits of Semla IV can be expected to outweigh the project costs under a wide range of circumstances as it is likely to be profitable, reduces GHG emissions, and has very limited social and environmental impacts.

Criteria met: Yes

11.2.4 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 an assessment of economic viability that incorporates all costs and benefits and is based on valuation in quantitative terms is a significant gaps against proven best practice.

There is no public disclosure of any economic viability analysis.

2 or more significant gaps

11.3 Scoring Summary

Sweden's Environmental Code requires that the project application demonstrates that the economic advantages outweigh disadvantages, and the application includes a very basic assessment of this. The project is economically viable. However the analysis is extremely limited. There are two significant gaps against proven best practice, resulting in a score of 3.

Topic Score: 3

11.4 Relevant Evidence

Interview:	11
Document:	3, 4, 91
Photo:	None

12 Procurement (P-12)

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.

12.1 Background Information

E.ON has comprehensive internal processes and procedures for procurement which are available to all staff via E.ON's intranet. The construction of Semla IV will require the procurement of consulting engineers, civil works contractors, turbine and generator equipment suppliers, and electro-mechanical contractors. E.ON will also procure services for the ongoing operation and maintenance of Semla IV.

12.2 Detailed Topic Evaluation

12.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment of major supply needs, supply sources, relevant legislation and guidelines, supply chain risks and corruption risks has been undertaken with no significant gaps.*

The project manager for the implementation of Semla IV initially defined procurement requirements, in very general terms as 'turbine, dam / civil works, automation', in the Phase 1 'initiation report'. This project manager has subsequently defined detailed specifications for these procurement requirements and for consulting engineers to oversee construction.

Assessment of procurement needs will continue through implementation and operation through E.ON Sweden oversight of all procurement, which is communicated with the use of a Procurement Planning Table, with spend category, costs etc., to the E.ON Group Procurement Manager 3 or 4 times per year.

This assessment does not include an assessment of relevant legislation and guidelines, supply chain risks and corruption risks specifically, but this is not a significant gap owing to E.ON Vattenkraft Sverige's long-standing experience of procurement in Sweden, and the low risk, including of corruption, in the supply chain.

Criteria met: Yes

Analysis against proven best practice

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

Civil works procurement will focus on the Swedish market. Whilst procurement of equipment has been broader, the preferred provider will use their workshops in Sweden, one at Västerås, and one at Kristinehamn, 155 km away. The current provider of operation and maintenance services, Maintpartner, is a company with 1,800 employees throughout Scandinavia and has an office in Fagersta.

No assessment has been made specifically on enhancing opportunities for local suppliers. However, this is not a significant gap because significant goods and services will be provided by locally-based companies. The supplier of turbines will use their workshops in Sweden, and civil works will be procured within Sweden, including invitations to large companies in the area. Swedish consultants and lawyers have been used in preparation to date.

Criteria met: Yes

12.2.2 Management

Analysis against basic good practice

Scoring statement: *Procurement plans and processes have been developed for project implementation and operation with no significant gaps.*

E.ON's corporate procurement processes, as follows, will apply:

- E.ON Group Policy 3.28 on Procurement, which sets out overall principles of procurement, and detailed procurement processes involving categorisation, tendering, prequalification, variations to the tender, authorisation of contracts etc;
- Appendices to Group Policy 3.28, for example, Appendix 06, which provides minimum requirements for identification and assessment of HSE/Sustainability-related risks for all procurement activities, and is applied in conjunction with Business Directive OP-EA-HSE 3 on Contractor Management; and
- The associated Group Policy 1.32 which defines E.ON's management structure for procurement.

The project manager for implementation (Projektledare) is following these processes, as demonstrated by evidence of a prequalification audit of the turbine supplier. Specifications for civil works and consulting engineers are already prepared, and a contract for the turbine and generator is prepared (for which a Sourcing Board meeting was held in August 2014 as the contract is in excess of the threshold).

E.ON will use standard contracts for civil works and other contracts during the implementation phase, i.e. AB-04 and ABT-06 standards established by BKK (Byggandets Konkraktskommitté), which are similar to FIDIC standard contracts. BKK is a non-profit association in the Swedish construction sector. AB 04 of 2004 is General Conditions of Contract for Building and Civil Engineering Works and Building Services, and ABT 06 of 2006 is General Conditions of Contract for Design and Construction Contracts for Building, Civil Engineering and Installation Works.

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.*

Processes to anticipate and respond to emerging risks and opportunities include the procedures for variation of contracts as set out in GP 3.28 and described in P-6 Integrated Project Management.

Sustainability issues and anti-corruption are specified in pre-qualification screening. E.ON's Supplier Pre-qualification Questionnaire includes sections on sustainability, mainly a significant section on HSE practices, consisting of 14 sections, and additional questions in other sections concerning corporate responsibility and HSE of the supplier's subcontractors. In addition, E.ON has a Responsible Procurement Audit Checklist, developed to ensure the suppliers compliance with E.ON´s Responsible Procurement Policy. The checklist presents questions on employees / working conditions, environment, and business integrity, using a similar structure as the policy. Although there is no evidence that these tools have been applied to Semla IV yet, a Supplier Prequalification Report including a Responsible Procurement Audit has been prepared for the potential supplier of the turbine. This report includes HSE issues and makes reference to the Responsible Procurement Audit as an observation.

Anti-corruption is strongly emphasized in E.ON's Responsible Procurement Policy, which is applied to pre-qualification. Examples of measures that are set out in GP 3.28 that concern anti-corruption include: the use of a separate Procurement Department separate from the business unit; procurement of contracts of more than €1 million are managed by a 'Sourcing Board'; a minimum number of quotes of 3 for every demand exceeding € 10,000; and supplier-neutral specifications. Anti-corruption could be more strongly emphasized in GP 3.28 (the

word ‘corruption’ is not included anywhere) but the measures set out in GP 3.28 such as these are practical anti-corruption measures.

Criteria met: Yes

12.2.3 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.*

No non-compliances or non-conformances with procurement processes are evident. All commitments are on track.

Criteria met: Yes

Analysis against proven best practice

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

No non-compliances or non-conformances with procurement processes are evident.

Criteria met: Yes

12.2.4 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.*

Procurement to date meets all of the above requirements.

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.*

There are no plans for enhancing opportunities for local suppliers in particular. As described above, the supplier of turbines will use their workshops in Sweden, and civil works will be procured within Sweden, including invitations to large companies in the area. Swedish consultants and lawyers have been used in preparation to date. Whilst further opportunities to promote local suppliers are not being taken, this is not a significant gap as the opportunities would be relatively limited on a small project, and there has been no demand for local opportunities or capacity development from local stakeholders.

Criteria met: Yes

12.2.5 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

12.3 Scoring Summary

Procurement requirements were defined in E.ON's initiation report and subsequently with detailed specifications for the procurement of civil works, electro-mechanical equipment and consulting engineers. Assessment of procurement needs will continue through implementation and operation through E.ON Sweden oversight of all procurement. E.ON's corporate procurement processes and standard Swedish contracts for civil works and other contracts will be used. Sustainability issues and anti-corruption are specified in pre-qualification screening, and anti-corruption is strongly emphasized in E.ON's Responsible Procurement Policy, which is applied to pre-qualification. No assessment has been made specifically on enhancing opportunities for local suppliers. However, this is not a significant gap because significant goods and services will be provided by locally-based companies in some cases.

Topic Score: 5

12.4 Relevant Evidence

Interview:	2, 10,
Document:	10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 31, 32, 54, 55
Photo:	None

13 Project-Affected Communities and Livelihoods (P-13)

This topic addresses impacts of the project on project affected communities, including 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 to project affected communities are fully delivered over an appropriate period of time.

13.1 Background Information

Vastmansland County has a long industrial tradition, especially in iron ore mining and processing, a lower than average per capita income, and a higher than average unemployment. The Kolbäcksån River has long been used for navigation and power generation, for mills and later for electric power, as well as for fishing and recreation. The short stretch of the Kolbäcksån where Semla IV will be located has been bypassed for navigation since the Strömsholm canal was built from 1772, and been used for power generation since the Semla I power plant was built in 1897.

The new project is essentially a modernization project that will maintain and expand the generation capacity. It will not change the operations of the reservoir and the downstream releases, will keep the dam in the current location, and will build new infrastructure on plots that were already owned by or recently purchased by E.ON.

13.2 Detailed Topic Evaluation

13.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment of issues relating to project affected communities has been undertaken with no significant gaps, utilising local knowledge.*

The EIA included a brief assessment of community impacts, based on site visits and discussions with local stakeholders. During construction, the project affects three neighboring families and a number of recreational users who come to the area for fishing, boating, birdwatching, and out of historical interest. During construction there will be temporary access restrictions because the penstock will cross a public road between the town of Fagersta and the village of Ulvsbo, and because there is a public footpath over the dam. There will also be other temporary negative impacts in the immediate vicinity such as noise, traffic congestion, damage to roads, restricted fishing, and water turbidity.

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 assessment is relatively limited in its review of indirect and secondary impacts. For example, access restrictions may not just be an inconvenience for individuals, but may also cause some losses for businesses. Some cabins – for example, the former lock-keeper houses owned by the canal company – may be more difficult to rent out during construction. The creation of jobs, in a working class community with below-average incomes, is of high importance; but local employment and procurement during construction and operation are not reviewed in the EIA. For example, this might include employment in a visitor centre and the induced tourist

trade. The absence of a review of these indirect local socio-economic risks and opportunities, and therefore also plans to address them, is considered a **significant gap** against proven best practices.

Criteria met: No

13.2.2 Management

Analysis against basic good practice

Scoring statement: *Management plans and processes for issues that affect project affected communities have been developed with no significant gaps including monitoring procedures, utilising local expertise when available; and if there are formal agreements with project affected communities these are publicly disclosed*

For a number of issues, management measures are prescribed by regulations, for example for reducing exposure to noise. For others, arrangements have been agreed during consultation; for example, a snowmobile trail has already been relocated to the other side of a road, or during the permitting proceedings in court, for example, for controlling turbidity during construction. For other measures, while E.ON has accepted responsibility in principle, the exact plans will be negotiated in due course. That is the case for access restrictions on the road to Ulvsbo, which can only be usefully discussed when the construction schedule is known.

E.ON will monitor its contractors, and the County Administrative Board will monitor the project to ensure compliance. Local expertise has been used through consultation to define solutions. Formal agreements in public proceedings and with public organisations are disclosed, although this does not apply to private contracts such as the purchase agreement for the plot on which the new powerhouse will be built.

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.*

There are a number of formal monitoring systems in the project (county supervision, ISO 14001 audits, water quality monitoring system, etc), as well as informal supervision through local stakeholders, with whom agreements have been made. Together these would be robust enough to ensure that emerging issues are identified and responded to, with the exception of the indirect local socio-economic impacts, discussed under Section 13.2.1. above.

Criteria met: Yes

13.2.3 Stakeholder Engagement

Analysis against basic good practice

Scoring statement: *Engagement with project affected communities has been appropriately timed and often two-way; ongoing processes are in place for project affected communities to raise issues and receive feedback.*

Consultation processes have been discussed under P-1 and P-5. They have started early and have resulted in a number of suggestions that have been taken up in the project design. Some stakeholders have chosen not to engage actively in the consultation process, presumably because they do not expect impacts relevant to them. This includes the municipality of Fagersta, although they are directly responsible for the project area and the representative of most potentially affected people. The opportunity for raising issues and receiving feedback from E.ON remains in place.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, engagement with project affected communities has been inclusive and participatory; and feedback on how issues raised have been taken into consideration has been thorough and timely.*

The engagement could be more inclusive, and more regular updates could be provided. This gap has been identified under P-1.

Those stakeholders who have been engaged reported a positive experience in dealing with E.ON, with no concerns, for example regarding feedback. The Ulvsbo Road Association, for example, has already provided their non-objection during the permitting process;. Schedules for access restrictions and compensation for possible damage to their road will be negotiated once the requirements for construction and heavy transports are known.

Criteria met: Yes

13.2.4 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.*

Several local stakeholders have personally expressed their support or reported that they do not know of others with negative opinions on the project. Some specific concerns that have been raised will be addressed under P-17 (Cultural Heritage) and P-19 (Biodiversity and Invasive Species). None of these appear to be significant enough to have been raised as objections during the permitting proceedings.

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.*

Several agreements have already been reached, including for example, the agreement to buy the woodland property required for the new power station (conditional upon issuance of the permit), with the property owner. Other agreements will be formalized when possible and required. No stakeholders expressed concern over a risk of not reaching agreement with E.ON, or of E.ON not honouring preliminary verbal agreements.

Criteria met: Yes

13.2.5 Outcomes

Analysis against basic good practice

Scoring statement: *Plans provide for livelihoods and living standards impacted by the project to be improved, and economic displacement fairly compensated, preferably through provision of comparable goods, property or services.*

No economic displacement is caused by the project. As mentioned, the land for the new power plant has been purchased through a normal land transaction ('negotiated settlement'), and the land was not actively used by the previous owner. The project will have hardly any impacts on livelihoods or living standards – possibly some people will be temporarily affected in a minor way (for example, by access restrictions). In fact there may be a small positive impact on livelihoods arising from employment opportunities during construction. Plans to improve affected livelihoods and living standards are not warranted.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition plans provide for livelihoods and living standards that are impacted by the project to be improved with the aim of self-sufficiency in the long-term; and the project contributes to addressing issues for project affected communities beyond impacts caused by the project itself.*

The aim of self-sufficiency is not relevant for the type of communities (which are self-sufficient with or without the project) and living standards impacts in this project.

The project does make a number of small positive contributions to the local community, such as restoring dam safety and improving the ability to operate the canal.

Criteria met: Yes

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

Indirect local socio-economic risks and opportunities have not been reviewed, and therefore there are also no plans to address them.

1 significant gap

13.3 Scoring Summary

The social impacts of the project are similar to those of any construction project and not specific for a hydropower project. The approach taken by E.ON is straightforward and is in compliance with Swedish regulations. It does leave some community members with negative socio-economic impacts or missed socio-economic opportunities, however. The absence of a systematic review of such impacts is considered a significant gap against proven best practice, resulting in a score of 4.

