Initial Environmental Examination

September 2014

CAM: Urban Water Supply Project – Svay Rieng Subproject

Prepared by Ministry of Industry and Handicraft for the Asian Development Bank.

Initial Environmental Examination
Svay Rieng Water Supply Subproject
CONTENTS

List of Tables

List of Figures

ABBREVIATIONS

ADB	Asian Development Bank
CAP	Corrective Action Plan
CC	Construction Contractor
CEMO	Contractor Environmental Management Officer
DDR	Due Diligence Report
DEIA	Department of EIA
DPWS	Department of Potable Water Supply
DSC	Design and Supervision Consultant
ES	Environmental Specialist
GMS	Greater Mekong Subregion
IEE	Initial Environmental Examination
MIH	Ministry of Industry and Handicraft
MOE	Ministry of Environment
MOH	Ministry of Health
MPWT	Ministry of Public Works and Transport
PDOE	Provincial Department of Environment
PSMO	PMU Environmental Management Officer
PIU	Project Implementation Unit
PMU	Project Management Unit
PPTA	Project Preparation Technical Assistance
PWW	Provincial Water Works
REA	Rapid Environmental Assessment (Checklist)
SPS	Safeguard Policy Statement (2009)
UWSP	Urban Water Supply Project
WTP	Water Treatment Plant

Units

cm	centimeter
km	kilometer
L	liter
m	meter
m^3/day	cubic meters per day
masl	meters above seal level
MCM	million cubic meters
mg/L	milligrams per liter
ROW	right of way
Φ	diameter

Summary IEE

Introduction

1. This report presents the findings of the Initial Environmental Examination (IEE) for the proposed Svay Rieng Water Supply Subproject. The Subproject is part of the Urban Water Supply Project (the Project) financed by the Asian Development Bank (ADB), which provides improvements in infrastructure for nine provincial towns. The province of Svay Rieng is located in Eastern Cambodia along the border with Vietnam, and shares a long common border with Prey Veng toward the east.

2. The Project is classified as Category B, thus subprojects require an initial environmental examination (IEE) to determine whether significant environmental impacts are likely. Also, Appendix I of the ADB SPS (2009) requires that, "when the project involves existing activities or facilities, . . . environmental audits [will be performed] to determine the existence of any areas where the project may cause or is causing environmental risks or impacts." The REA checklist includes a section in which the existing facilities have been audited to identify the presence of environmental risks or impacts.

3. Overall management of the environment in Cambodia lies with the Ministry of Environment (MOE). EIA policy has been extended through the Sub-decree on Environmental Impact Assessment Process passed by the Council of Ministers on 11 Aug 1999. Under the sub-decree an Initial Environmental Impact Assessment (IEIA) report is required from a project owner. All IEIAs and related documents are reviewed and approved by the Department of EIA in the MOE. A timeline for submittal and approval of the IEE during implementation is provided in the report.

4. The Department of Potable Water Supply (DPWS) under the Ministry of Industry and Handicraft (MIH) is responsible production and distribution of safe water throughout the country. Water Supply Authorities (WSAs) are active in the two municipalities (Phnom Penh and Siem Reap) while Provincial Water Works (PWWs) oversee water supply systems in provincial and district urban centers.

Description of the Project

5. The Svay Rieng water supply system utilizes groundwater from three deep boreholes, which is pre-chlorinated and then put through two package-plant type iron/manganese filters, before further chlorination and storage. In 2014, MIH measured the plant capacity at 4,800 m^3/day and daily supply was 2,618 m^3/day. The WTP does not function well: the gas chlorination system has failed and various water meters around the plant do not work. The iron/manganese filters have been problematic since the beginning and do not appear to be appropriate technology. The filters frequently block and need backwashing regularly; customers complain about red stained water. In addition, parts of the distribution system require renovation and the system needs to be extended into new service areas.

6. Improvements involve installing additional boreholes to increase system capacity, improving the functioning of the iron-manganese removal system, installation of further ancillaries in the plant area, and extension of the distribution system. Other improvements involve electrical switch gear and valves/fittings, as well as piping to alleviate pressure problems and to extend the system, along with isolation valves between pressure zones. Land acquisition involves a 9 m^2 plot of land to be purchased for installation of one of the boreholes, whereas the remaining borehole will be installed on the water treatment plant site.

Description of the Environment

Physical Resources

7. Svay Rieng Province is an agricultural province of lowland rice fields bordering Vietnam in the south. The land is mostly flat –elevation extremes are 5 – 18 MASL. In the rainy season flooding of rice fields and overflowing streams are typical. Monthly rainfall and temperature are summarized in the report. There are no predictions available on the effects of climate change on local rainfall or groundwater availability.

8. The local geology consists of sedimentary layers of recent origin and shallow depressions that hold swamps or wetlands. Sandy soils tend to predominate and increase as one moves northward through the Province. There are no natural hazards such as steep slopes and unstable soils within the confines of the plant property or along distribution line routes that would affect success of the project.

9. The Waiko River courses through Svay Rieng town, which is dammed to form broad and shallow lakes within the town area. Naturally flooded wetlands are found downstream of the main weir. A groundwater quality survey of Svay Rieng identified the presence of arsenic in shallow wells used for household water supply. Manganese, often found in association with arsenic, was also present. No arsenic is reported in the deep aquifer, based on sampling and analysis by the PWW. Water quality data obtained by the waterworks consistently shows high levels of iron and manganese, which will be remedied by improvements under the project.

Ecological Resources

10. The project does not have any effect on aquatic ecosystems, nor is there natural forest located close to the project area. Terrestrial wildlife species are mostly gone from the area around Svay Rieng. Some provincial protected areas can be found in the north of the province; these are generally maintained as community forests. None are in the project vicinity.

Economic Development

11. Land use in the project area includes residential, commercial and institutional space, low-lying flooded lands, agricultural fields and grazing land. Land use is undergoing some change in the vicinity of Svay Rieng along the highway. Higher proportions of the population are engaged in agriculture, and fewer in industry and services, in comparison with the national average. Svay Rieng is served by two national roads, running for 127 km. The province has twice as many kilometers of national road per square kilometer of area than the national average. Svay Rieng is supplied with electricity from a number of sources, including independent power producers.

Social and Cultural Resources

12. The majority of people of Svay Rieng Province are farmers and fishers. Data revealed through the project socioeconomic survey show the households within the project area to be comprised mainly of very poor (2.1%) and poor (60%) households. Health centers and a referral hospital are found at Svay Rieng. The World Food Programme survey (2008) gives the province a low rating in health indicators, with 50% of women suffering from anemia, 92% of births occurring outside of a health clinic and 71% without a health professional in attendance. There are no historical sites in Svay Rieng of note.

Potential Environmental Impacts and Mitigation Measures

13. The IEE presents a summary of the potential impacts for each phase of the project and each impact is then analyzed and necessary mitigation measures are proposed to reduce the overall magnitude of impact. Findings regarding preconstruction impacts have been incorporated into the planning under the PPTA.

Location Planning and Design

14. The subproject will provide raw water from two additional deep wells, with no significant impact on the yield of deep aquifers in the area. These are unconfined aquifers that recharge annually during the rainy season, and for the most part the aquifers are not tapped by other users. However identifying a suitable location where wells will yield sufficient water has been difficult and wells drilled by the PWW have come up dry or with low yield. A hydrogeologist should be engaged for a period of months during loan implementation to support this and other subprojects where wells are being installed.

15. Arsenic is present in some wells from the shallow aquifer in the vicinity of Svay Rieng. Cross-contamination can occur if the upper and lower aquifers are interconnected. During installation of the wells, a hydrogeologist should assess the potential for arsenic presence in the wells. Sampling and analysis for arsenic should be undertaken on

a regular basis until it is shown that it is not present in quantities that exceed the WHO drinking water standard.

16. Other than the voluntary transfer/purchase of a small parcel of land for the deep well, all subproject improvements will take place on land already owned by the DPWS or, in the case of piping, in the public alignment of roadways. No involuntary land acquisition is anticipated under the subproject. The potential presence of unexploded ordinance (UXO) and mines has been evaluated within the subproject area based on survey maps and discussion with provincial authorities. It has been determined that there is no basis for suspecting that UXO or mines are present.

Construction

17. Deep well drilling poses some impacts that result from the operation of drilling equipment, including the noise generated by drilling, use of drilling fluid and production of borehole cuttings contained in the drilling mud, which is continuously circulated between the borehole and a pit built on the ground or tank. Mud can escape from the pit, but is not particularly noxious. The presence of workers may also cause impact. The contractor should follow guidelines related to deep well placement that are contained in the IEE and included in the Environmental Specifications for Contract Procurement.

18. Most of the subproject works takes place onsite, either at the water treatment plant (WTP) or the site for the proposed office building. The replacement and extension of water distribution pipe takes place along linear alignments along roadways (for extensions), and city streets (where replacement of existing pipe is proposed). Potential impacts stem from the presence of workers carrying out their jobs and temporarily residing at the site and working along roadways. Noise and air emissions may extend beyond the site boundaries and cause a nuisance for adjacent land uses. Movement of materials to and off the site can affect traffic and conditions on roadways. Workers may be exposed to health and safety risks as a result of the work. None of these impacts is significant, and a high standard of project implementation by the contractor can minimize the effect. A comprehensive list or potential impacts and proposed mitigation measures are proposed to protect community health and safety; meet the needs of the work force, provide for worker camps, and ensure worker health and safety; protect air and water and mitigate noise impacts; and protect soils and dispose of excess materials as necessary. Construction impacts are mitigated by a set of environmental specifications to be included in procurement documents, which will be binding on the contractor. Specific procedures should be applied throughout pipe laying with particular emphasis on work conducted in congested areas. The contractor should conduct pipe laying in a manner that has minimum impact on the health, safety and convenience of businesses, residences and users of the street area; specific guidelines are provided in the IEE to accomplish this goal. All roadway surfaces should be repaired as construction progresses; bid packages should contain a unit bid price for roadway repair, and for repair of any other facility, structure or surface that is likely to be damaged in quantity during construction. Finally, commissioning requires that newly constructed or repaired water mains, tanks and reservoirs be disinfected through chlorination. Installation contracts should include a bid item for disinfection of installed piping.

Operations

19. Impacts during operations concern environmental or public health. Poorly operated treatment plants pass pathogens; failure to chlorinate allows pathogens to survive in distribution systems; broken pipes and low pressure allow cross-contamination from sewers and soil organisms. Modern, well-operated water treatment plants deliver a product water consistently free of coliform organisms and other pathogens, no matter how polluted the raw water may have been. Further, effective coagulation and sedimentation reduces turbidity to improve the effectiveness of chlorination. Regardless of the effectiveness of the treatment process, continuous chlorination at the head of the delivery system is necessary for delivery of safe water free of bacterial contamination, viruses and other pathogens. Broken lines and low pressure provide means for entry of pathogens into distribution systems. Maintaining chlorine residual in the system is one way to guard against cross-contamination, as is sustaining adequate pressure in the system. Capacity building

is recommended during implementation in the safe handling of chlorine effective during the operations period.

Indirect, Cumulative and Induced Impacts

20. One type of cumulative impact stems from the effect of water supply systems on urban growth. Urbanization is accompanied by congestion with concomitant effects on air pollution and overall quality of life. New areas being served in Svay Rieng are already settled, so the aggravation of uncontrolled development does not occur.

21. An indirect impact of water supply expansion has to do with the disposal of increased quantities of wastewater from households and industrial/commercial users. Generally speaking, improved water supply should be accompanied by improvements in sanitation and drainage that mitigate the effect of increased discharges. Data obtained through the socioeconomic survey for the coverage area shows 90% of households equipped with pour flush toilets—a high percentage, indicating lack of sanitation should not be a constraining factor in advancing water supply coverage.

22. Increased flows enter drainage systems. Impacts occur if drainage increases pollution load to receiving waters. In general, drainage systems suffer from a lack of investment in infrastructure, limited cooperation between government departments, clogging with solid waste and infilling/blockage by property owners. The situation at Svay Rieng is that most septic tank supernatants will percolate into the sandy soil and that which flows overland will receive some 'treatment' in the shallow wetlands that course through the town. The cumulative effect of discharges from many small urban drains on receiving water quality can be severe over the long term, and available solutions are inadequate to deal with the greater problem.

Resilience to Climate Change Impacts

23. The quantities of water supplied "at source" and the extent of water supply distribution to a recipient population provides the base case for comparison with future conditions under which the subproject is implemented and climate change effects take place. The subproject either improves, or is neutral with respect to, climate change resilience. A further issue concerns the exacerbation of health impacts due to climate change in the absence of effective sanitation and drainage in urban and peri-urban communities. Finally, whether subproject infrastructure is vulnerable to weather conditions brought about by climate change may be considered.

24. As of December 2012, downscaling of the general circulation models (GCMs) to determine regional climate conditions under global climate change had not been accomplished for Cambodia. Thus predictions related to the effects of climate change on hydrometeorological parameters in Cambodia are uncertain and generally qualitative. Long range effects on water supply, especially groundwater availability and reserves, are not known. The subproject improves climate change resilience by increasing the supply of water at-source; and by extending the reach of the distribution system to areas within the community that lack piped water supply. To the extent that the community is lacking in piped water supply either from shortage of source quantities or due to inadequate distribution, the recipient populations are benefited.

25. The subproject is vulnerable to the effects of climate change and sources of supply could become depleted. However the aquifers providing water to the wells in the area are replenished annually during the monsoons. The effects of reduced rainfall are likely to be insignificant in comparison with high rainfall events and the annual monsoon rains.

26. Drainage conditions are worsened under climate change scenarios, whether stagnant and still water bodies during periods of drought that breed mosquitoes and harbor high numbers of enteric disease bacteria, or flooding conditions where drainage systems are overwhelmed and polluted water enters human living spaces.

Existing Facilities Audit

27. Appendix I of the ADB SPS (2009) requires that, "when the project involves existing activities or facilities, relevant external experts will perform environmental audits to determine the existence of any areas where the project may cause or is causing environmental risks or impacts." Rapid environmental assessment was conducted at the fa-

cility to identify the presence of waste, spent, out-of-spec and discarded water treatment chemicals, oils, cleaning fluids and solvents, as well as contaminated soils that have or have the potential for causing environmental impacts or risks. Waste materials that pose a hazard to human health or the environment have not been identified at the facility, nor are there any other environmental hazards connected with the facility. There is no need to prepare a corrective action plan for purposes of reducing environmental impact and risk.

Environmental Management Plan

28. Impacts are presented in a tabular form along with summaries of the required mitigation measures, institutional responsibilities for assuring the mitigation action is carried out and costs, which are in all cases included in previously identified budgets for design, construction and operation of the systems.

Institutional Arrangements

29. The Department of Potable Water Supply (DPWS) at central level under Ministry of Industry and Handicraft (MIH) is the executing agency and will establish the Project management Unit (PMU) to execute the Project. The PMU will assign responsibility for environmental aspects to a particular individual as staff PMU Safeguard Management Officer (PSMO) who is engaged full time with implementation of the project to oversee work related to monitoring. The Provincial Water Works (PWW) is the operator of the Svay Rieng water supply system and implementation agency for the subproject. PWW will establish a Project Implementation Unit (PIU) to undertake construction of the Subproject in Svay Rieng Province.