Topic Score: 4

13.4 Relevant Evidence

Interview:	1, 4, 5, 6, 7, 8, 9, 15
Document:	3, 6, 73, 84, 87, 112
Photo:	13, 15, 20, 21, 24, 27, 32, 33, 38, 39, 42, 43

14 Resettlement (P-14)

This topic addresses physical displacement arising from the 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; and that livelihoods and standards of living for resettlees and host communities are improved.

This topic is Not Relevant because Semla IV has will not require any physical displacement.

15 Indigenous Peoples (P-15)

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 is Not Relevant because Semla IV will not affect any peoples that meet the definition of Indigenous Peoples.

16 Labour and Working Conditions (P-16)

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.

16.1 Background Information

E.ON Vattenkraft Sverige staff are based in two offices, in Malmö and Sundsvall. Staff that will oversee implementation of Semla IV are based in these offices, and contractors will be used for civil works, equipment construction and installation, and automation. An operations manager is employed to oversee the operation and maintenance of the cascade, and is based locally. A contractor, currently Maintpartner, is used for operation and maintenance. E.ON Sweden employs 150 staff (FTE, Full-time Equivalent). It is not yet known how many contractors' employees will work on the implementation of Semla IV. Very limited numbers of staff will be engaged in operation and maintenance.

E.ON applies detailed corporate-level occupational health and safety and human-resources management systems, and operates within Sweden's stringent labour laws. The Swedish Work Environment Act (Arbetsmiljölagen) places responsibility for the work environment on the owner, with associated directives concerning construction and installation, and building works.

Please note that this topic concerns both occupational health and safety (OHS) as well as broader human resources (HR) issues.

16.2 Detailed Topic Evaluation

16.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment has been undertaken of human resource and labour management requirements for the project, including project occupational health and safety (OH&S) issues, risks, and management measures, with no significant gaps.*

An assessment of human-resource and labour-management requirements for the project has not been fully undertaken for construction or operation. This is not a significant gap, as E.ON's corporate policies and systems and Swedish law will require various assessments prior to construction, which are integrated into the procedures described under 'Management' below. For example:

- Preparation of 'Work Environment Plans' concerning all aspects of health and safety by contractors; and
- Assessment of E.ON's 'work environment' demands, which concern OHS and HR issues, at pre-qualification, tendering and later stages
- Safety auditing for OHSAS 18001 certification.

In addition, please note that incidents are monitored, enabling compilation of LTIF (Lost Time Incident Frequency) and TRIF (Total Reported Incident Frequency).

E.ON has provided evidence, in the pre-qualification of the provider of turbine equipment, of the assessment of sustainability, including amongst other issues, safety and adherence to E.ON's code of conduct, which includes HR-related commitments such as equal opportunities. Tenderers will be required to assess human-resource and labour-management issues when tendering for the project.

Within E.ON, workforce planning is carried out at the levels of E.ON Sweden and the Hydro Fleet, for example by reviewing competencies etc. This does not extend to contractors.

Criteria met: Yes

Analysis against proven best practice

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

E.ON's policies on labour and working conditions take a broad approach to relevant issues – for example human rights are referred to in the E.ON Responsible Procurement Policy. Monitoring of diversity at the company and functional levels (though not on project level) indicates the broad approach to labour and working conditions.

However it is not clear how E.ON's detailed human resources policies are applied in practice on a project level. For example, whilst E.ON's Code of Conduct is referred to as part of the scope of the pre-qualification audit, it is not clear how the requirements of the Code of Conduct have been assessed. This is a **significant gap** against proven best practice.

Criteria met: No

16.2.2 Management

Analysis against basic good practice

Scoring statement: *Human resource and labour management policies, plans and processes have been developed for project implementation and operation that cover all labour management planning components, including those of contractors, subcontractors, and intermediaries, with no significant gaps.*

E.ON's human resource and labour management policies, plans and processes and Swedish legal requirements will be applied to project implementation and operation. These cover all labour management planning components, including those of contractors, subcontractors, and intermediaries.

E.ON Vattenkraft Sverige's work environment demands (15 in total) apply to contractors, sub-contractors and hired personnel, and concern, for example, conditions and management of critical risks, outstationing of employees, training/competence requirements, participation in meetings, compliance with the Swedish Work Environment Act, and completion documentation.

The work environment demands are reviewed and signed by E.ON and the contractor at each stage, i.e. 'compilation of the inquiry documentation' (prequalification); tender evaluation, contracts, project start meeting, construction meetings, and project completion.

All employees and contractors are required to read and sign the leaflet 'What's your responsibility?', 'a folder about safety and working environment for everyone working at E.ON Hydro Power Stations'.

Interviewees described how E.ON requires that a contractor must have appointed a safety coordinator at the start of the contract, and E.ON's HSE team and Project Manager go through the Work Environment Plan with them. All contractors are required to produce a Work Environment Plan to meet Swedish law. Safety inductions are provided for all new personnel on site, and project-specific rules are set out in the Work Environment plan.

Maintpartner are required, by law, to apply their own OHS system, and would report any accidents or near misses to the Operations Manager and the E.ON Sundsvall Office. On a practical level, during operation, the Operations Manager and Maintpartner carry out monthly safety walks to inspect safety standards, and manuals are held at each plant. Maintpartner would raise issues directly with employees if they observed a non-compliance.

Please note that the prequalification of the turbine supplier identified a non-compliance concerning health and safety at their workshop in Sweden. The absence of a health and safety plan, which is required by law, is a gap

against basic good practice, but is not significant as it has been identified through pre-qualification and E.ON has asked that it is provided.

With respect to E.ON employees and HR issues, union representation and collective agreements provide the basis for HR management. Employees are represented by several unions for blue collar and white collar employees, and agreements are made at the group level: general conditions are agreed every 2 years and more specific agreements more frequently. Training is addressed by the development plan of all employees, and there are compulsory training requirements in some areas (e.g. working at height).

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.*

E.ON HR processes are able to anticipate and provide a response to emerging risks and opportunities, for example: 6 monthly staff appraisals to identify emerging risks concerning retention or opportunities for training; meetings and negotiations with unions; a "Safety F1rst" promotion with associated phone number for raising emerging OHS issues; at least weekly visits by the implementation project manager to the site to oversee contractor's compliance.

The Safety F1rst programme is addressed directly at compiling information on near misses and incidents in order to identify improved practices to reduce lost-time incidents. Interviewees report the difficulty in ensuring that contractors report sufficient near misses (they report zero, which suggests they are under-reporting). Contractors taking short-cuts in safety is reported in the closure reports of recent construction projects. However, this is a problem which is recognised by E.ON, and acknowledged as a challenge at group-level, with a range of measures in place to address it – including the Safety F1rst programme and LTIF indicators being integrated into management-level KPIs (Key Performance Indicators), and targets are set for E.ON Generation and Hydro.

Criteria met: Yes

16.2.3 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.*

All interviewees including union representatives were confident that employees can raise any issues directly with their line managers and get feedback. Each employee has an annual appraisal and 6-monthly catch-ups with their line manager. However there are a number of additional formal processes for raising issues including: union representation; an HR "business partner", i.e. a staff member of the E.ON Sweden HR department designated to E.ON Vattenkraft Sverige; staff surveys (linked to management KPIs); a group-wide whistleblower system; an intranet-based 'Prevent' system of raising issues; and the phone number provided on the safety cards for reporting incidents and accidents. Three or four staff meetings are held each year, with one large staff meeting annually to discuss developments at the E.ON Group level. E.ON has a legal obligation to keep unions informed of any developments that they may be interested in, and holds at least 4 meetings per year between the CEO, HR "business partner" and unions.

Employees can access a broad range of information through the intranet and E.ON workspace, such as union agreements, and the E.ON Nordic 'HR Online', 'My Employment', 'Support', and 'Development TalkTool' (for storing staff development / appraisals) pages. Management meeting minutes are distributed to staff.

Complaints or grievances raised by employees are rare. There is no formal 'grievance mechanism' by which grievances would be recorded. However, serious complaints would be escalated to a Works Council for resolution.

Some of the above also applies to contractors: employees of contractors also have union representation, and can speak to their supervisor on-site to raise issues, or use the Safety F1rst phone number to raise OHS incidents.

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.*

No employees interviewed raised concerns with the thoroughness or timeliness of feedback, and the union representative indicated that E.ON's responses are always very good: problems are solved quickly, questions addressed immediately, and there is an open climate. The positive climate is indicated by very low levels of sick leave.

Criteria met: Yes

16.2.4 Outcomes

Analysis against basic good practice

***Scoring statement:** There are no identified inconsistencies of labour management policies, plans and practices with internationally recognised labour rights.*

There are no identified inconsistencies on the existing operating plant or in the policies and practices that E.ON Vattenkraft Sverige applies and that will be applied to the new plant. E.ON Vattenkraft Sverige's systems for the management of health and safety are certified to the OHSAS 18001: 2007 standard.

One of the biggest issues or concerns for E.ON employees is the retrenchment programme known as E.ON 2.0. The union representative interviewed for this assessment indicated that this programme, despite its obvious difficulty for E.ON employees, has been carried out in a responsible manner.

Criteria met: Yes

Analysis against proven best practice

***Scoring statement:** In addition, labour management policies, plans and practices are demonstrated to be consistent with internationally recognised labour rights.*

Occupational health and safety policies, plans and practices are demonstrated to be consistent with internationally recognised labour rights through certification to OHSAS 18001:2007 standards.

E.ON has not demonstrated that other labour policies, plans and practices meet internationally-recognised labour rights, for example through a separate analysis. However, this is not a significant gap, as E.ON is fully legally compliant in a jurisdiction that has put into force relevant international conventions.[2]

Criteria met: Yes

[2] Sweden has put into force all of the ILO 'fundamental' conventions and the UN Convention on the Rights of the Child, referred to in the IFC Performance Standard (2) on Labour and Working Conditions.

16.2.5 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

It is not clear how E.ON's broad human resources policies are applied in practice on a project level, including to contractors.

1 significant gap

16.3 Scoring Summary

E.ON's corporate policies and systems and Swedish law will require various assessments of labour issues prior to construction. E.ON's human resource and labour management policies, plans and processes and Swedish legal requirements will be applied to project implementation and operation. E.ON's policies on labour and working conditions take a broad approach to relevant issues. Engagement with employees is highly effective and there is a broadly positive climate. Labour management policies, plans and practices are consistent with internationally recognised labour rights. There is one significant gap against proven best practice: it is not clear how E.ON's detailed human resources policies are applied in practice on a project level. This results in a score of 4.

Topic Score: 4

16.4 Relevant Evidence

Interview:	3, 10, 14, 26, 27
Document:	37, 53, 79, 80, 81
Photo:	16, 17, 18, 19

17 Cultural Heritage (P-17)

This topic addresses cultural heritage, with specific reference to physical cultural resources, at risk of damage or loss by the hydropower project and associated infrastructure impacts (e.g. new roads, transmission lines). 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.

17.1 Background Information

The Bergslagen region of southern Sweden is rich in industrial heritage values. A large regional open air museum, the Ekomuseum Bergslagen, includes many historical sites, among them iron mines and works and the canal with its locks at Semla. Sweden was the world's leading iron exporter for centuries, and the Semla mines date back to the 14th century. The canal was built in the 18th century to facilitate trade and was later superseded by railways, but is still maintained for recreational boat traffic. The first cut for the canal at this site was later used as the intake channel for the Semla I plant, built at the end of the 19th century. The Semla dam was built for the Semla II plant at the beginning of the 20th century. The Semla III plant was then added in 1910, to make more effective use of the water. The area is signposted and brochures for self-guided walking tours are available.

Valuable historic buildings and other sites are listed and supervised by the County Administrative Boards and enjoy special protection; owners are eligible for grants. There are about 2,200 protected buildings in Sweden, among them the Strömsholm canal and the Västanfors hydropower station, downstream of Semla. The existing Semla stations are not protected, but are listed in a broader category of 'national interest' sites.

17.2 Detailed Topic Evaluation

17.2.1 Assessment

Analysis against basic good practice

Scoring statement: *A cultural heritage assessment has been undertaken with no significant gaps; the assessment includes identification and recording of physical cultural resources, evaluation of the relative levels of importance, and identification of any risks arising from the project.*

The various cultural heritage assets in the project area have been assessed separately. The history of the Strömsholm canal is well documented, and the Swedish authorities recognize its importance. The Ekomuseum Bergslagen has made its own assessment of the priority sites in the region, and included the Semla area with its canal, iron works, and hydropower stations. The Fagersta municipality has prioritized the Semla area in its historic preservation program. The county has included the stations in its inventory of industrial heritage sites. Archaeological studies have been conducted and several iron works, farm sites, and chapels have been identified; but not on the left bank of the river where the new penstock and power station are to be built.

The EIA includes cultural heritage aspects. A more detailed study of the history, design, heritage value and structural damages of the Semla I-III plants was undertaken in 2012 for E.ON by a group of national experts. The plants are not unique, and an example of an even older power station is already protected some kilometres downstream, at Västanfors. Nevertheless, Semla III is a good example of a working power plant from more than 100 years ago. Further discussions with the County Administrative Board resulted in a recommendation to leave the Semla III powerhouse standing (without its modern attachment from the 1980s, which will be dismantled). The Semla II building has been without machinery since its decommissioning in 1910, and would be very difficult to preserve as one of its walls is part of the dam and needs to be replaced for safety reasons. The historic wooden penstocks can only be preserved in part because of the layout of the new penstock. The Semla I plant was already demolished in the 20th century.

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 assessments and the subsequent discussions with stakeholders have taken all cultural heritage values into account, and have identified potential risks as well as some opportunities for a better preservation and presentation of cultural resources.