30. The PMU will engage Contractors for specific works, based on the subcontract packages considered most suitable for execution. Legal clauses regarding mitigation measures are required to be included in construction contract bidding documents and become part of contract agreements; a typical set of specifications are provided in Appendix 2. For the main construction contracts, the Contractor will be required to appoint a staff Construction Environmental Management Officer (CEMO) responsible for supervising implementation of mitigation measures during the execution of the contract. The contractor will be required to prepare a Construction Management Plan (CMP) to ensure construction, demolition and excavation that take place at building sites do not adversely affect health, safety, amenity, traffic or the environment in the surrounding area.

31. The PMU will be assisted by the Environmental Specialists (ES), consultants who are part of the Design and Supervision Consultant (DSC) and support all the subprojects undertaken through the loan. The ES will update and finalize the IEE, submit the plans on behalf of MIH to the Ministry of Environment, incorporate legal clauses regarding mitigation measures into construction contract bidding documents, and assist the PSMO in monitoring the implementation of those measures during the progress of construction. The ES also will provide training to PMU and PIU staff.

32. The ES will revise and update the IEE based on final designs, and the document will be translated into Khmer prior to submittal to MOE DEIA, which will engage in the review process the provincial PDOE where the subproject takes place. Once DEIA approves the EMP for the subproject, implementation can proceed with construction mitigation measures mostly in the hands of the contractor, and the ES, PDOE, PIU and PSMO working together to perform monitoring and reporting. It will be the job of the PIU supported by the ES to compile quarterly reports, which then are compiled into semi-annual safeguard monitoring reports by the PMU and DSC, supported by the ES. The PSMO and PMU Project Director will be responsible for submittal of reporting to ADB.

33. A table summarizing monitoring requirements is provided in the IEE. The PIU and ES are responsible for the bulk of the monitoring being undertaken during the design and construction periods. During operations, the Provincial Water Works is responsible. During the detailed design, repeated samples of well water from any newly developed, test, or surrogate wells should be analyzed for standard parameters: temperature, color, turbidity, pH, total dissolved solids and conductivity; as well as for iron, manganese and arsenic. Data should be used to determine acceptability of the raw water source and be

incorporated into the treatment system design. Recommended protocols for monitoring raw water quality used in production operations (the raw water source) and finished water quality are already in place by DPWS in which a number of parameters are monitored.

Public Consultation and Information Disclosure

34. The Provincial Water Works (PWW) is a key stakeholder that holds the interests of the community to be its primary mission. The subproject concept and design are driven by PWW perceived needs for rehabilitation of system elements within the constraints of the available budget. Furthermore the IEE has been reviewed by DPWS and concurrence has been reached on the contents of the EMP.

35. Consultation: During field work on environmental and social components, people were told about the subproject in their area, and asked about conditions regarding water supply, sanitation and drainage. The social component combined focus group discussions with socioeconomic survey work, and conducted random sampling surveys that focused on local experience and perceptions of thematic issues like sanitation practice and water supply quantity and quality. A meeting was held in Svay Rieng, combining resettlement and environmental components of project activity. Initial discussions were held with the DPWS director and staff to understand the proposed system components and operational constraints. Following that, a meeting was held on the grounds of the water treatment plant. About 30 persons attended the meeting representing commune leaders and ordinary citizens. A general description of the project was prepared in Khmer language, using visual means to provide some detail about the project proposal. A hand-out in Khmer was provided and used in the presentation. Responses were recorded on specially prepared forms, noting the name, age, sex and occupation of the respondent, and the nature of the response. These are provided in Appendix 3. Responses were positive, in favor of the project. People expressed concern about damage to roads and private property due to the installation of pipelines. Other concerns centered around the price for connecting to the system and suggested that a installment plan be established to help poorer households. This suggestion has been forwarded to the financial consultant for the project. There was general all-round support and enthusiasm for the project.

36. Disclosure: MIH shall provide the relevant environmental information for this subproject, including information from the IEE to affected people in a timely manner, in an accessible place, and in a form and language(s) understandable to them by providing a copy of the IEE in Khmer language at the PWW office for review by interested parties. In addition, ADB will post on its website the subproject IEE, updates prepared during the project implementation period, and environmental monitoring reports prepared during the implementation period.

37. Grievance Redress: Grievances related to both environmental and resettlement issues are addressed through the Grievance Redress Mechanism (GRM). In order to ensure that complaints from all affected persons (APs) on any aspect of environment, land acquisition, compensation and resettlement are addressed in a timely and satisfactory manner, and that all possible avenues are available to APs to air their grievances, a well defined grievance redress mechanism will be established. All APs can send any questions to the implementing agency about their rights in relation with redress of environmental problems and entitlements. APs are not required to pay any fee in order to file a complaint at any level. The GRM is explained in detail in the IEE and in the public information booklet distributed to all APs.

Findings, Recommendations and Conclusions

Findings

38. The Initial Environmental Examination for this Category B subproject provides a review of the proposed infrastructure and its interactions with the surrounding environment, and analyzes potential impacts. The review and analysis shows that these are unlikely to occur. Because water supply is an important infrastructure improvement that runs concurrently with – and are essential for – economic development, the main impact is expected to be beneficial. Furthermore, good engineering practice in the design, installation and operations of water supply systems mitigate substantially the environmental impacts noted herein.

39. There are ways in which the environmental performance of the project can be improved, and the IEE provides recommendations in regard to these opportunities. The majority of negative impacts that have been identified are associated with construction and installation of the proposed works. These are short term and localized, hence are impacts of minor significance that are minimized by application of safeguards that are common in the construction industry. Environmental criteria for construction are recommended to mitigate construction impacts, and are included as a separate appendix.

40. Negative environmental impacts occurring during the operation of the project are few. These are mainly concerned with maintaining water supply systems so that safe water, free of pathogens, can be delivered. Monitoring treated water quality and chlorine residual in the distribution lines is necessary for assuring safe supply, and is already a routine activity by government water supply agencies.

41. Public consultation has been conducted to make clear to the directly affected communities the potential social and environmental impacts as identified by the environmental and social reviews. No significant issues were raised during the public consultation that have not been addressed in the IEE. A proposal has been described for continuing the process of public consultation during construction that includes mechanisms for disclosure and for redress of grievances that arise during the construction phase.

Recommendations

42. Environmental safeguards involve mitigation of construction impacts by means of environmental requirements placed on the construction contractor, and operations and maintenance of the completed system to guarantee high quality of potable water. Sanitation and drainage have been addressed in terms of indirect and cumulative impacts.

43. The water quality of newly developed, test, or surrogate wells should be tested on a repeat basis to provide data for design and to assure that arsenic is not present in excess of national limits.

44. Mitigation measures to be undertaken during construction cover hiring of workers, provision of facilities for worker housing and sustenance, site work and pipe laying, temporary suspension of water supply and pipeline commissioning. Recommendations are aimed at maintaining access to residences and businesses, reducing dust, noise pollution and congestion at the site and along roadways and haul routes, provision of alternative services for water supply when the system needs to be shut down, disinfecting completed distribution mains prior to commissioning, provisions for worker housing, sanitation and waste management, and worker safety and health.

45. Mitigation measures for implementation during operations include chlorination of water supplies, periodic testing to assure good bacteriological quality, and maintenance of system pressures to prevent cross-contamination in distribution systems.

Conclusions

46. The environmental impacts of the proposed improvements in water supply infrastructure for Svay Rieng have been assessed by the Initial Environmental Examination reported in this document, conducted according to ADB guidelines. Issues related to involuntary resettlement were assessed by a parallel process of resettlement planning and determined to be insignificant, in that no involuntary land acquisition will occur within the scope of the subproject.

47. The overall conclusion of both processes is that providing the mitigation, compensation and enhancement measures are implemented in full, there should be no significant negative environmental impact as a result of location, planning, design, construction and operation of the project. There are benefits stemming from recommended mitigation and enhancement measures, and major improvements in quality of life and individual and public health once the project is in operation.

48. Further work on the IEE will be required prior to implementation to update the mitigation proposals and identify any associated costs, to be performed by the Environmental Specialist working with the Design Supervision Consultant.

I. INTRODUCTION

A. Purpose of the Report

1. This report presents the findings of the Initial Environmental Examination (IEE) for the proposed Svay Rieng Water Supply Subproject. The Subproject is part of the Urban Water Supply Project (the Project) financed by the Asian Development Bank (ADB), which provides improvements in infrastructure for nine provincial towns in Cambodia. The ADB's sector strategy for Cambodia, currently being formalized, seeks alignment with the Government's action plan to facilitate public-private partnerships, strengthen management of publicly owned water supply facilities and integrate urban waters supply and urban environmental management;[1] and supports Cambodia's millennium development goal for 80% of urban access to improved water supply by 2015.[2]

2. The province of Svay Rieng is located in Eastern Cambodia along the border with Vietnam, and shares a long common border with Prey Veng toward the east. The town of Svay Rieng has seven sangkats (communes), with a population of 44,936 in 2012.

B. Institutional and Regulatory Framework

3. The Project is classified under ADB rules as a Category B project. According to the ADB Safeguard Policy Statement (2009), such projects are judged to have some adverse environmental impacts, but of lesser degree and/or significance than those for category A projects. An initial environmental examination (IEE) is required for subprojects to determine whether or not significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report. A Rapid Environmental Assessment Checklist for the subproject is found in Appendix 1.

4. Appendix I of the ADB SPS (2009) requires that, "when the project involves existing activities or facilities, relevant external experts will perform environmental audits to determine the existence of any areas where the project may cause or is causing environmental risks or impacts." The rapid environmental assessment checklist (Appendix 1) includes a section in which the existing facilities have been audited to identify the presence of waste, spent, out-of-spec and discarded water treatment chemicals, oils, cleaning fluids and solvents, as well as contaminated soils that have or have the potential for causing environmental impacts or risks.

5. Overall management of the environment in Cambodia lies with the Ministry of Environment (MOE), which was created in 1993 with a wide set of responsibilities. At provincial and city levels, there are corresponding Provincial/City Environment Departments. Local departments have the responsibility of enforcing environmental legislation coming under the competence of the MOE.

6. The hierarchy of legislation in Cambodia includes the Constitution, laws issued by the National Assembly, decrees/sub-decrees/implementing regulations issued by the Council of Ministers, implementing legislation (prakas) issued by ministries and decree laws, which are legal instruments issued prior to the 1992 Constitution. Article 59 of the Cambodian Constitution provides for the protection of the environment. In November

[1] Cambodia: Water Supply and Sanitation Sector Assessment, Strategy, and Road Map; ADB Manila, 2012.

[2] Overview of the Urban Water Supply Sector in the Kingdom of Cambodia, Sub -Technical Working Group for Urban Water Supply, Department of Potable Water Supply, Ministry of Industry, Mines and Energy, January 2012.

1996, the Cambodian National Assembly passed the Law on Environmental Protection and Natural Resource Management (the framework law). The objectives of this law are to protect environmental quality through the prevention, reduction and control of pollution, to establish an Environmental Impact Assessment (EIA) system, to ensure sustainable use of natural resources, to encourage public participation and to suppress acts which are harmful to the environment. The law calls for EIAs to be conducted for every private or public project, to be reviewed by the Ministry of Environment before submission to the Government for a final decision. All proposed as well as existing activities are to be covered under this requirement.

7. Other articles of the law prescribe sustainable use of natural resources, and anticipate the establishment of natural resource protected areas by decrees. Another article provides that the MOE shall collaborate with other ministries to develop an environmental inventory which details the sources, types and quantities of wastes, toxic substances and noise disturbances which may exist in Cambodia.

8. EIA policy has been extended through the Sub-decree on Environmental Impact Assessment Process passed by the Council of Ministers on 11 Aug 1999. Under the sub-decree an Initial Environmental Impact Assessment (IEIA) report is required from a project owner either private, joint-venture or public sector.[3] A Project Owner must apply to the MOE for reviewing the IEIA report or to the Provincial/Urban Environmental Office (PEO) if the investment value is less than $2,000,000 and environmental impacts are not considered severe. In the case of a project that causes serious impact, the Project Owner must prepare a full EIA report and apply to the MOE for review. In practice, all IEIAs and related documents are reviewed and approved by the Department of EIA in the MOE. Declaration No. 49 *Guideline for EIA Reports* was issued in June 2000, and Declaration No. 745 *Determination of Service Charge for Environmental Impact Assessment Report Review and Follow-up and Monitoring of Project Implementation* was issued in October, 2000. For the present project, RGC/Client approval for Environment Clearance from the Ministry of Environment involves revision of the IEE during the design phase, coincident with detailed design preparation, and translation of the IEE into Khmer. The IEE is submitted to the Department of EIA within MOE, which has a period of 30 days to review and respond with comments, or approve, the IEE.

9. The Department of Potable Water Supply (DPWS) under the Ministry of Industry and Handicraft (MIH) is responsible production and distribution of safe water throughout the country; collecting information and preparing inventories of potential surface and groundwater supply; developing policies, rules and regulations to manage urban water supply; operating laboratories for control of water quality in line with National Drinking Water Standards; and issuing licenses for operation of water supply facilities in accordance with ministerial guidelines and principles. Water Supply Authorities (WSAs) are active in the two municipalities (Phnom Penh and Siem Reap) while Provincial Water Works (PWWs) oversee water supply systems in provincial and district urban centers.

C. Extent of IEE Study

10. The IEE was prepared as part of the ADB project preparation technical assistance (PPTA) TA 8125-CAM, with two months of international and three months of national consultant input. Data sources include government agencies, professional and academic reference materials, government publications and project background sources provided by the project management office (PMO). Field observations were conducted at the sites of proposed construction.

[3] The IEIA report is similar in scope and effort to an Initial Environmental Examination (IEE).

II. DESCRIPTION OF THE PROJECT

A. Scope

11. The Svay Rieng water supply system utilizes groundwater from three deep (90 to 190 m) boreholes, which is pre-chlorinated and then put through two package-plant type iron/manganese filters, before further chlorination and storage. In 2014, MIH measured the plant capacity at 4,800 m^3/day and daily supply was 2,618 m^3/day. The WTP does not function well: the gas chlorination system has failed and various water meters around the plant do not work. The iron/manganese filters have been problematic since the beginning and do not appear to be appropriate technology. The filters frequently block and need backwashing regularly; customers complain about red stained water. In addition, parts of the distribution system require renovation and the system needs to be extended into new service areas.

B. Interventions

12. Improvements involve installing additional boreholes to increase system capacity, improving the functioning of the iron-manganese removal system, installation of further ancillaries in the plant area, and extension of the distribution system. Other improvements involve electrical switch gear and valves/fittings, as well as piping to alleviate pressure problems and to extend the system, along with isolation valves between pressure zones:

Wells, In-plant and Electrical

A. Installation of two high capacity boreholes (deep wells) with submersible pumps to supplement current raw water pumping capacity (2 X 190m deep boreholes, submersible pumps, control panels, wellheads, power supply and pump buildings)
B. Change-out of the iron/manganese package plant filters with conventional filters and aeration
C. Replacement of the gas chlorination system
D. Construction of a 2-3 storey administrative office in the same area of the elevated water tower
E. Installation of drain on the existing elevated tank
F. Addition of frequency inverters on three intake pumps (Capacity 100m^3/h)
G. Installation of bulk flow meters to replace non-working ones on raw water, backwash, clear water and three existing boreholes
H. Addition of sludge drying bed in WTP grounds
I. Installation of an additional 160KVA transformer to feed new wells and office

Piping and Valves in Service Area

J. Replace old pipeline network with 5.2 km of new HDPE pipe
K. Extensions in service area with 23.5 km of new small diameter piping
L. Gate valves and bulk meters for isolation zoning.