Criteria met: Yes

17.2.2 Management

Analysis against basic good practice

Scoring statement: *Plans and processes to address physical cultural resources have been developed for project implementation and operation with no significant gaps; plans include arrangements for chance finds, and ensure that cultural heritage expertise will be on site and regularly liaised with by the project management team during construction.*

The project design has been developed with an understanding of cultural heritage values. No known archaeological sites will be affected. The County Administrative Board will provide supervision as for all construction projects in Sweden that may affect listed cultural heritage (in this case, because the part of the dam that requires rebuilding is directly connected to the embankment dam of the Strömsholm canal). Legal rules for chance finds are the same as for all construction projects in Sweden, and contractors will be required to follow these rules. Cultural heritage expertise will not be permanently on site but will be available if required, which is sufficient. The Semla IV powerhouse is being designed to fit into the historic assemblage, and will receive a building permit from the Fagersta municipality. The project will also rebuild, in the traditional style, a stop log that will permit the Strömsholm canal company to close off the upstream inflow to the canal, for example in order to undertake repairs on the locks.

The visual impact on cultural resources during construction will be temporary. The regular operations of the project will not affect cultural resources. In fact, maintaining an operating power station is in line with the character of the site.

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 are supported by public, formal and legally enforceable commitments.*

The cultural heritage environment is well understood and documented. Structural risks may emerge during the decommissioning and conversion of the Semla III building, but will be directly addressed by the construction contractor. It is unlikely that any additional risks will emerge.

Opportunities for a better preservation and presentation of cultural resources are still under discussion, and plans for the future use of the Semla III powerhouse have not yet been fully developed. It appears that the different parties with a potential interest in the issue (municipality, county, canal company, E.ON, Ekomuseum Bergslagen) are reluctant to take the lead on discussions or make financial commitments. E.ON could take more of a leadership role to facilitate these discussions and develop these plans, which is considered a **significant gap** against proven best practices.

Plans as currently developed are publicly available, as part of the court proceedings and license conditions. Future plans are likely to involve some form of public-private partnership, and would therefore also be made public.

Criteria met: No

17.2.3 Stakeholder Engagement

Analysis against basic good practice

Scoring statement: *The assessment and planning for cultural heritage issues has involved appropriately timed, and often two-way, engagement with directly affected stakeholders; ongoing processes are in place for stakeholders to raise issues and get feedback.*

Directly affected stakeholders are residents and tourists interested in cultural heritage who currently or potentially visit the Semla area, the responsible authorities, and the Strömsholm Canal Company.

E.ON has provided, through the consultation materials and the 2012 study, important information to stakeholders. No problems have been reported in the communication between E.ON and the county and municipal authorities on cultural heritage issues. Communication with the canal company has been productive, resulting in a formal agreement. Upon request by the canal company, E.ON will install a wooden instead of a steel structure, as originally planned.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, engagement with directly affected stakeholders has been inclusive and participatory; and feedback on how issues raised have been taken into consideration has been thorough and timely.*

With a little additional effort, engagement could have been more inclusive, as discussed under P-1. Engagement has been participatory, as evidenced by the solutions found with the county and the canal company. Feedback to stakeholders has been thorough and timely, with the exception of the unresolved plans for the future use of the Semla III building (see Section 17.2.2).

Criteria met: Yes

17.2.4 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.*

Some local stakeholders – including boat club members who cross the dam on the way to their lake cabins – have reportedly been concerned about the demolition of the Semla II building, but been satisfied with the solution of retaining Semla III. No opposition has been raised against the planned measures in the permitting procedures.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, formal agreements with the directly affected stakeholder groups have been reached for cultural heritage management measures.*

A formal agreement has been reached to maintain the Semla III building. No agreement has been reached yet on its future use, but that does not affect the preservation of its cultural value *per se*.

Criteria met: Yes

17.2.5 Outcomes

Analysis against basic good practice

Scoring statement: *Plans avoid, minimise, mitigate, and compensate negative impacts on cultural heritage arising from project activities with no significant gaps.*

All cultural heritage issues have been taken into account in the design of the Semla IV project. The assemblage of cultural heritage assets in the project area will be modified. Some parts will be lost (the Semla II building, most of the wooden penstocks), some will be altered (the dam), and others preserved or improved (the Semla III building, the canal entrance). The overall solution appears to be an acceptable compromise to stakeholders.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, plans avoid, minimise, mitigate and compensate negative cultural heritage impacts with no identified gaps; and contribute to addressing cultural heritage issues beyond those impacts caused by the project.*

Even if the cultural resources are not unique and will be well documented, the fact that some of them are removed without compensation because an alternative solution would be too costly, is a **significant gap** against proven best practice.

The project will re-build a traditional stop log at the entrance to the canal, which helps protect the historic boat locks. There is also an opportunity to improve the presentation of the area's industrial heritage, compared to the pre-project situation, although there is some uncertainty whether it will be realized.

Criteria met: No

17.2.6 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

Neither E.ON or other agencies with heritage responsibilities are leading discussions on the future presentation of the heritage assets in the area.

While the cultural resources in the area are not unique and will be well documented, some of them will be removed without compensation, because an alternative solution would be too costly.

2 or more significant gaps

17.3 Scoring Summary

The Semla area contains a valuable combination of heritage assets. The Semla IV project, while it causes the loss of or changes to some of these assets, could also be an opportunity to improve the overall cultural heritage status of the area. Due to budget restrictions, some options to compensate losses and develop a better visitor experience could not be or have not been realized. A coalition of partners that are responsible for and interested in the area's industrial heritage is probably required to turn the Semla III powerhouse into a museum or visitor centre, and E.ON could play a more active role in assembling this coalition.There are two significant gaps at proven best practice level, resulting in a score of 3.

Topic Score: 3

17.4 Relevant Evidence

Interview:	1, 5, 15, 16
Document:	1, 2, 3, 9, 84, 87, 111, 112
Photo:	3, 4, 5, 6, 15, 24, 25, 27, 30, 32, 35, 36, 40, 41, 42, 47, 48

18 Public Health (P-18)

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, and that improvements in public health can be achieved through the project in project-affected areas where there are significant pre-existing public health issues.

18.1 Background Information

The objectives of the Swedish Environmental Code, under which the permit for Semla IV has been issued, include the protection of human health alongside with the natural environment.

Sweden has one of the best public health records in the world. According to OECD comparisons between member countries, life expectancy at birth is 82 years; the proportions of daily smokers and obese people are only 13% and 11%; and 80% of people report to be in good health. The health care system is primarily run by the counties.

The Semla project is very unlikely to have any permanent effects on public health. As with any construction project, there will be temporary local increases in the levels of traffic and construction noise and air emissions. There will also be a temporary road closure that may affect emergency services, as the alternate route (an old forest road) may take longer.

18.2 Detailed Topic Evaluation

18.2.1 Assessment

Analysis against basic good practice

Scoring statement: *A public health issues assessment has been undertaken with no significant gaps; the assessment includes public health system capacities and access to health services, and has considered health needs, issues and risks for different community groups.*

The EIA covers temporary construction impacts briefly but sufficiently, considering the limited scale of the affected community and impacts. It also covers levels of contamination of water, fish, sediment and soils with heavy metals, which are a legacy of the metal industries in the region. These are covered in more detail in the long-term monitoring programs described under P-21. The EIA does not address the current health system, which is generally known in Sweden, or differentiate according to different community groups. These are not considered significant gaps in this context.

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 EIA assumes that staying within environmental standards will ensure that there are no health impacts. There is no discussion of interactions with other sources of noise, such as the nearby railway line and roads, and their current levels of traffic. The risk from increased time to access emergency services during road closures is not discussed. The EIA also does not address traffic safety (see P-8). The assessment does not take such broad public health considerations and risks into account. Although these risks may be unlikely to materialize, this must be considered a **significant gap** against proven best practice.

Criteria met: No

18.2.2 Management

Analysis against basic good practice

Scoring statement: *Plans and processes to address identified public health issues have been developed for project implementation and operation with no significant gaps.*

Measures to minimize temporary health-relevant impacts are likely to be included in the contractor's EMP. In a recent comparable project (Knislinge), these included rules for noise levels, blasting, vibrations, chemicals and fuels handling, fire protection, waste management, and water protection. Often these refer back to national standards, which all construction projects need to comply with.

The design of the new project effectively reduces the risk of mobilizing contaminated sediment and soils, as discussed under P-5, P-20 and P-21.

Alternative access during road closures is foreseen, and the construction schedule will aim to minimize the time during which the road is closed.

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.*

Sweden maintains a comprehensive health monitoring system. EMPs for construction typically will monitor that noise levels and other impacts in order to remain within regulatory limits. Traffic safety will be monitored by the authorities. Monitoring of water quality is comprehensive, including up to 52 parameters (as described under P-21). Together these monitoring systems will allow the identification of any emerging public health risks and potentially, opportunities in the project area. Construction management, the health system and the river basin management processes will then be able to respond.

Criteria met: Yes

18.2.3 Stakeholder Engagement

Analysis against basic good practice

Scoring statement: *The assessment and planning for public health has involved appropriately timed, and often two-way, engagement with directly affected stakeholders, including health officials and project affected communities; ongoing processes are in place for stakeholders to raise issues and get feedback.*

The impact assessment and permitting process has involved opportunities for engagement with multiple stakeholders, and there are ongoing mechanisms for communications. The main environmental authority, the County Administrative Board, is at the same time also the main health authority. No significant public health issues have emerged.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, engagement with directly affected stakeholders has been inclusive and participatory; and feedback on how issues raised have been taken into consideration has been thorough and timely.*

Engagement with stakeholders that have significant interests in health issues has been participatory, including neighbours, both direct neighbours and those living in Ulvsbo and represented by the road association, and the

county. No issues have been raised specifically on public health for which feedback has been required. There is no indication that engagement has been deficient, apart from the issues discussed under 1.2.3. above.

Criteria met: Yes

18.2.4 Outcomes

Analysis against basic good practice

Scoring statement: *Plans avoid, minimise and mitigate negative public health impacts arising from project activities with no significant gaps.*

The Semla IV project is very unlikely to have any permanent effects on public health. As with any construction project, there will be temporary local increases in the levels of traffic and construction noise and air emissions. However, the typical EMPs for construction together with standard Swedish norms should ensure that these increases do not generate significant temporary public health impacts. The increased time requirement for emergency services is acceptable for a limited period, compared to much longer distances which are commonplace in Sweden.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, plans avoid, minimise, mitigate and compensate negative public health impacts with no identified gaps; and provide for enhancements to pre-project public health conditions or contribute to addressing public health issues beyond those impacts caused by the project.*

There are no measures foreseen to compensate local neighbours for construction impacts, which is the same gap already listed under Section 5.2.4. There are no plans to address pre-existing public health issues or contribute to addressing public health issues beyond those impacts caused by the project. This is not considered a significant gap in the Swedish context, where there are no public health issues that could be effectively addressed through a small hydropower project.

Criteria met: Yes

18.2.5 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 assessment does not take broad public health considerations and risks into account.

1 significant gap

18.3 Scoring Summary

The relevance of the public health topic is limited, as the Semla IV project has small impacts and is embedded in a highly developed public health context. Nevertheless, as is often the case in small infrastructure projects, no special health impact assessment was done and it is assumed that as long as environmental standards are met, health impacts are not relevant. This is considered a significant gap against best practice, resulting in a score of 4.

Topic Score: 4

18.4 Relevant Evidence

Interview:	1, 5, 6, 9
Document:	3, 84, 85, 92,
Photo:	20, 38, 39

19 Biodiversity and Invasive Species (P-19)

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 planned 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, and that biodiversity impacts arising from project activities are managed responsibly.

19.1 Background Information

The population density in the Fagersta municipality is higher (at 48 persons/km^2) than the Swedish average, and the area does not have particularly high conservation values or protected areas. In general, the natural vegetation is forest, in transition between the temperate and boreal biomes. Some of the surrounding area has been declared a 'national interest area' for outdoor recreation and nature conservation, which is a category designed to raise awareness. The direct vicinity of the project has some broadleaf forest with birdwatching opportunities and beavers.

While there are healthy populations of fish in several of the lakes, migration of aquatic species is limited by at least 23 hydropower projects in the river basin (11 downstream of Semla, 10 upstream, and 1 on a downstream tributary). These are not equipped with fish passage facilities; nevertheless some downstream passage occurs through spillways and turbines, and the Strömsholm canal allows some up- and downstream passage when the locks are in operation.

Some invasive aquatic plants and animals are known in Sweden, for example the Signal Crayfish that is replacing the native Noble Crayfish species, and causing significant damages. The project region has been identified as a transition region where Signal Crayfish should be stopped from further expanding north. E.ON Vattenkraft also has some experience with the management of an invasive plant in one reservoir. Dams may act as barriers to the spread of aquatic invasives.

The EU Water Framework Directive (WFD) requires in general that by 2015, waterbodies should achieve 'Good Ecological Status' and 'Good Chemical Status', i.e. close to natural conditions in biological and chemical variables. If waterbodies are categorized as Heavily Modified, which is likely for most rivers used for hydropower production, they should achieve 'Good Ecological Potential'. Implementation of the directive in Sweden has resulted in a programme to classify the status of each waterbody on a five-point scale, ranging from high quality to poor quality. Five regional river basin authorities have been set up to monitor the status of rivers and develop six-year River Basin Management Plans. A consultation on the next generation of these plans, for 2015-2021, including an Action Plan for the Kolbäcksån River, is currently ongoing (November 1, 2014 to April 30, 2015). Achievement of targets is postponed from the original objective of 2015, as in most of the EU.

Research efforts and guidelines for maintaining aquatic biodiversity are coordinated by river basin authorities and the Swedish Agency for Marine and Water Management, all newly established.

Under Swedish law, actions that require changes to licenses and cost owners of hydropower stations with existing licenses more than 5% of revenue need to be compensated by the government, and are thus subject to budget restrictions.

19.2 Detailed Topic Evaluation

19.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment of terrestrial biodiversity; aquatic biodiversity including passage of aquatic species and loss of connectivity to significant habitat; and risks of invasive species has been undertaken with no significant gaps.*

The EIA includes a very brief assessment of impacts on natural values, based on site visits, discussions with local stakeholders, and literature reviews.