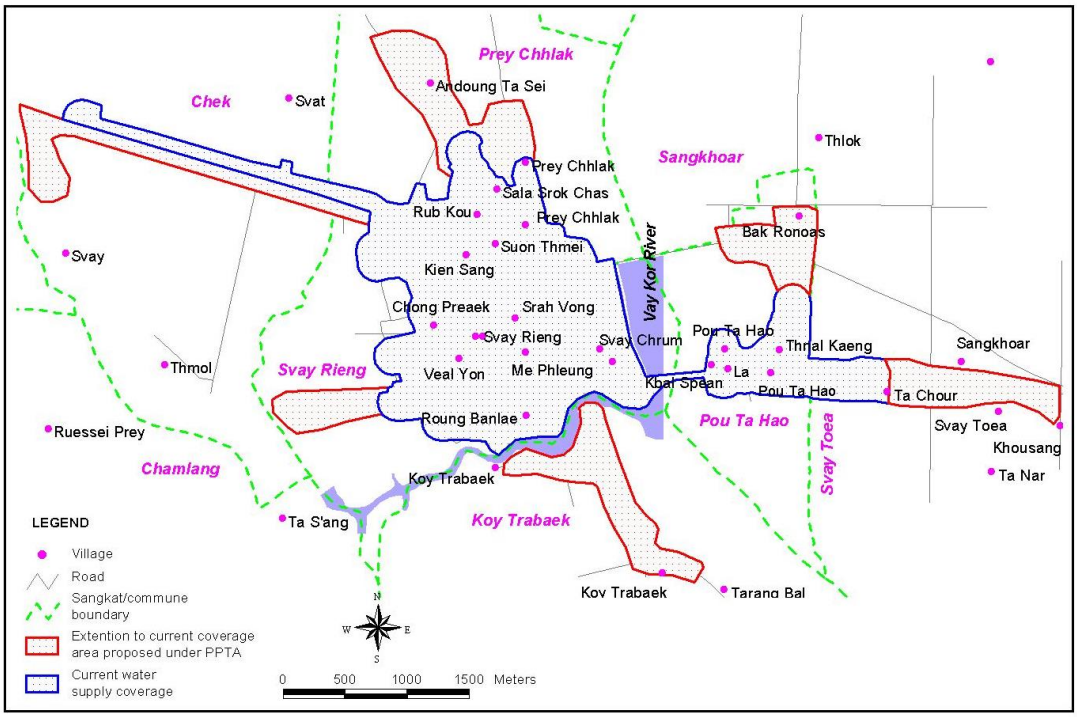
C. Location

13. The existing water treatment plant is located at UTM coordinates (Zone 48P) 588888 m E X 1225255 N and the location for the new administration building is 1.07 km due west near the city center of Svay Rieng, a centralized location more accessible to the public. Onsite work takes place at these two locations; offsite expansion of the distribution system and pipe replacement are shown in Figure 1. Additional land amounting to 9 m^2 is required for installing one of the two new boreholes; the remaining one will be installed at the WTP site.

D. Capacity and Performance

14. The present and 2030 demands are 4,853 and 5,311 m^3/day, respectively, based on a 2012 population of 44,936 persons with an increase to 45,089 over the design life of the project (an annual population growth rate of 0.02%) and 120 lpcd consumption. The current design capacity of the treatment plan is 4,800 m^3/day; the project aims to increase efficiency of treatment, increase distribution system pressure, provide additional storage, improve chlorination, and simplify O&M, but does not increase treatment plant capacity.

Figure 1: Svay Rieng Water Supply System: Current and Proposed Coverage



E. Sanitation

15. Various ministries have overlapping responsibilities related to sewerage and sewage/wastewater treatment in urban sanitation, but in general urban sanitation remains the responsibility of the Ministry of Public Works and Transport (MPWT). The implications with respect to environmental issues of the approach to sanitation proposed under the project are taken up in Sec. IV.E on indirect and cumulative impact.

III. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Climate and Air Quality

16. Svay Rieng Province is an agricultural province of lowland rice fields bordering Vietnam in the south. The land is mostly flat –elevation extremes are 5 – 18 MASL. In the rainy season flooding of rice fields and overflowing streams are typical. Isolated community forests are found throughout the province, and more common in the north. Small-scale irrigation is done by confining water in incised stream channels to extend the growing season, but with little storage capacity. There is a 14 ha irrigation and water supply reservoir above Svay Rieng town and its main canal irrigates one ha rice plots that may be further subdivided. Plot sizes are smaller in the north of the province (1/4 ha) and the land sandier and drier, with low weirs across stream channels for irrigation. About 80% of the drainage area of Svay Rieng Province flows into Vietnam. Monthly average rainfall and temperature are summarized in Figure 2. These values reflect the average of 30

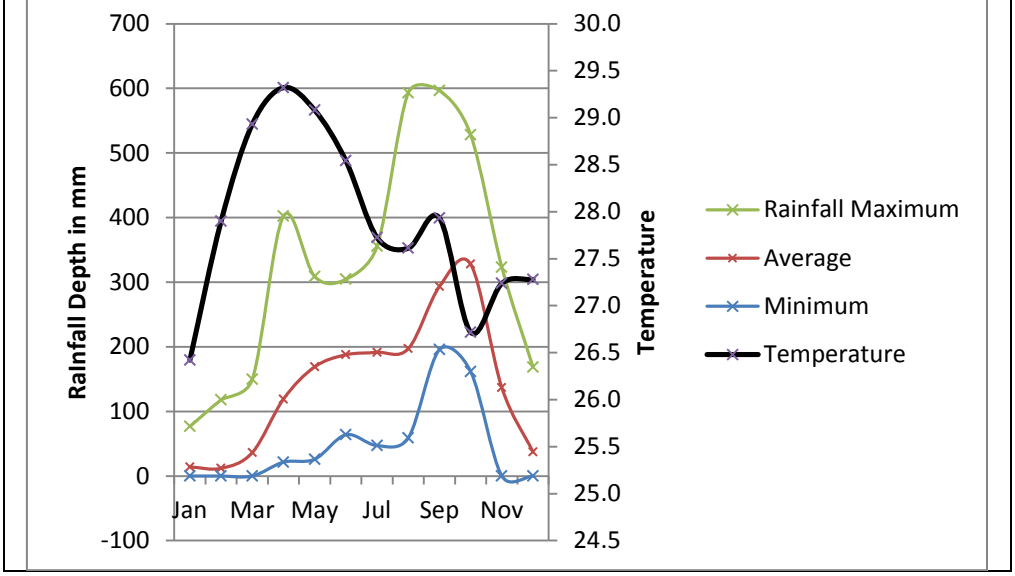
years of data (1981-2011) recorded at the Svay Rieng Province weather station. There are no predictions available on the effects of climate change on local rainfall or groundwater availability.

17. The town of Svay Rieng is located along National Hwy 1 between Phnom Penh and Ho Chi Minh City (HCMC). Extensive development exists along this highway in Vietnam for industrial and housing estates on the approach to HCMC. Similar development is occurring in the special economic zone (SEZ) of Bavet along the national highway. Though there is little large scale development occurring now in Svay Rieng, such is likely to occur in the future, and place strain on water supply and other public services.