The most relevant potential migratory aquatic species on the Kolbäcksån River is the European Eel, which is critically endangered partly because of lost habitat access, due to dams. Eel is currently stocked in the lakes. Eel and trout are mentioned in the Semla IV EIA, but the barrier effect of the dam is not discussed. This is not a significant gap at the basic good practice level, as the project will not alter the conditions for these species.

Invasive species issues are not mentioned in the Semla IV EIA, and not addressed in the 2015-2021 Action Plan for the Kolbäcksån River. This is not a significant gap at the basic good practice level, as the project will not alter the conditions for these species.

The river basin authorities have established a countrywide monitoring system to guide and track progress towards the WFD objectives. The relevant stretches of the Kolbäcksån River, upstream of the dam and between the Semla and Fagersta dams, are currently classified as of 'moderate ecological status'. The biological quality is high, especially with regards to zoobenthos, while fish are affected by the moderate hydromorphological quality, because of flow alterations and connectivity loss.

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 EIA addressed biodiversity issues only in general terms, by referring to some fish species, a rich birdlife, and areas of interesting fauna and flora. Some risks and opportunities, while they may not have been identified in the EIA document, were raised during the consultation and permitting process. For example, it was realised that resident dippers would lose their nesting platform under the Semla II building, but that once the Semla III station is decommissioned, a comparable nesting opportunity can easily be provided.

There is no assessment of issues of fish passage. The Kammarkollegiet (the agency tasked with representing the public interest in licencing proceedings) requested an expert opinion on fish passage, but this was denied by the court. This is understandable from a legal point of view, considering the license conditions, and because a fish passage on a single dam would currently have a very minor benefit due to the many other migration barriers on the Kolbäcksån River. But it is a missed opportunity to assess the longer term potential for restoring fish passage (see 'Management' below).

The lack of a broader assessment of biodiversity and identification of longer-term risks and opportunities, for example risks from climate change and invasive species, or opportunities resulting from the WFD process or for river restoration, is a **significant gap**.

Criteria met: No

19.2.2 Management

Analysis against basic good practice

Scoring statement: *Plans and processes to address identified biodiversity issues have been developed for project implementation and operation with no significant gaps.*

At the level of the Semla project, as no biodiversity issues have been identified, there are also no plans to address such issues, with one minor exception: the relocation of a breeding shelf for the dipper from under the Semla II building (to be demolished) to the Semla III building (to be retained). There will also be a benefit for downstream fish survival from the use of a relatively slow-moving Kaplan turbine.

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 commitments in plans are public, formal and legally enforceable.*

At the level of E.ON's entire Swedish hydropower fleet, there are recent examples for other projects with biodiversity conservation measures, principally with regards to upstream and downstream fish passage. For example, there has been some success with modifying trash racks to facilitate downstream eel passage, on the Ätran River, and with bypass channels on the Faxälven River. Also on the Faxälven River, E.ON in cooperation with the responsible river basin authority established a list of projects that would be most desirable ecologically and most feasible economically, to achieve good ecological potential.

On the Kolbäcksån, currently projects are modernized one by one, without considering fish passage, as recently on the Fagersta dam, and now the Semla dam. The authorities have postponed the WFD requirement to achieve "good ecological status" to 2021, and the Land and Environment Court concluded that Semla IV will not preclude the goal of "good ecological status" to be achieved by 2021. As a consequence, no decisions on fish passage restoration covering the whole river have been taken. A disadvantage of this approach is that the costs of retrofitting fish passage on an operating dam are likely to be higher than installing one while the dam is being rebuilt (both construction costs and also the cost of generation capacity that will be larger than necessary in the future if water is diverted over a fish ladder) and these higher costs may preclude future changes if they outweigh the benefits of fish passage.

It is uncertain at this stage how the management objective of 'good ecological status' is to be met by 2021, whether the Semla project would require modifications, and how the barriers of 'excessive costs' and 'technical impossibility' would be overcome during the upcoming planning cycle. These uncertainties are due to a lack of action plans for which E.ON is not responsible, although E.ON is closely working with the authorities on guidelines and river basin management plans in general. Nonetheless, these uncertainties are a **significant gap** against proven best practice.

Criteria met: No

19.2.3 Outcomes

Analysis against basic good practice

Scoring statement: *Plans avoid, minimise, mitigate, and compensate negative biodiversity impacts arising from project activities with no significant gaps.*

Because the Semla IV project does not increase negative biodiversity impacts compared to the existing Semla III project, there is no need for mitigation action, except for the minor issue of replacing a nesting facility for the dipper. The only possible exception is the lengthening of the dry riverbed by ca. 100 m, which is not seen as a significant impact.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, plans avoid, minimise, mitigate and compensate negative biodiversity impacts due to project activities with no identified gaps; and plans provide for enhancements to pre-project biodiversity conditions or contribute to addressing biodiversity issues beyond those impacts caused by the project.*

There are no significant impacts compared to the existing project, so no compensation is required. Any impacts due to the lengthening of the dry riverbed are minor, as the riverbed was cleared before and has lost some of its diversity and habitat value. The expected increased survival rate through the turbine for aquatic species migrating downstream, contributes to the maintenance of aquatic biodiversity.

There are no plans that contribute to addressing biodiversity issues beyond those impacts caused by the project, but this gap is addressed under Management.

Criteria met: Yes

19.2.4 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 broader assessment of biodiversity and identification of longer-term risks and opportunities, for example from climate change, invasive species, and river restoration.

It is uncertain at this stage how the management objective of 'good ecological status' is to be met by 2021 and unclear whether Semla IV, as currently designed, would make future changes more costly.

2 or more significant gaps

19.3 Scoring Summary

The project region is not currently known for high biodiversity, and the Semla IV project has only some minor positive and negative biodiversity impacts. However, Sweden has ambitious objectives for restoring its rivers, including their biological quality, in line with the EU Water Framework Directive. A potential contribution to these objectives has not been analysed, and there is some uncertainty about the future changes on the Kolbäcksån River, and how the project will be affected by them. There are two significant gaps against proven best practice, resulting in a score of 3.

Topic Score: 3

19.4 Relevant Evidence

Interview:	1, 8, 19, 21, 28
Document:	3, 63, 64, 82, 84, 100, 101, 102, 103, 108, 109, 110, 114, 115, 116, 117
Photo:	27, 31,36, 43, 44, 46

20 Erosion and Sedimentation (P-20)

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, and that external erosion or sedimentation occurrences which may have impacts on the project are recognised and managed.

20.1 Background Information

The upper watershed of the Kolbäcksån River is mostly forested and experiences little erosion, and the river also flows through a series of natural lakes upstream as well as downstream of Semla, where any remaining sediment load gets deposited, so that turbidity is overall very low. Some of the lake sediments are known to be contaminated with heavy metals, a result of the industrial history. In the immediate vicinity of Semla, the river flows largely over bedrock. There has been very little erosion in the past centuries, judging from the stable conditions of the riverbanks and the built infrastructure, such as the banks of the Strömsholm canal. The only relevant erosion and sedimentation issue appears to be potentially increased turbidity during the construction phase.

20.2 Detailed Topic Evaluation

20.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An erosion and sedimentation issues assessment has been undertaken with no significant gaps; the assessment identifies impacts that may be caused by the project, issues that may impact on the project, and establishes an understanding of the sediment load and dynamics for the affected river system.*

Increased turbidity during construction has been assessed in the EIA as a minor and temporary impact.

During operation, experience shows that there is hardly any sediment accumulation in front of the Semla dam. Periodic floods during the spring snowmelt season would flush out any sediment deposits, at least to the level of the spillway crest.

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 project-level assessment in the EIA is limited to an analysis of issues during the construction period, which is appropriate given the absence of sediment and erosion problems on the river stretch between the upstream Vevungen and the downstream Flogen lakes, and the fact that the Semla project has no erosion and sedimentation impacts during operation.

At the level of the river basin, the studies and action plans that have been undertaken to implement the WFD have looked at morphological and sediment issues, and identified a number of areas where improvements are possible.

Criteria met: Yes

20.2.2 Management

Analysis against basic good practice

Scoring statement: *Plans and processes to address identified erosion and sedimentation issues have been developed for project implementation and operation with no significant gaps.*

Construction works will be undertaken preferably during low flows and under dry conditions, behind cofferdams and caissons, so that minimal increased turbidity is expected. This has been successfully practiced in other projects, for example the recent Knislinge project. Any increased sediment load would likely settle out immediately downstream, in the Flogen lake.

The direction of the tailrace channel has been chosen to prevent local erosion problems during operation. In any case, since there is no sediment near the tailrace, there is no risk of disturbing any potentially contaminated sediment.

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.*

Construction guidelines and supervision should ensure that turbidity remains low. In the longer run, water quality monitoring along the Kolbäcksån River also will be able to detect any increases in erosion and sedimentation, as well as possible sources. The river management framework established under the WFD would then be able to respond to any risks and opportunities.

Criteria met: Yes

20.2.3 Outcomes

Analysis against basic good practice

Scoring statement: *Plans avoid, minimise and mitigate erosion and sedimentation issues arising from project activities and erosion and sedimentation issues that may impact on the project with no significant gaps.*

Plans as described above will ensure that any significant issues are avoided.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, plans avoid, minimise, mitigate and compensate erosion and sedimentation issues due to project activities with no identified gaps; and plans provide for enhancements to pre-project erosion and sedimentation conditions or contribute to addressing erosion and sedimentation issues beyond those impacts caused by the project.*

There are no identified gaps in the handling of erosion and sedimentation issues. While it is technically possible to build sedimentation basins to allow settling out of some turbid water, which needs to be pumped out from behind the caissons and cofferdams, these measures would create other environmental issues and are not reasonable as the turbidity impacts would only be noticeable in the short stretch to the Flogen lake downstream.

The project does not enhance the pre-project situation or contribute to addressing external issues, which is considered a **significant gap** against proven best practices. Given the situation in the project area, such issues could probably only refer to remediation of contaminated sediments, which has been identified as a priority under the 2015-2021 action plan for the river.

Criteria met: No

20.2.4 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 plans to contribute to addressing external issues, such as the remediation of contaminated sediments.

1 significant gap

20.3 Scoring Summary

The Kolbäcksån River carries little sediment and shows no major erosion issues, at least in the stretch between the Vevungen and Flogen lakes. The project may cause some minor and temporary increases in turbidity, which are well managed. It makes no intent to address erosion and sedimentation issues beyond its own impacts. This is considered a significant gap against best practices, resulting in a score of 4.

Topic Score: 4

20.4 Relevant Evidence

Interview:	1, 7, 8, 13, 19, 28
Document:	3, 84, 103, 114
Photo:	21, 29

21 Water Quality (P-21)

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.

21.1 Background Information

Water at the Semla plants comes from a 2,200 km^2 large catchment that is largely forested but includes some towns, historic and current industrial sites, and agricultural areas. Like in many regions in Sweden, the surface waters in the upper catchments are nutrient poor and therefore poorly buffered against acidification. Most lakes are limed regularly. Water quality is generally moderate to good, as shown by monitoring commissioned by the Kolbäcksån Vattenförbund for many years. Some cabins use drinking water directly from the lakes above Semla, with filtration as the only treatment. Most industrial sites are downstream of Semla, and only a few are upstream, at a significant distance across the Barken lakes. The Kolbäcksån River is one of the tributaries to Lake Mälaren, the main drinking water source for Stockholm.

All three turbines in the existing Semla III station are oil-lubricated. Two were installed in 1910 and one in 1988, and only the last one has an oil filter. The risk of oil leakage generally increases with age.

21.2 Detailed Topic Evaluation

21.2.1 Assessment

Analysis against basic good practice

Scoring statement: *A water quality issues assessment has been undertaken with no significant gaps.*

The EIA includes an assessment of water quality issues, according to which the Semla project has no impact on water quality during regular operations. It could have temporary impacts either from accidents such as oil and chemical spills, or during construction of the new Semla IV plant.

The project is embedded in a comprehensive system to evaluate water quality on the Kolbäcksån River. On behalf of the Vattenförbund, the Swedish University of Agricultural Sciences (Department of Aquatic Sciences and Assessment) monitored 11 lakes and 10 watercourses in the basin during the period 1997-2010. The programme comprised physical, chemical and biological parameters. The sampling was carried out monthly in the watercourses, while the lakes were sampled two times a year. Results from all monitoring points are available online (for Semla, showing series for 52 parameters at http://info1.ma.slu.se/ma/www_ma.acgi$Station?ID=Intro&S=581). Since 2011, the Vattenförbund has commissioned ALcontrol Laboratories AB to continue the sampling programme and publish the results.

The river basin authorities have established a countrywide monitoring system to guide and track progress towards the WFD objectives. In the EIA, the relevant stretches of the Kolbäcksån River, upstream of the dam and between the Semla and Fagersta dams, are classified as of 'good chemical status' (excluding mercury, which is a concern in all parts of the basin). In the latest documents, the action plans for 2015-2021, the stretch upstream of the dam (southern and northern Barken lakes) has been downgraded to 'moderate chemical status', because of contamination with polycyclic aromatic hydrocarbons (PAHs) and heavy metals (primarily zinc).

Criteria met: Yes

Analysis against proven best practice

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

Regarding water quality during construction, the assessment is based on experience with many comparable projects.

For assessing water quality during operations, the project relies on the water quality monitoring programmes described above, which are part of Sweden's exceptionally thorough system for nation-wide, long-term programs to monitor and respond to problems in water quality.

Criteria met: Yes

21.2.2 Management

Analysis against basic good practice

Scoring statement: *Plans and processes to address identified water quality issues have been developed for project implementation and operation with no significant gaps.*

Turbidity control measures during construction have been agreed in coordination with the County Administrative Board. Works on the dam and the tailrace channel will be conducted in a dry environment, protected by caissons or cofferdams. Turbidity is addressed in more detail under P-20.

All the turbine runners currently operated by E.ON on the Kolbäcksån River are oil lubricated. All of them, except the two oldest ones in the Semla III powerhouse, have oil collectors. The three units of Semla III will now be replaced with one water-lubricated turbine.

The EU WFD, as discussed under P-19, requires the achievement of Good Chemical Status by 2015 or, under certain conditions, at a later stage. It also requires at least maintaining a status once it has been achieved. Action plans for this purpose have been developed.

There are no particular use restrictions in place in the Semla area that are related to water quality. For example, despite possible mercury bioaccumulation, there are no restrictions on or advisories against the consumption of fish and crayfish in the upstream and downstream lakes.

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.*

E.ON is continuing to investigate and apply new technologies and new construction methods to protect water quality. Construction guidelines and supervision should ensure that no water significant water contamination occurs. Monitoring along the Kolbäcksån River that is organised by the Vattenförbund will be able to detect any changes in water quality, as well as possible sources of contamination, and the WFD process will provide a framework for setting objectives and responding.

Criteria met: Yes

21.2.3 Outcomes

Analysis against basic good practice

Scoring statement: *Plans avoid, minimise and mitigate negative water quality impacts arising from project activities with no significant gaps.*

There are no impacts on water quality during regular operations. The turbine technology reduces the risk of accidental oil leakage. The project design, construction methods and the EMP will effectively reduce the risk of temporary impacts and accidents during construction and operations.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, plans avoid, minimise, mitigate and compensate negative water quality impacts with no identified gaps; and plans provide for enhancements to pre-project water quality conditions or contribute to addressing water quality issues beyond those impacts caused by the project.*

Plans will effectively deal with all water quality impacts.

The project enhances the pre-project situation by reducing the risk of oil leakage, which is significant given the age of the turbines in Semla III.

Criteria met: Yes

21.2.4 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

21.3 Scoring Summary

The water quality situation in the project area is mixed, with a number of concerns that are, however, not related to the small hydropower stations operated by E.ON. Monitoring of water quality is exemplary and plans to ensure 'good chemical status' under the WFD is driving the development of plans to improve water quality Semla IV will not have negative impacts and will contribute to reducing one contamination risk, from turbine lubricants. There are no significant gaps against best practice, resulting in a score of 5.

Topic Score: 5

21.4 Relevant Evidence

Interview:	1, 7, 8, 19, 28
Document:	3, 29, 77, 84, 103, 106, 107, 108, 114, 116
Photo:	none

22 Reservoir Planning (P-22)

This topic addresses the planning for management of environmental, social and economic issues within the reservoir area during project implementation and operation. The intent is that the reservoir will be well managed taking into account power generation operations, environmental and social management requirements, and multi-purpose uses where relevant.

22.1 Background Information

The Vevungen lake upstream of the Semla project is connected to the much larger southern and northern Barken lakes, with a total surface area of 34 km^2. Flows between the lakes are constrained by narrows. The outflow of the Vevungen lake is controlled by a natural barrier, which was slightly raised in the 18^{th} century to facilitate boat traffic into the Strömsholm canal. Downstream of this barrier is the headpond of the Semla dam. At low flows, the water level in the headpond equals the level in the Vevungen lake. At high flows, because of the narrows and natural barriers, levels in the lakes are higher. Therefore, the Semla dam has only a very limited role in flood control, especially not over significant floods, such as during the 1977 and 1935 spring snowmelt, when lake levels rose to unprecedented levels and many houses and other facilities, including hydropower projects, were damaged.

The main objectives of the reservoir operations are to contribute to a relatively even lake water level throughout the seasons, with a slightly lower headpond level during the spring flood to reduce backwater effects and facilitate outflow from the lake, and a slightly higher level during the summer to facilitate boating and other lake uses. The water level in the headpond is regulated in the licence, remains within a range of less than 1 m, and will remain unchanged when Semla III is replaced by Semla IV. There is no direct access to the headpond, as boats are not allowed beyond the pedestrian bridge adjacent to the entrance to the canal; boating safety is addressed under P-8.

The lake levels on the Kolbäcksån River have been regulated for centuries, even before the first hydroelectric dams, for mills and canals. Most of the hydroelectric facilities are run-of-river projects with minor water level variations, within narrow bands determined by license conditions. The Vattenförbund discusses, among other things, operations in the larger reservoirs from a flood management perspective.

22.2 Detailed Topic Evaluation

22.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment has been undertaken of the important considerations prior to and during reservoir filling and during reservoir operations, with no significant gaps.*

Because the reservoir remains filled during project implementation, an assessment is only required for the operational stage. E.ON has accepted the long-existing, narrow constraints that will apply during operation and that were defined for environmental and social reasons.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, the assessment is based on dialogue with local community representatives, and takes broad considerations, risks and opportunities into account.*

During project preparation, community representatives reiterated their interest in maintaining the current operational rules, which have worked well from their perspective.

An assessment of broad considerations, risks and opportunities might have concerned risks that replacing three units with one would result in more frequent fluctuations in the level of the headpond, or opportunities for increased generation with revised operational rules and the related risks of a larger headpond. These issues have not been assessed, but this is not a significant gap as there are good reasons to conclude that an assessment would not offer any benefits: (a) there are no risks of more frequent fluctuations in the level of the headpond because the modern Kaplan turbine can be run efficiently at different flows; (b) small storage capacity in the headpond constrains opportunities for additional generation; (c) the licensing conditions would have to be changed if a different operational regime was sought, which would be impossible within the Swedish regulatory environment; and (d) Semla is required to release water according to a plan agreed with the plants downstream in the cascade.

Criteria met: Yes

22.2.2 Management

Analysis against basic good practice

Scoring statement: *Plans and processes to manage reservoir preparation, filling and operations have been developed.*

The reservoir does not require preparation and filling: it will remain filled during the reconstruction of the dam. Plans for operations are contained in the original license, will remain unchanged, and have been confirmed through the recent permitting proceedings. The existing and the future power station are and will be remotely controlled, and water levels are continuously measured to remain within the prescribed limits.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, reservoir plans are based on dialogue with local community and government representatives; and processes are in place to anticipate and respond to emerging risks and opportunities.*

The narrow bands for water level management in the reservoir are a response to community interests, such as the continued operation of the Strömsholm canal and recreation on the upper lakes.

For example, on the southern Barken lake alone, there are 138 cabins – some of them ca. 100 years old – the owners of which are member of a boat club. The club is one of the more active stakeholders in discussions with E.ON, and its main concern is the maintenance of constant water levels. Even so, boat club representatives may only approach E.ON about once a year, as the reservoir level rules have long been established. Reservoir levels will not be affected by the Semla IV construction and operation.

The Barken fishing association, which manages fishing on the upper lakes on behalf of ca. 700 owners of fishing rights, is also interested in stable lake levels, both to maintain a productive natural habitat and because of the benefits for lakeshore residents and lake users. Again, there is a functional but infrequent interaction with E.ON.

E.ON, the boating and fishing associations, and many other river users are members of the Vattenförbund, which is a forum to discuss and as far as possible, resolve emerging risks and opportunities. Other processes include the periodic action plans under the WFD, and the possibility to review and modify licenses through the Land and Environment Courts.

Criteria met: Yes

22.2.3 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

22.3 Scoring Summary

The small Semla headpond is not operated to maximize power generation, but to help maintain upstream lake levels within a narrow band. This reflects the extensive human use of the lakes, which takes precedence. The current rule curves are the result of long-standing agreements to which all users and residents on the lake have adapted. Cooperative arrangements are in place between municipalities and major water users on the river, including E.ON, to discuss seasonal water management issues such as flood management. Any changes in fluctuations of the headpond, compared to the current regime, will be minor. There are no significant gaps against best practice, resulting in a score of 5.

Topic Score: 5

22.4 Relevant Evidence

Interview:	1, 4, 5, 6, 7, 8, 9, 13, 15, 19, 28
Document:	3, 45, 84, 87, 103, 107, 114, 115
Photo:	7, 8, 10, 21, 22, 23, 28, 36, 45

23 Downstream Flow Regimes (P-23)

This topic addresses the flow regimes downstream of hydropower project infrastructure in relation to environmental, social and economic impacts and benefits. The intent is that flow regimes downstream of hydropower project infrastructure are planned and delivered with an awareness of and measures incorporated to address environmental, social and economic objectives affected by those flows.

23.1 Background Information

Flows from the Vevungen lake upstream of the Semla project reach the downstream Flogen lake through four waterways:

1. On the left bank, the intake, penstocks, powerhouse and tailrace of the project. These will be changed from the Semla III to the Semla IV project. The maximum flow – 35 m^3/s – will remain the same, however.
2. The original course of the Kolbäcksån River, immediately downstream of the dam, which only receives water when the Semla dam spills. The current bypass stretch is approximately 200 m long, which will increase to approximately 300 m once Semla III is replaced by Semla IV and the water will re-enter the riverbed approximately 100 m further downstream.
3. The so-called 'trout brook', between the river course and the canal. This is an artificial channel that was cut as the first boat canal, and later used as the headrace for the Semla I plant. It receives a continuous flow of 50 l/s, currently largely from seepage and in the future from a controllable release valve in the dam.
4. On the right bank, the current Strömsholm canal. The intake for this canal is several hundred meters upstream of the dam. The canal company intends to rebuild the pier that directs the flow into this intake. The waterway has some continuous leakage through the locks, and in the summer season when the locks are in operation, water may be released several times a day from the chambers.

All flows go directly into Flogen lake, the level of which is controlled by the next dam 2 km downstream, the Fagersta dam. The lake is kept within a small range at all times, because it is a source of industrial process water for metal industries in Fagersta. It is used much less frequently than the upstream lakes, mainly by boats that pass through between two sections of the canal, and for crawfish fishing. The design flow at the Fagersta power plant and the two next downstream plants, all owned by E.ON, is also 35 m^3/s.

23.2 Detailed Topic Evaluation

23.2.1 Assessment

Analysis against basic good practice

Scoring statement: *An assessment of flow regimes downstream of project infrastructure over all potentially affected river reaches, including identification of the flow ranges and variability to achieve different environmental, social and economic objectives, has been undertaken based on relevant scientific and other information with no significant gaps.*

Impacts are very minor, and changes are limited to a 100 m stretch of the riverbed between the present and the future tailrace, which will be filled with still water instead of flowing water as at present, except when the dam is spilling. This stretch probably has no important ecological function, and the main impact is the visual change for people crossing the road bridge between the present and the future tailrace. The absence of discussion of this impact in the EIA is not considered a significant gap at the level of basic good practice.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, the assessment is based on field studies, and takes broad considerations, risks and opportunities into account.*

No field studies appear to have been undertaken to assess the impacts of the changes in flows in the bypass stretch, or to determine the permanent flow of 50 l/s for the trout brook. Visual considerations have not been assessed. Although this is understandable given the scale of the impact, it must be considered a **significant gap** against proven best practice.

Criteria met: No

23.2.2 Management

Analysis against basic good practice

Scoring statement: *Plans and processes for delivery of downstream flow regimes have been developed that include the flow objectives; the magnitude, range and variability of the flow regimes; the locations at which flows will be verified; and ongoing monitoring; and where formal commitments have been made, these are publicly disclosed.*

Because the upstream lake is not actively used for storage, but kept at predetermined seasonal levels (see P-22), flows are essentially natural flows and influenced by the project only in the stretch between the two lakes. Minor flows are released through the canal and the trout brook for environmental and recreational purposes. The bypass stretch remains dry whenever the flow at the dam is below 35 m^3/s.

During construction, there will be a period of several months during which no water is diverted through the penstocks, and the dam will spill continuously.

The flows in the two relevant stretches downstream of the Semla dam – in the bypass stretch and the trout brook – have been determined through a very simple process. For the trout brook, a regular flow of 50 l/s is assumed on the basis of historic flows through that watercourse. The valve through which that flow is released, however, can be regulated to allow for later adjustments if they should become desirable. For the bypass stretch, flows will be either any river flows above 35 m^3/s, or the complete river flow during construction or when the single turbine in Semla IV is shut down during operation. For monitoring, flow measurements in the powerhouse are sufficient. Commitments to these flows are contained in the license and the EIA, and hence they are formal and 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; and commitments in plans are public, formal and legally enforceable.*

There is also a process in Sweden to review operating licenses, which could be used in principle if any risks or opportunities emerged. E.ON has reviewed environmental flow releases in other projects where there were significant possible gains (for example a pristine riverbed with high ecological values if provided with more water). However, in the case of Semla this is unlikely as there are no obvious risks or opportunities on the short bypass stretch. Current arrangements are legally enforceable as well as public and formal.

Criteria met: Yes

23.2.3 Stakeholder Engagement

Analysis against basic good practice

Scoring statement: *The assessment and planning process for downstream flow regimes has involved appropriately timed, and often two-way, engagement with directly affected stakeholders; ongoing processes are in place for stakeholders to raise issues with downstream flow regimes and get feedback.*

The impact assessment and permitting process has involved appropriately timed opportunities for engagement with multiple stakeholders, and there are ongoing mechanisms for communications with stakeholders. The fact that downstream flows have not been raised as an issue during this process shows that they are of minor relevance. Some invited downstream groups (for example, the fishing association of Flogen lake) did not attend the consultation meetings.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, engagement with directly affected stakeholders has been inclusive and participatory; and feedback on how issues raised have been taken into consideration has been thorough and timely.*

No issues appear to have been raised by stakeholders regarding downstream flows.

As discussed under P-1 (Communications and Consultations), the engagement process could have been more inclusive. This gap will not be double counted. There are no indications that any additional stakeholders or any additional issues regarding downstream flows would have come forward.

Criteria met: Yes

23.2.4 Outcomes

Analysis against basic good practice

Scoring statement: *Plans for downstream flows take into account environmental, social and economic objectives, and where relevant, agreed transboundary objectives.*

The flow arrangements have taken a number of different objectives into account. In the bypass stretch these are primarily economic objectives, in the trout brook environmental objectives.

Criteria met: Yes

Analysis against proven best practice

Scoring statement: *In addition, plans for downstream flow regimes represent an optimal fit amongst environmental, social and economic objectives.*

There are no indications for an optimization process in the determination of the flows, that would have looked at alternative flow arrangements. For example, the benefits of leaving a residual aesthetic flow in the bypass stretch at all times could have been compared to the costs in terms of reduced generation. This is considered a **significant gap** against proven best practice.