2. Soils, Geology and Seismology

18. The local geology consists of sedimentary layers of recent origin and shallow depressions that hold swamps or wetlands. Cross-bedded alternate layers of sand, fine sand and silt are typical. Sandy soils tend to predominate and increase as one moves northward through the Province.

Figure 2: Average Temperature and Rainfall



3. Topography and Drainage

19. Svay Rieng is a southerly province with little elevation differential from that of the lower Mekong delta. Surface elevation in the area of Svay Rieng town is about 8 masl. Groundwater elevation could be expected to be high in the area, and responsible for generally waterlogged conditions found in otherwise sandy and porous soils. There are no natural hazards such as steep slopes and unstable soils within the confines of the plant property or along distribution line routes that would affect success of the project.

4. Surface Water

20. The Waiko River courses through Svay Rieng town, which is dammed to form broad and shallow lakes within the town area. Naturally flooded wetlands are found downstream of the main weir. Flooding occurs during wet periods on rice fields adjacent to drainage channels due to flat drainage gradients found in the area.

5. Groundwater

21. The DPWS Annual Report on Water Quality Analysis for 2011 reports on six parameters for raw water from deep wells in the water supply system: temperature, color, turbidity, pH, total dissolved solids and conductivity. pH is near neutral, averaging 6.7. TDS is low, an average of 149 mg/L and conductivity is 299 µs/cm. The water is treated for removal of iron and manganese through aeration and filtration.

22. A groundwater quality survey of Svay Rieng by Resource Development International[4] identified the presence of arsenic above WHO limits in 11% of collected well samples; however these are likely shallow wells used for household water supply. Manganese, often found in association with arsenic, was also present in 34% of samples. The graphical representation of that work is shown in Figure 3. The aeration and filtration system used for iron removal at Svay Rieng will remove arsenic as well, and generally removal of one mg/L of iron achieves removal 50 µg/L of arsenic in an optimized system. Water quality monitoring data provided by the Svay Rieng Water Works (see Table 1) is consistently above DOE standards in iron and manganese, a situation that will be remedied through the improved filtration system being installed under the project.

B. Ecological Resources

1. Aquatic Biology and Fisheries

23. Aquatic ecosystems in Svay Rieng are present in the extensive wetlands within the town and may harbor wildlife, but its nature is not clear. Flooded lands can support migratory bird species. The project does not have any effect on aquatic ecosystems.

2. Forests and Wildlife

24. There is no extensive natural forest located close to the project area. Svay Rieng Province is characterized by about 20 % forest cover, mostly in the north of the province.

3. Rare or Endangered Species

25. Terrestrial wildlife species are mostly gone from the area around Svay Rieng. Numerous mammal species in the past could perhaps be found in Svay Rieng Province, but none are likely to be found now in the project area.

4. Protected Areas

26. Some provincial protected areas can be found in the north of the province; these are generally maintained as community forests. None are in the project vicinity.

[4] http://www.rdic.org/dwqireport/svay-rieng/Svay_Rieng_Krong_Svay_Rieng_Svay_Rieng.pdf

Table 1: Summary of Treated and Raw Water Quality 1st Quarter 2013

All Parameter Analysis (Analyze every 3month)				
Water Treatment plant Name(ឈ្មោះអង្គភាព):			Year/Month (ខែ):April	
Items		DWQS Maximum	Date:29 /04 /2013	
			Raw Water	Treated Water
Drinking Water Quality Standards	Taste	Acceptable		ok
	Odor	Acceptable		ok
	Color	5 TCU	0	0
	Turbidity	5 NTU	0.00	0.00
	Residual Chlorine	0.2-0.5 mg/L		0.27
	pH	6.5-8.5	7.02	7.19
	Total dissolved solids	800 mg/L	149.5	147.5
	Manganese (Mn)	0.1 mg/L	1.8	0.6
	Zinc (Zn)	3 mg/L	0.05	0.05
	Sulfate (SO4)	250 mg/L	4	4
	Copper (Cu)	1 mg/L	<0.02	<0.02
	Hydrogen Sulfide (H2S)	0.05 mg/L	3	2
	Hardness	300 mg/L	246	84
	Aluminum (Al)	0.2 mg/L	0.026	0.009
	Chloride (Cl)	250 mg/L	17.79	19.79
	Iron (Fe)	0.3 mg/L	2.824	0.755
	Ammonia (NH3-N)	1.5 mg/L	<0.001	<0.001
	E.Coli			x
	Total coliform			x
other	Alkalinity	mg/L (as $CaCO_3$)	X	X
	Conductivity	µs/cm	299	295
	Organic Carbons	mg/L	0.32	1.25
Date:		Date:		Date:
Director		Chief of Production (Laboratory)		Analyst
ប្រធាន		ប្រធានផលិតកម្ម(មន្ទីរពិសោធន៍)		អ្នកធ្វើតេស្ត

C. Economic Development

1. Land Use

27. Land use in the project area includes residential space, commercial and institutional space, low-lying flooded lands, agricultural fields and grazing land. Land use is undergoing some change in the vicinity of Svay Rieng along the highway.

2. Agriculture, Industry and Tourism

28. Svay Rieng's economy consists of farming, fishing, rice and fruit cropping and some garment factories producing for international markets.

29. Statistics available from the World Food Program[5] regarding employment show higher proportions of the population engaged in agriculture, and fewer in industry and services, in comparison with the national average (Table 2). However road infrastructure and access to markets compare favorably (Table 3).