Criteria met: No

23.2.5 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

No field studies appear to have been undertaken to assess the impacts of the changes in flows in the bypass stretch, or to determine the permanent flow of 50 l/s for the trout brook. Visual considerations have not been assessed.

There are no indications for an optimization process in the determination of the flows, that would have looked at the costs and benefits of alternative flow arrangements.

2 or more significant gaps

23.3 Scoring Summary

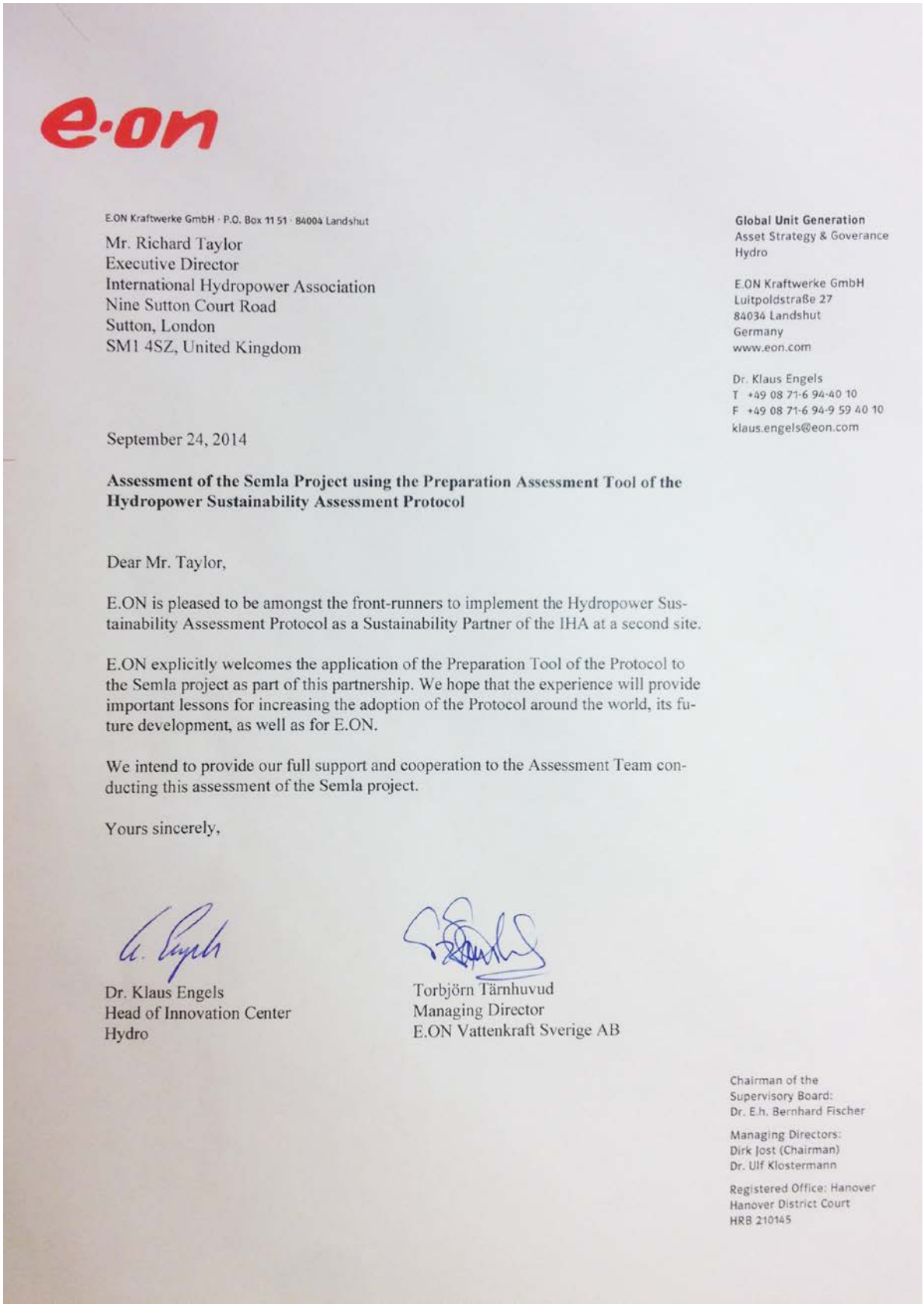
Due to the physical arrangements in the short river stretch between the upstream and downstream lakes, downstream flows are of minor relevance and will experience minor changes when Semla III is replaced by Semla IV. No effort has been made to study the effect of these changes, or to optimize flows. This may be a reasonable decision, and any identified gaps need to be interpreted in that context. There are two significant gaps against best practice, resulting in a score of 3.

Topic Score: 3

23.4 Relevant Evidence

Interview:	1, 4, 5, 6, 7, 8, 9,13, 15, 19, 28
Document:	45, 87, 103, 105, 107, 114, 115
Photo:	10, 24, 25, 29, 31, 34, 40, 46

Appendix A: Written Support of the Project Developer



E.ON Kraftwerke GmbH · P.O. Box 11 51 · 84004 Landshut

Mr. Richard Taylor
Executive Director
International Hydropower Association
Nine Sutton Court Road
Sutton, London
SM1 4SZ, United Kingdom

Global Unit Generation
Asset Strategy & Goverance
Hydro

E.ON Kraftwerke GmbH
Luitpoldstraße 27
84034 Landshut
Germany
www.eon.com

Dr. Klaus Engels
T +49 08 71-6 94-40 10
F +49 08 71-6 94-9 59 40 10
klaus.engels@eon.com

September 24, 2014

Assessment of the Semla Project using the Preparation Assessment Tool of the Hydropower Sustainability Assessment Protocol

Dear Mr. Taylor,

E.ON is pleased to be amongst the front-runners to implement the Hydropower Sustainability Assessment Protocol as a Sustainability Partner of the IHA at a second site.

E.ON explicitly welcomes the application of the Preparation Tool of the Protocol to the Semla project as part of this partnership. We hope that the experience will provide important lessons for increasing the adoption of the Protocol around the world, its future development, as well as for E.ON.

We intend to provide our full support and cooperation to the Assessment Team conducting this assessment of the Semla project.

Yours sincerely,

Dr. Klaus Engels
Head of Innovation Center
Hydro

Torbjörn Tärnhuvud
Managing Director
E.ON Vattenkraft Sverige AB

Appendix B: Verbal Evidence

Ref	Interviewee/s, Position	Organization	Department	Date	Location	Interviewer(s)
1	Roland Kristofferson, Plant Manager / Jonas Andren, Head of Communications / Ake Henriksson, Specialist Real Estate and Permits / Johan Tielman, Head of Environmental Management / Johan Jingskog, Head of Safety / Oscar Janderberg, Project Manager / Lennart Olsson, Project Consultant / Ingemar Jansson, Procurement Expert	E.ON Vattenkraft Sverige AB	-	10.11.14	Malmö	Doug Smith, Joerg Hartmann
2	Oscar Janderberg, Project Manager / Ingemar Jansson, Procurement Expert	E.ON Vattenkraft Sverige AB	River Group South / Procurement	10.11.14	Malmö	Doug Smith
3	Johan Jingskog, Head of Safety	E.ON Vattenkraft Sverige AB	Safety and Risk	10.11.14	Malmö	Doug Smith
4	Ake Henriksson, Specialist Real Estate and Permits / Jonas Andren, Head of Communications / Johan Tielman, Head of Environmental Management / Lennart Olsson, Project Consultant	E.ON Vattenkraft Sverige AB	Real Estate and Water Permits / Communications / Environmental Management / River Group South	10.11.14	Malmö	Joerg Hartmann
5	Per Andersson and Pasi Koskinen	Neighbours	Private individuals	11.11.14	Fagersta	Joerg Hartmann, Doug Smith
6	Karin Hedström and Jon Rehdin	Neighbour and friend of neighbour	Private individual	11.11.14	Fagersta	Joerg Hartmann, Doug Smith
7	Thomas Flink, Chairman	Fagersta Boat Club	--	11.11.14	Fagersta	Joerg Hartmann
8	Bengt Rönning, Chairman	Barken Fishing Association	--	11.11.14	Fagersta	Joerg Hartmann
9	Jan Erik Bäckgren, Treasurer	Ulvsbo Road Association	--	12.11.14	Fagersta	Joerg Hartmann
10	Roine Fransson, Operations Manager	E.ON Vattenkraft Sverige AB	River Group South	11.11.14	Fagersta	Doug Smith
11	Ake Henriksson, Specialist Real Estate and Permits	E.ON Vattenkraft Sverige AB	Real Estate and Water Permits	11.11.14	Fagersta	Doug Smith
12	Jonas Andren, Head of Communications	E.ON Vattenkraft Sverige AB	Communications	11.11.14	Malmö	Doug Smith
13	Roine Fransson, Operations Manager	E.ON Vattenkraft Sverige AB	River Group South	12.11.14	Fagersta	Joerg Hartmann
14	Lars Gustafsson, Head of O&M Semla	Maintpartner	O&M	12.11.14	Fagersta	Doug Smith
15	Carina Janzon, Managing Director	Strömsholms Canal Company	--	12.11.14	Fagersta	Joerg Hartmann
16	Kerstin Fogelberg, Antiquarian	Västmanland County Administrative	Department of Cultural Affairs	12.11.14	Telephone interview	Joerg Hartmann

		Board				
17	Oliver Müssig	Global Unit Generation E.ON Kraftwerke GmbH	Asset Risk and Governance Hydro	12.11.14	Fagersta	Doug Smith
18	Jonas Andren, Head of Communications	E.ON Vattenkraft Sverige AB	Communications	12.11.14	Malmö	Joerg Hartmann
19	Johan Tielman, Head of Environmental Management	E.ON Vattenkraft Sverige AB	Environmental Management	13.11.14	Malmö	Joerg Hartmann
20	Erik Nordgaard, Commercial Performance Optimizer / Ake Norman, Head of Financial Controlling / Eva Risberg, Controlling Specialist	E.ON Vattenkraft Sverige AB	Production Planning / Controlling / Controlling	13.11.14	Video conference Malmö - Sundsvall	Doug Smith
21	Karoline Egerup, Consultant	AF Consult	Environmental Consulting	13.11.14	Malmö	Joerg Hartmann
22	Johan Stenberg, Lawyer	ALRUTZ' ADVOKATBYRÅ AB	Public Law	13.11.14	Telephone interview	Joerg Hartmann
23	Oscar Janderberg, Project Manager	E.ON Vattenkraft Sverige AB	River Group South	13.11.14	Malmö	Doug Smith
24	Torbjörn Tärnhuvud, Managing Director and Jonas Andren, Head of Communications	E.ON Vattenkraft Sverige AB	-	13.11.14	Video conference Malmö - Sundsvall	Doug Smith
25	Anders Isander, Dam Safety Expert	E.ON Vattenkraft Sverige AB	Dam Safety	13.11.14	Telephone interview	Doug Smith
26	Katarina Sigeus Ek, HR Business Partner	E.ON Vattenkraft Sverige AB	Human Resources	13.11.14	Malmö	Doug Smith
27	Ronnie Lindblom, Chairman	"Sveriges Ingenjörer" Union		14.11.14	Telephone interview	Doug Smith
28	Lars Edenman, Water Administrator	Västmanland County Administrative Board	Department of Environment	20.11.14	Telephone interview	Joerg Hartmann

Appendix C: Documentary Evidence

Ref	Author / Organisation	Title	Year	Language	Description / Notes / Weblink
1	AB Lars Harrysson	Semla 4 Design fasad 1	2011	Swedish	Semla 4 Facade Design 1
2	AB Lars Harrysson	Semla 4 Design fasad 2	2011	Swedish	Semla 4 Facade Design 2
3	ÅF-Industry AB	Miljökonsekvens-beskrivning (MKB)	2012	Swedish	Environmental Impact Analysis (EIA)
4	ÅF-Industry AB on behalf of E.ON	Samrådsunderlag Semla kraftverk	2011	Swedish	Report on Semla HPP for the Public Consultation
5	Åke Henriksson/ E.ON Vattenkraft Sverige AB	Sammanställning över domsvillkor, utfästelser mm avseende Semla kraftverk	2013	Swedish	Summary of Semla power plant project for handover
6	ALRUTZ' ADVOKATBYRÅ AB	Samrådsprotocol	2011	Swedish	Public Consultation Meeting Minutes
7	ALRUTZ' ADVOKATBYRÅ AB	Ansökan MMD	2012	Swedish	Main application file
8	ALRUTZ' ADVOKATBYRÅ AB	Bilaga 1 MKB	2011	Swedish	Attachment 1 to Environmental Impact Analysis
9	Bertil Bertilsson, Lena Knutson Udd, Bengt Spade	Utredning Semla kraftstationer	2012	Swedish	Investigation Semla power stations
10	BKK	AB04Doc	2005	English	AB04 General Conditions of Contract for Construction Works
11	BKK	ABT06Doc	2007	English	ABT06 General Conditions of Contract for Construction Works
12	E.ON SE	GP_3-28_Procurement Policy Abstract	2014	English	Group Policy_3-28_Procurement Policy Abstract
13	E.ON SE	GP1-32_Management_Group_Policy_Procurement	2014	English	GP1-32_Management_Group_Policy_Procurement
14	E.ON SE	E.ON Responsible Procurement Policy	2007	English	http://www.E.ON-einkauf.com/content/dam/E.ON-einkauf/downloads/en/1107_E.ON_Procurement_Policy.pdf
15	E.ON SE	GP_3-28_Business Governance Policy Procurement	2014	English	Group Policy_3-28_Business Governance Policy Procurement
16	E.ON SE	GP_3-28_Appendix_01	2013	English	Group Policy_3-28_Appendix_01
17	E.ON SE	GP_3-28_Appendix_02	2013	English	Group Policy_3-28_Appendix_02
18	E.ON SE	GP_3-28_Appendix_03	2014	English	Group Policy_3-28_Appendix_03
19	E.ON SE	GP_3-28_Appendix_04	2013	English	Group Policy_3-28_Appendix_04
20	E.ON SE	GP_3-28_Appendix_05	2013	English	Group Policy_3-28_Appendix_05
21	E.ON SE	GP_3-28_Appendix_06	2013	English	minimum requirements for identification and assessments of HSE/Sustainability related risks for all procurement activities
22	E.ON Sverige AB	Detaljerade arbetsmiljökra	2013	Swedish	Detailed work environment demands
23	E.ON Sverige AB	E.ON Sverige medierapport	2014	Swedish	Example of the daily media intelligence mail
24	E.ON Sverige AB	E.ONS-Hallbarhetsredovisning 2013	2014	Swedish	E.ON Nordics sustainability report 2013
25	E.ON Vattenkraft Sverige AB	Klassificering, Semla dammanläggning	2011	Swedish	Classification of Semla dam

26	E.ON Vattenkraft Sverige AB	Lönsamhetskalkyl	2013	Swedish	Profitability Calculation
27	E.ON Vattenkraft Sverige AB	Miljöpresentation vid projektmöten	2012	Swedish	Environmental Presentation at project meetings
28	E.ON Vattenkraft Sverige AB	S5[1] Miljöpolicy	2013	Swedish	Environmental Policy
29	E.ON Vattenkraft Sverige AB	S31[1] incidentrapportering	2012	Swedish	Incident Reporting
30	E.ON Vattenkraft Sverige AB	S45[1] Miljökrav i projekt	2014	Swedish	Environmental conditions in the project
31	E.ON Vattenkraft Sverige AB	S114[1] Generell miljöhänsynsinstruktion	2013	Swedish	General environmental considerations instruction
32	E.ON Vattenkraft Sverige AB	S422[1] Lokal miljöhänsynsinstruktion Semla SEM	2011	Swedish	Local environmental instructions Semla SEM
33	E.ON Vattenkraft Sverige AB	S2912 Local environmental consideration instruction Semla SEM	2012	English	S2912 Local environmental consideration instruction Semla SEM
34	E.ON Vattenkraft Sverige AB	Efteranalys KLEK 905219 Nytt aggregat	2014	Swedish	Evaluation of Knisslinge new unit project
35	E.ON Vattenkraft Sverige AB	Kontrolprogram Knisslinge	2012	Swedish	Control Program Knisslinge
36	E.ON Vattenkraft Sverige AB	Slutrapport Knisslinge 20131007	2013	Swedish	Final Report Knisslinge Project
37	E.ON Vattenkraft Sverige AB	S507[1] Generell säkerhetsinstruktion	2013	Swedish	General Safety instruction
38	E.ON Vattenkraft Sverige AB	Projektorganisation Semla	2014	Swedish	Organizational Chart Project Semla
39	E.ON Vattenkraft Sverige AB	Projekthandbok Ppkorrigerat	2014	Swedish	General Project Handbook
40	E.ON Vattenkraft Sverige AB	Semla Huvudtidplan 2014-06-04	2014	Swedish	Semla Main Schedule 2014-06-04
41	E.ON Vattenkraft Sverige AB	Specifications for tender for civil works contractor on Semla IV	2014	Swedish	Table of Contents and Sections 13.9 General Environmental Instructions and 13.10 Local Environmental Instructions
42	E.ON Vattenkraft Sverige AB	BEREDSKAPSPLAN Semla kraftverk	2014	Swedish	Emergency Plan Semla
43	E.ON Vattenkraft Sverige AB	Krisrutiner CMT	2014	Swedish	Crisis Plan CMT
44	E.ON Vattenkraft Sverige AB	Semla Nature Value Plan	2007	Swedish	Documentation concerning environmental values around the plant
45	E.ON Vattenkraft Sverige AB	Flöde 2013 vid Semla kraftverk	2014	Swedish	Flow 2013 at Semla power plant
46	E.ON Vattenkraft Sverige AB	140519 BUS Project Evaluation Sweden Semla External	2014	English	Figures slightly modified due to business sensitivity
47	E.ON Vattenkraft Sverige AB	Individual risk report Semla 1	2014	English	Individual risk report Semla 1
48	E.ON Vattenkraft Sverige AB	Individual risk report Semla 2	2014	English	Individual risk report Semla 2
49	E.ON Vattenkraft Sverige AB	Individual risk report Semla 3	2014	English	Individual risk report Semla 3
50	E.ON Vattenkraft Sverige AB	Semla Assessment - Accounting Presentation	2014	Swedish	Semla Assessment - Accounting Presentation
51	E.ON Vattenkraft Sverige AB	Semla Assessment -Status report Ramsele	2014	English	Semla Assessment - Status report Ramsele
52	E.ON Vattenkraft Sverige AB	20100827_Plant_Audit_Checklist_template_final.xls	2010	English	20100827_Plant_Audit_Checklist_template_final.xls
53	E.ON Vattenkraft Sverige AB	AMP Vattenkraft för bygg- och anläggning	2009	Swedish	Work environment plan for construction works (form sheet)

54	E.ON Vattenkraft Sverige AB	Responsible Procurement Audit Checklist	2008	English	Responsible Procurement Audit Checklist
55	E.ON Vattenkraft Sverige AB	Supplier_PQ_Questionnaire_20120312	2012	English	Supplier Prequalification Questionnaire
56	E.ON Vattenkraft Sverige AB	KA_PBL_Knislinge 18-3 nybyggnad	2012	Swedish	Knislinge Works Control Plan of Power House New Build
57	E.ON Vattenkraft Sverige AB	Plán jakost A-Č KNISLINGE Rev.1 10.10.2012 715 - 0	2012	Swedish/English	Knislinge Quality Plan
58	E.ON Vattenkraft Sverige AB	141113 Follow Up Managing Director Interview V1	2014	English	
59	E.ON Vattenkraft Sverige AB	Arbetsordning Vattenkraft engelska	2014	English	Board of Directors' Rules of Procedure
60	E.ON Vattenkraft Sverige AB	Stakeholder map	2012	Swedish	
61	E.ON Vattenkraft Sverige AB	E.ON Yttrande Betänkande SOU 2013_69	2013	Swedish	E.ON replies to the referral procedure 2013
62	E.ON Vattenkraft Sverige AB	E.ON Yttrande SOU 2014_35	2014	Swedish	E.ON replies to the referral procedure 2014
63	E.ON Vattenkraft Sverige AB	case study for sustainability report	2014	Swedish	Potential case study from E.ON Vattenkraft for the Nordic sustainability report 2014
64	E.ON Vattenkraft Sverige AB	Case study text	2014	Swedish	Potential case study from E.ON Vattenkraft for the Nordic sustainability report 2014
65	E.ON Vattenkraft Sverige AB	PMI Vattenkraft	2013	Swedish	Leadership survey (Lower Score is better)
66	E.ON Vattenkraft Sverige AB	Bolagsstrategi - Prioriterade områden	2014	Swedish	E.ON Vattenkraft strategy - prioritized areas
67	E.ON Vattenkraft Sverige AB	Alternativ angående ombyggnad i Semla kraft verk	2011	Swedish	Options concerning the conversion in power plants Semla
68	E.ON Vattenkraft Sverige AB	Semla Techno Economic valuation model alt 1-3	2010	Swedish/ English	Figures slightly modified due to business sensitivity
69	E.ON Vattenkraft Sverige AB	E.ON Vattenkraft KPIs and actual performance 2013	2014	English	
70	EnergoRetea Energi, Elkraft & ICT AB	Semla – Dammbrottsberäkning avseende underlag för konsekvensklassificering	2008	Swedish	Semla - Dam failure Calculation as input for Impact Classification
71	EnergoRetea Energi, Elkraft & ICT AB	Konsekvensklassificering av Semla dammanläggning	2008	Swedish	Impact Classification of Semla dam
72	Fagersta Municipality	ÖVERSIKTSPLAN FÖR FAGERSTA KOMMUN	2007	Swedish	Master plan Fagersta
73	Fagerstaposten	E.ON vill riva och bygga nytt kraftverk i Semla	2011	Swedish	Newspaper Article: E.ON wants to demolish and build new power plant in Semla
74	Justitiedepartementet	Offentlighetsprincipen och sekretess	2013	Swedish	Swedish Transparency Principles
75	Kadesjös Ingenjörsbyrå AB	Utlåtande över möjligheten att bygga om Semla kraftstation	2011	Swedish	Study about the opportunity for a new-build at present Semla powerhouse
76	Kolbäcksåns Älvsamord-ningsgrupp	Älvsamordnings-gruppen	2014	Swedish	established contact roads at high flows or similar crises with authorities, rescue services, municipalities, hydrologists
77	Kölbäcksans Vattenförbund	Recipientkontrollens årsrapport 2012	2014	Swedish	Recipient control annual report 2012 http://www.vattenorganisationer.se/Kolbäcksånsvf/modules.php?name=Downloads&cat=613 (and previous years)

78	Lennart Olsson / E.ON Vattenkraft Sverige AB	Teknisk beskrivning Semla	2012	Swedish	Technical Description of Semla HPP
79	Lloyd's Register Quality Assurance Ltd. Gothenburg	Uppföljningsrevision 1 (2)	2013	Swedish	Report from the last external ISO 14001:2004 and OHSAS 18001:2007 assessment
80	Lloyd's Register Quality Assurance Sverige AB	LRQA Business Assurance Certifikat_2539_001	2012	Swedish	LRQA Business Assurance Certificate_2539_001
81	Lloyd's Register Quality Assurance Sverige AB	LRQA Uppföljningsrapport till revisionsrapport 2013	2014	Swedish	LRQA Follow-up report to the 2013 audit report
82	Magnus Svensson	Elfiske_Semla	2012	Swedish	Electric Fishing Study
83	N.N.	The Nordic electricity mix	2003	Swedish	The Nordic electricity mix
84	Nacka District Land and Environment Court	Domslut: Tillstånd till ombyggnad och effektivisering av Semla kraftverk i Kolbäcksån, Fagersta kommun	2012	Swedish	Project Approval by Nacka District Land and Environment Court
85	Socialstyrelsen och Folkhälsoinstitute t	Health in Sweden 2013	2013	Swedish	
86	Stokholms Tingsrätt	Semla VA28 1987 Tillstånd att bygga nytt aggregat	1987	Swedish	Semla HPP Original Permit to build new Unit from 1987
87	Strömsholms Kanalbolag and E.ON Vattenkraft Sverige AB	Avtal Kanalbolaget	2012	Swedish	Agreement between E.ON and the canal company regarding usage of land and the stop lock construction
88	Svensk Energi – Swedenergy – AB	Ridas - Hydropower Industry Dam Safety Guidelines	2012	English	Ridas - Hydropower Industry Dam Safety Guidelines
89	Swedish Energy Agency	The Electricity Certificate System	2014	English	The Electricity Certificate System http://www.energimyndigheten.se/en/Sustainability/The-electricity-certificate-system/
90	Swedish Environmental Protection Agency	Sweden's environmental objectives	2012	English	Sweden's environmental objectives
91	Swedish Government	Utdrag ur Miljöbalken angående kravet på samhällsekonomisk lönsamhet	2014	Swedish	Excerpt from the Environmental Code regarding the requirement for cost-benefit analysis
92	Swedish Government	Excerpt from The Swedish environmental Code re Public Health	2014	Swedish	http://www.notisum.se/rnp/sls/lag/19980808.htm
93	Swedish Government	VVU 1	2013	Swedish	State investigation regarding legal framework
94	Swedish Government	VVU 2	2014	Swedish	State investigation regarding legal framework
95	Swedish Meteorological and Hydrological Institute	Change in annual precipitation in river basin Norrström, scenario RCP 8.5	2014	English	http://www.smhi.se/klimatdata/framtidens-klimat/klimatscenarier?area=avr&var=n&sc=a1b&seas=ar&dnr=18&sp=en&sx=0&sy=0#area=avr&dnr=18&sc=rcp85&seas=ar&var=n
96	Swedish Meteorological and Hydrological Institute	Change in annual precipitation in river basin Norrström, scenario SRES A1B	2014	English	http://www.smhi.se/klimatdata/framtidens-klimat/klimatscenarier?area=avr&var=n&sc=a1b&seas=ar&dnr=18&sp=en&sx=0&sy=0#area=avr&dnr=18&sc=a1b&seas

					=ar&var=n
97	Swedish Meteorological and Hydrological Institute	Change in annual precipitation in river basin Norrström, scenario RCP 4.5	2014	English	http://www.smhi.se/klimatdata/framtidens-klimat/klimatscenarier?area=avr&var=n&sc=a1b&seas=ar&dnr=18&sp=en&sx=0&sy=0#area=avr&dnr=18&sc=rcp45&seas=ar&var=n
98	Västmanland County Administrative Board	Klimatstrategi för Västmanlands län	2013	Swedish	Climate strategy for Västmanlands county
99	Västmanland County Administrative Board	Bilaga 2 MKB (Attachment)	2011	Swedish	Attachment 2 to EIA
100	Västmanland County Administrative Board	ElRapport 2010	2010	Swedish	Outline of electric fishing in Västmanland County 2010
101	Västmanland County Administrative Board	ElRapport 2011	2011	Swedish	Outline of electric fishing in Västmanland County 2011
102	Västmanland County Administrative Board	Rapport2008-23-elfisken	2008	Swedish	Report 2008-23- electric fishing
103	Vatteninformationssystem Sverige	VISS Rapport	2014	Swedish	VISS-report (from a data-base used in the Swedish WFD-process)
104	Vattenrättsdomaren	Semla ÄrD11 1940 Inskrivning av anläggning	1943	Swedish	Semla HPP Original Operating Permit from 1940
105	Länsstyrelsen Dalarna	Dalarna svämmar över- erfarenheter av översvämningar i Dalarna 1916-2010	2012	Swedish	Report on major floods, including the 1977 flood on the Kolbäcksån River
106	Sveriges lantbruksuniversitet, Department of Aquatic Sciences and Assessment	http://www.slu.se/en/departments/aquatic-sciences-assessment/environment/environmental-monitoring-of-lakes-and-watercourses/river-Kolbäcksån/		Swedish and English	Website describing water quality monitoring approach and results
107	Kolbäcksån Vattenfoerbund	http://www.vattenorganisationer.se/Kolbäcksånsvf/		Swedish	Website of the water association, including list of members
108	Sveriges lantbruksuniversitet, Department of Aquatic Sciences and Assessment	Kolbäcksån Provfiske och metaller i fisk	2007	Swedish	Report on bioaccumulation of heavy metals
109	Bohman & Edsman	Status, Management and Conservation of Crayfish in Sweden: Results and the Way Forward	2011	English	Describes project region as current frontier in the spread of Signal Crayfish
110	Calles, Karlsson, Vezza, Comoglio and Tielman	Success of a low-sloping rack for improving downstream passage of silver eels at a hydroelectric plant	2013	English	Describes E.ON initiative on River Aetran
111	Stroemsholm Canal Company	http://Strömsholmskanal.se/artikel/historia		Swedish	History of the canal