[5] http://www.foodsecurityatlas.org/khm/country/provincial-Profile/Svay-Rieng

Figure 3: Sampling and Exceedence in Shallow Wells near Svay Rieng Town

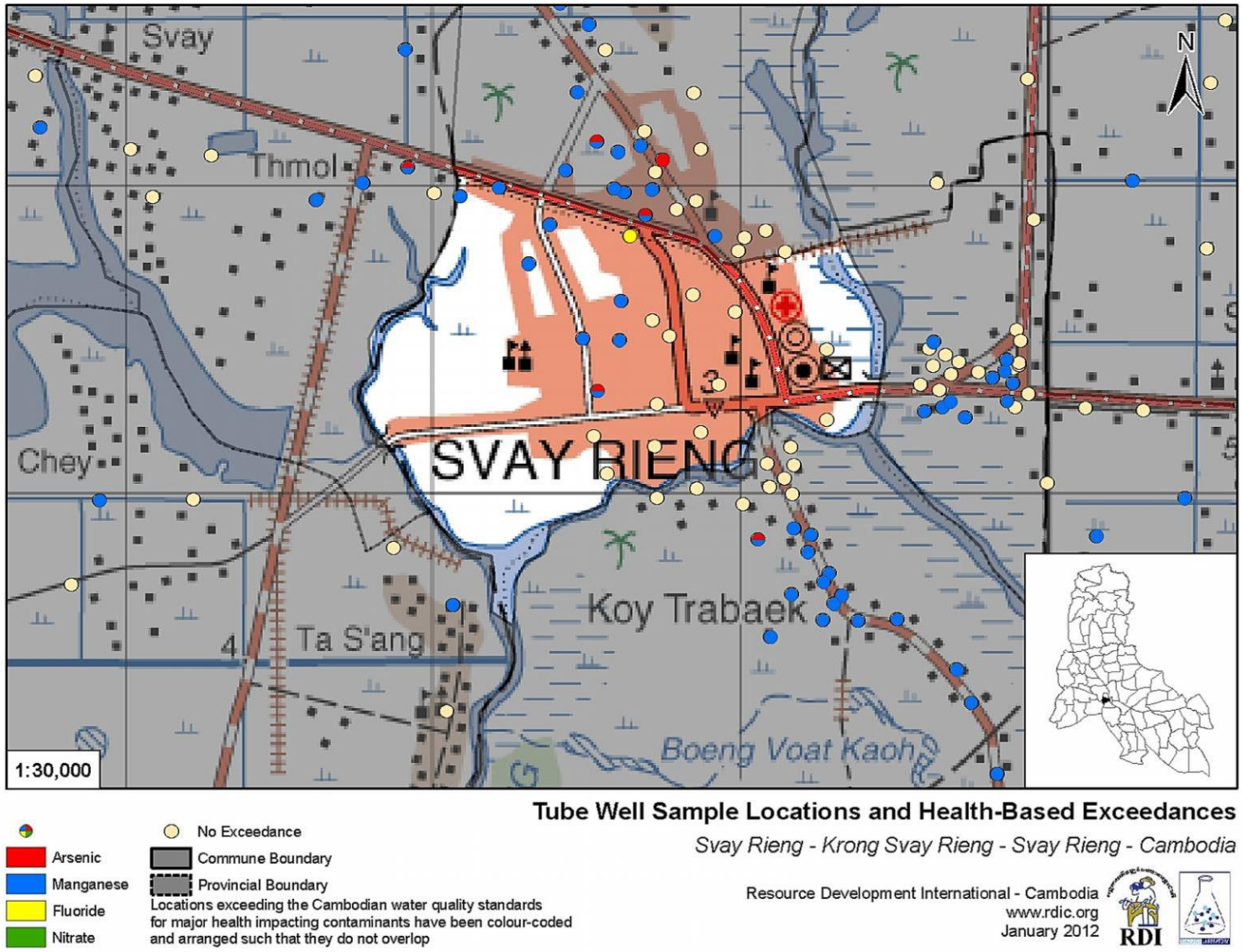


Table 2: Employment and Labor Force Indicators

Indicator	Svay Rieng	National
Literacy Rate > 15 years % total population	64	67
Literacy Rate > 15 years % females	54	60
% of the labor force in the primary sector incl. Agriculture	76	60
% of the labor force in the secondary sector/ Industry	10	13
% of the labor force in the tertiary sector/ Services	13	25
% of the labor force economically active <=10 days/ mth	35	29

Table 3: Market Access Indicators

Indicator	Svay Rieng	National
Average time (minutes) from village to the nearest market	36	45
Average farm gate price of paddy in Riel	503	521
Distance (Km) to nearest year-round road	2.0	3.8
Average time (minutes) from village to nearest year-road	9	18

3. Infrastructure, Transport and Power Supply

30. Svay Rieng is served by two national roads, running for 127 km. The province has twice as many kilometers of national road per square kilometer of area than the national average. National Road #1 runs through the province from Phnom Penh to Ho Chi Minh City and has recently been rebuilt. It serves as part of the ASEAN road network that is important in the region's economic integration, and provides increased throughput and development within the corridor.

31. Svay Rieng is supplied with electricity from a number of sources, including independent power producers. The state-owned EDC, in conjunction with GTS, produces electricity at three plants; in Svay Rieng town, in Memot, and in Ponhear Kraek. In addition, 36 independent power producers operate within the province. A third important source of electricity is imports from Vietnam — to Memot and to Por Ngekrek. Four districts in the province are connected to the Vietnamese grid, which provides a source of cheap and reliable power. Electricity imported from Vietnam costs 650 riel/kWh. Imports from Vietnam are expected to increase. In Svay Rieng town, 97% of families are supplied with electricity, consuming an average of 31 kWh each per month (2008 data).

D. Social and Cultural Resources

1. Population and Communities

32. The majority of people of Svay Rieng Province are farmers and fishers; however as of 2008 there were seven garment factories operational in the province, four in the Special Economic Zone at Bavat and three elsewhere. The province's poverty rate of 33% is slightly higher than the national average (Table 4). Data revealed through the project socioeconomic survey show the households within the project area to be comprised mainly of very poor (2.1%) and poor (60%) households.

Table 4: Indicators of Consumption Poverty

Consumption Poverty Indicator	Svay Rieng	National
Per capita consumption in riel	2650	3247
Consumption poverty line in riel	1765	1836
% of households below the poverty line	33	32
The poverty line value as a percentage of total consumption	67	49
World Food Program, http://www.foodsecurityatlas.org/khm/country/provincial-Profile/Svay-Rieng		

2. Health Facilities and Conditions

33. Health centers and a referral hospital are found at Svay Rieng. The World Food Programme survey (2008) gives the province a low rating in health indicators, with 50% of women suffering from anemia, 92% of births occurring outside of a health clinic and

71% without a health professional in attendance[6], all worse than the national average. However according to WFP only 2% of the provincial population are without access to safe drinking water within 150 m of their homes.

3. Sites of Historical, Archaeological, Paleontological, or Architectural Significance

34. There are no historical sites in Svay Rieng of note.

IV. POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

35. This section reviews potential environmental impacts in relation to location, planning and design; construction; and operations. A summary of the potential impacts is presented for each phase of the project. Each potential impact is then analyzed and necessary mitigation measures are proposed to reduce the overall magnitude of impact. Findings regarding preconstruction impacts have been incorporated into the planning under the PPTA.

A. Location, Planning and Design

36. The subproject will provide raw water from two additional deep wells, with no significant impact on the yield of deep aquifers in the area. Wells typically reach to 90-200 m to tap intermittent sand lenses that exist at various depths and with limited areal extent. Test drilling or repeated drilling is often necessary to find a sand lens that provides sufficient yield for high capacity production. These are thought to be unconfined aquifers that recharge annually during the rainy season, and for the most part the aquifers are not tapped by other users. However identifying a suitable location where wells will yield sufficient water has been difficult and wells drilled by the PWW have come up dry or with low yield. A hydrogeologist should be engaged for a period of months during loan implementation to support this and other subprojects where wells are being installed.

37. As indicated earlier, arsenic is present in some wells from the shallow aquifer in the vicinity of Svay Rieng, and may also be a concern in the deep aquifer. Cross-contamination can occur if the upper and lower aquifers are interconnected. During installation of the wells, a hydrogeologist should assess the potential for arsenic presence in the wells. Sampling and analysis for arsenic should be undertaken on a regular basis until it is shown that it is not present in quantities that exceed the WHO drinking water standard.

38. The locations for the two deep wells are, for well no. 1, on the grounds of the water treatment plant (WTP) and, for well no. 2, near the water treatment plant, to the south, as shown on Figure 4. The WTP grounds is spacious, with sufficient yet-unused area for placement of well no. 1 as well as for construction of the conventional sand filters and the sludge drying bed. Figure 5 provides a view across the grounds of the WTP. Other mechanical and electrical (M/E) improvements at the WTP (replacement of the chlorination system, addition of a transformer and modification of pump drives) have no effect on the environment.

39. The location of well no. 2 is shown in Figure 4 and a photographs of well sites are shown in Figures 5 and 6. The land is in private ownership and once it is determined that a well of usable volume and quality can be drilled at the site, a sufficient area will be purchased from the current land owner under voluntary acquisition arrangements. The amount of land is estimated to be a 9 m^2 plot.

40. The location for the construction of an administrative office building and for installation of a drain on the elevated tank is proposed at the location marked “Site for New Of-

[6] http://www.foodsecurityatlas.org/khm/country/provincial-Profile/Kampong-Cham

fice Building" on Figure 4. The site is sufficiently spacious to accommodate the building. Surrounding land uses are institutional and, at some distance, residential. Other than the typical noise from building construction, there are no impacts on the public due to the use of the site for this purpose.

41. None of the facilities proposed under the project are subject to damage or failure due to natural disasters such as floods and earthquakes, a factor that was taken into consideration during the design of the project.

42. Other than the voluntary transfer/purchase of a small parcel of land for the deep well, all subproject improvements will take place on land already owned by the DPWS or, in the case of piping, in the public alignment of roadways. No involuntary land acquisition is anticipated under the subproject.