112	Ekomuseum Bergslagen	http://ekomuseum.se/		Swedish	Website of the Ekomuseum, with links to and brochures about Semla
113	E.ON SE	http://www.E.ON.se/om-E.ON/Om-energi/Energikallor/Vattenkraft/		Swedish	E.ON website on hydropower in Sweden
114	Vattenmyndigheterna	The road to better water Sweden and the Water Framework Directive		English	Overview at http://www.vattenmyndigheterna.se/SiteCollectionDocuments/gemensamt/publikationer/faktablad-engelska.pdf
115	Länsstyrelsen Västernorrland	Att definiera god ekologisk potential Förslag på metod för kraftigt modifierade vatten – särskilt nedre Faxälven	2014	Swedish	Joint report with E.ON on reaching WFD objectives in the Faexalven River
116	Länsstyrelsen Västmanlands län / Vattenmyndigheten Norra Östersjön	Åtgärdsprogram för Kolbäcksåns åtgärdsområde - samrådsmaterial	2014	Swedish	Consultation document for the 2015-2021 WFD action plan
117	Swedish Society for Nature Conservation	Running Water: Hydropower development on small waterways – small benefits but large-scale damage	2002	English	Review of environmental losses from small hydropower in Sweden
118	Havs- och vattenmyndigheten och Energimyndigheten	Strategi för åtgärder i vattenkraften Avvägning mellan energimål och miljökvalitetsmålet Levande sjöar och vattendrag	2014	Swedish	Joint report by SwAM and the Energy Agency on the future strategy for hydropower in Sweden
119	Stockholm Environment Institute / Peter Rudberg	Sweden's Evolving Hydropower Sector: Renovation, Restoration and Concession Change	2013	English	Review of legal and political developments in the sector
120	E.ON Vattenkraft Sverige AB	DTU-manual Semla kraftverk	2014	Swedish	Operation and Maintenance Manual
121	E.ON Vattenkraft Sverige AB	ADMINISTRATIVA FÖRESKRIFTER AB 04 Avseende Semla, nytt vattenkraftverk Malmö den 2014-10-01	2014	Swedish	Includes contents of specification for civil works contractor
122	E.ON Vattenkraft Sverige AB	Förfrågan – konsultuppdrag Semla nytt vattenkraftverk	2014	Swedish	Includes contents of specification for consultant engineers
123	E.ON	Pages from E.ON Group and E.ON Sweden websites on governance	-	English	Such as: http://www.E.ON.com/en/sustainability/regional-activities/sweden.html
124	E.ON	Discounted Cashflow Summary	2014	English	20140831 DCF Summary Semla.pdf
125	E.ON	Attachment 3 Sensitivity Analysis Semla	-	English	Prepared for E.ON's Phase 2 decision

Appendix D: Visual Evidence

Photo 1: P-3 Existing penstocks in disrepair, indicating the need for rehabilitation

Photo 2: P-3 Leakage through the old part of the dam adjacent to Semla II powerhouse

Photo 3: P-3 , P-17Poor condition of foundation of Semla III powerhouse

Photo 4: P-3, P-17 Indications of structural movement of Semla III powerhouse

Photo 5: P-3, P-17 Indications of structural movement of Semla III powerhouse

Photo 6: P-3, P-17 Indications of structural movement of Semla III powerhouse

Photo 7: P-7, P-22 Water level gauges - wire and visual - on Semla Dam

Photo 8: P-7, P-22 The arrow marks the permitted upper level of the reservoir

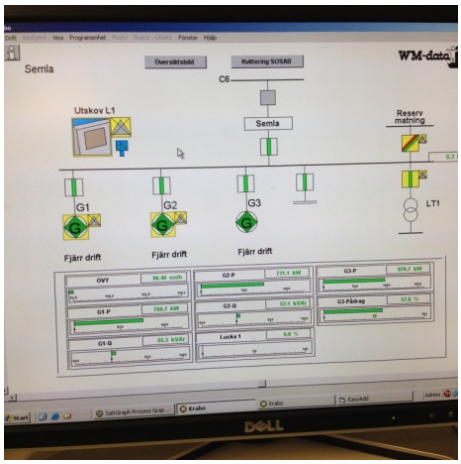


Photo 9: P-7 Screens of the control system housed at Vasterhas

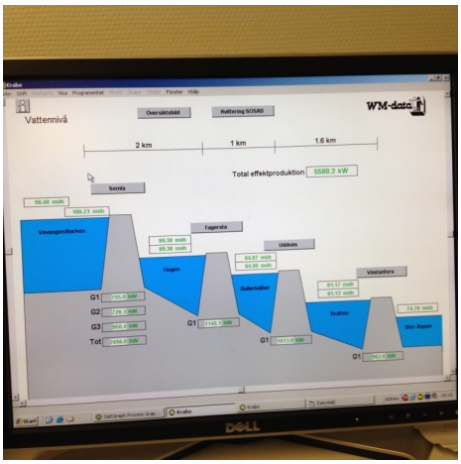


Photo 10: P-7, P-22, P-23 Screens of the control system housed at Vasterhas

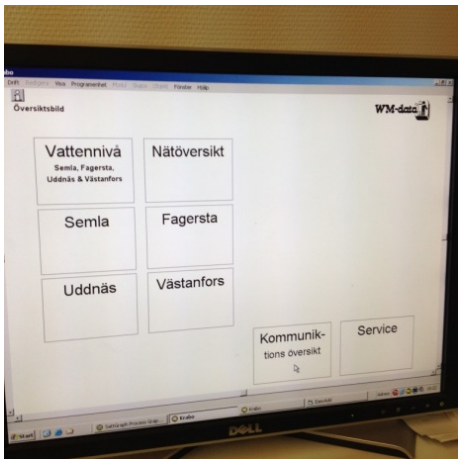


Photo 11: P-7 Screens of the control system housed at Vasterhas

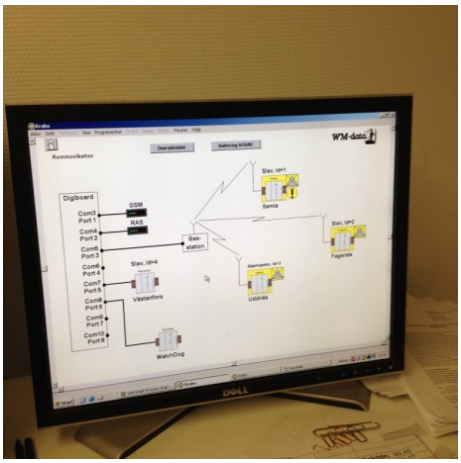


Photo 12: P-7 Screens of the control system housed at Vasterhas

Photo 13: P-8, P-13 Canal lock showing potential falling hazard for the public

Photo 14: P-8 Walkie-talkie for SOS contact with emergency services (this one at Vasterhas)

Photo 15: P-8 , P-13, P-17 Deteriorating steps down to Semla II powerhouse present a tripping hazard for the public

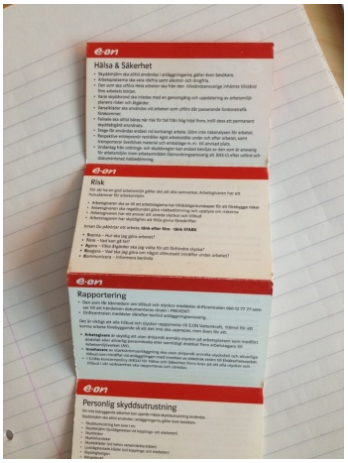


Photo 16: P-16 E.ON's 'What's Your Responsibility?' safety card

Photo 17: P-16 Safety signage on entering Semla III powerhouse

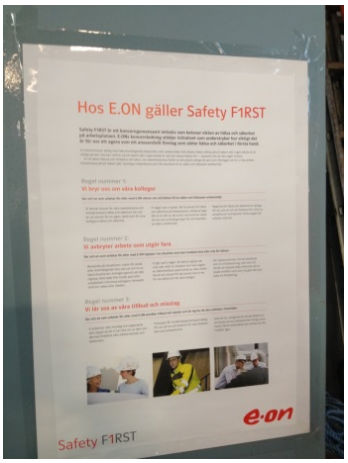


Photo 18: P-16 Poster on E.ON's Safety F1rst campaign displayed inside Semla III powerhouse

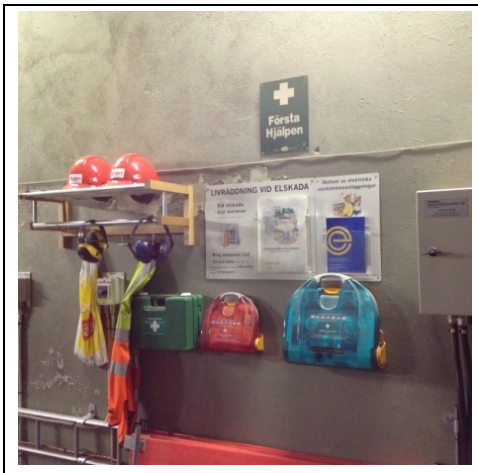


Photo 19: P-16 Safety equipment held within Semla III powerhouse.

Photo 20: P-13, P-18 Bridge with road to Ulvsbo

Photo 21: P-13, P-20, P-22 View upstream from end of embankment dam with entrance to canal on left, diversion structure in middle, and pedestrian bridge leading to lake cabin colony on right

Photo 22: P-23 View from Semla III outlet to bridge

Photo 23: P-22 View from right bank over reservoir to Semla dam

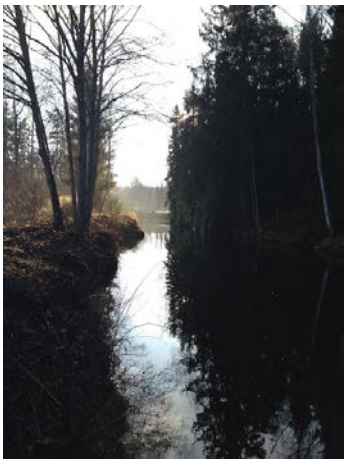


Photo 24: P-13, P-17, P-23 View downstream on Stroemsholm canal above upper lock

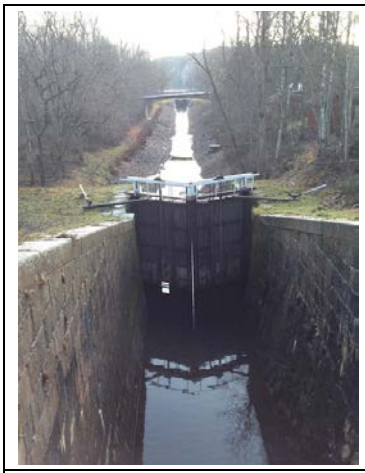


Photo 25: P-23, P-17 View downstream from upper locks in canal

Photo 26: P-16, P-22, P-23 Station manager in Västanfors control room

Photo 27: P-13, P-17, P-19 Signage on Semla historical and nature trail

Photo 28: P-22 Semla reservoir view from dam

Photo 29: P-5, P-20, P-23 Semla IV construction site from bridge

Photo 30: P-10, P-17 Semla III power house interior

Photo 31: P-23, P-19 Riverbed when dam is not spilling (picture taken 2 weeks before site visit)

Photo 32: P-13, P-17 Semla II powerhouse

Photo 33: P-13 Semla dam with public footpath over crest

Photo 34: P-23 River entering into Flogen Lake downstream

Photo 35: P-17 Remains of Semla I structure

Photo 36: P-17, P-19,P-23 Old Semla I headrace channel aka trout brook

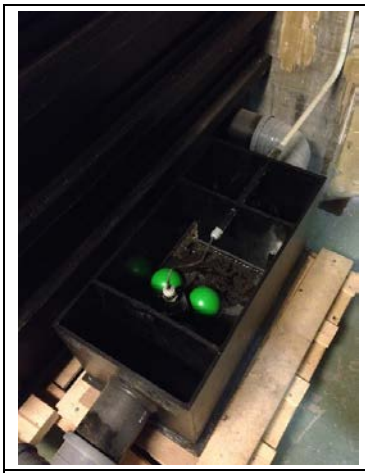


Photo 37: P-5 Oil filters in Västanfors station

Photo 38: P-1, P-13, P-18 Neighbour's house 1

Photo 39: P-1, P-13, P-18 Neighbour house 2

Photo 40: P-8, P-17, P-23 Location for reconstruction of stop log on canal

Photo 41: P-17 Historic instruments in Västanfors hydropower museum

Photo 42: P-13, P-17 Historic generators in Semla III powerhouse

Photo 43: P-19, P-13 Bird conservation clubhouse at Semla

Photo 44: P-19 Beaver activity on reservoir shore

Photo 45: P-7, P-22 Graph of reservoir operating rules in Semla III powerhouseJPG

Photo 46: P-19, P-23 Flow during spill with penstocks and Semla III powerhouse

Photo 47: P-5, P-17 Embankment dam between canal on left and river on right, view upstream

Photo 48: P-10, P-17 Ekomuseum sign at Semla

	
Photo 49: P-5 Construction site for Semla IV powerhouse	