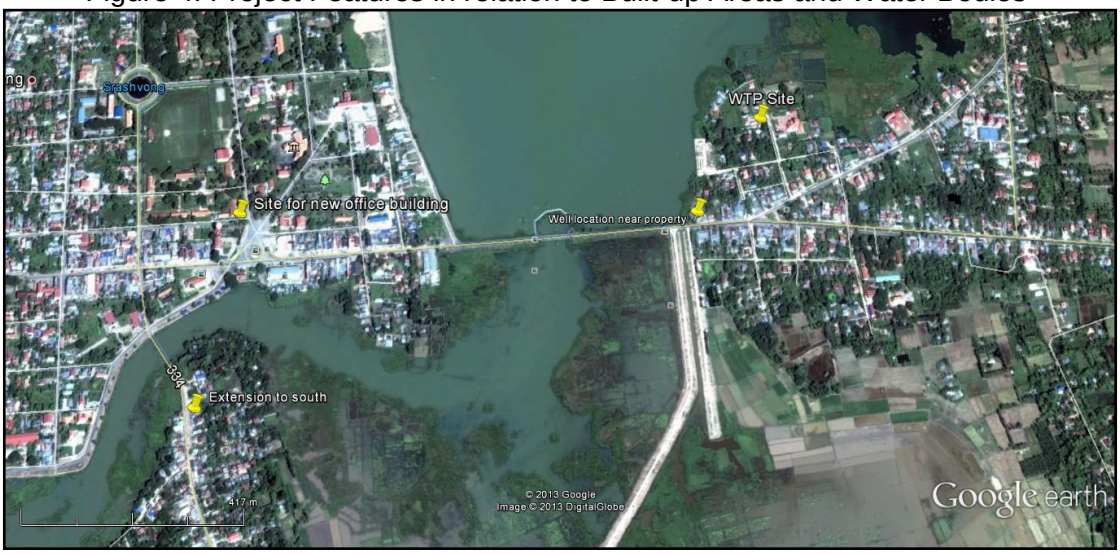
43. The potential presence of unexploded ordinance (UXO) and mines has been evaluated within the subproject area. It has been determined that there is no basis for suspecting that UXO or mines are present based on survey maps and discussion with provincial authorities. As a result, there is no need for further investigation of this factor in subproject preparation.

B. Construction

1. Installation of Deep wells

44. One of the wells will be installed on the WTP grounds whereas the other will be installed on a plot of land in proximity with sparsely settled traditional Khmer homes. Deep well drilling poses some impacts that result from the operation of drilling equipment, including the noise generated by drilling, use of drilling fluid and production of borehole cuttings contained in the drilling mud, which is continuously circulated between the borehole and a pit built on the ground or tank. Mud can escape from the pit, but is not particularly noxious. The presence of workers may also cause impact.

Figure 4: Project Features in relation to Built-up Areas and Water Bodies



45. The contractor should follow guidelines related to deep well placement as follows:

- Minimize to the extent possible noise and air emissions at the site through use of modern drilling equipment outfitted with functioning mufflers and emissions controls conforming to US Tier 4i/EU Stage IIIB regulations on internal combustion (diesel) engines.
- House workers offsite in suitable housing available in the town of Svay Rieng.

- Have only the number of workers present to undertake the work, with families of workers not allowed at the site.
- Minimize the escape of drilling fluid from the mudpit and provide a secondary containment berm down-gradient to intercept materials that overflow the pit. After completion, allow materials to dry and re-grade the site, and remove excess material for disposal elsewhere.
- Prevent the escape to the ground of drilling chemicals and oil from the drilling rig through use of drip pans, as needed.

Figure 5: WTP Site (Well Location #1)	Figure 6: Well Location #2 Site
	

2. Construction of Filters, Office building and Other M/E

46. All of the work described herein takes place onsite, either at the WTP or the site for the proposed office building. Potential impacts stem from the presence of workers carrying out their jobs and temporarily residing at the site. Noise and air emissions may extend beyond the site boundaries and cause a nuisance for adjacent land uses. Movement of materials to and off the site can affect traffic and conditions on roadways. Workers may be exposed to health and safety risks as a result of the work. None of these impacts is significant, and a high standard of project implementation by the contractor can minimize the effect.

47. To the extent necessary to accommodate the needs of the workforce, the contractor should provide suitable housing, adequate supplies of potable water, and toilet and bathing facilities. Onsite facilities for preparing food need to be provided, or food service contracted. Alternatively, since the size of the workforce is small, the Contractor may house workers at commercial guesthouses in the City. In the event a labor camp is set up, the contractor should provide means for disposing of wastewater from toilets, baths and food preparation areas either through a septic tank and soakaway, or holding tank with removal by vacuum truck. Solid waste should be collected at waste bins and disposed of properly offsite. The public should be barred from the site and children of workers should not be allowed within the work area.

48. The Contractor should have a basic safety and health plan in place for workers, in which workers are required to wear personal protective gear suitable to the type of work being performed and a worker is suitably trained (or experienced) in the work he/she is assigned to do. Emergency care should be available on call. The Contractor should maintain a record of accidents, which should be reviewed on occasion with the supervising engineer.

49. There is unlikely to be significant disturbance of surface soils at the sites, hence the potential for erosion and soil loss is insignificant. Any excess earth should be used in landscaping at the site or used as fill offsite at locations agreed upon by the property owner. Construction debris should be stockpiled and removed from the site soon after completion of the work.

50. Dust emissions can be controlled using water sprays. Operation of high decibel emitting equipment should be limited to daylight hours, as with receipt of materials and supplies shipments.

3. Installation of Distribution Piping

51. The replacement and extension of water distribution pipe takes place along linear alignments along roadways (for extensions), and city streets (where replacement of existing pipe is proposed). In limited instances the installation may cut across or intersect the street or road alignment. Replacement piping will be installed in sidewalks as shown in Figure 7. A total of 5.2 km of aging PVC pipe will be replaced with HDPE in a single branching system. Extensions are done in areas (see Figure 1) where there are no sidewalks, and the line is placed in the shoulder of the roadway, outside the edge of the pavement. A total of 40 km of 160—63 mm ϕ HDPE pipe will be installed, often on both sides of a given roadway to minimize road cuts. A typical location is shown in Figure 8. There is sufficient space between the property line and roadway available for easy placement without damage to road or private property.

52. Pipe will typically be installed about one meter outside the property line. Actual alignments will be set during the detailed design to minimize impacts on private property and damage to trees in the public right-of-way. Some alignments have homes and shops along the roadway; other alignments are away from areas where there are homes. The potential for environmental impact is found primarily in those areas where there are homes, but the impact is of temporary duration and limited extent. Special precautions need to be taken in more built up areas. The following procedures should be applied throughout pipe laying with particular emphasis where the work is conducted in congested areas.

Fig. 7: View of Alignment for Replacement Piping	*Fig.8: Typical Alignment for Extensions*
	

53. Facilities to accommodate the needs of the workforce have been described previously and are generally applicable; however the labor camp for the pipeline installer needs to be located away from work locations and workers transported to the work site on a daily basis. Temporary lodging for workers should not be set up along the alignments where piping is being installed. The labor camp should be set up at a selected and approved location for the duration of the contract, at a location that does not interfere with or cause a nuisance for the local community.

54. The contractor should conduct pipe laying in a manner that has minimum impact on the health, safety and convenience of businesses, residences and users of the street area. This includes the following:

1. Minimize the period of time that a segment of excavation is kept open by not allowing trenching to outpace pipe-laying by more than a day or so. Trenches should be backfilled and ground leveled after installation of piping.

2. Place only bedding and pipe materials at the location that will be used within the next few days work, well out of the line of traffic. Clean up and remove from the site any excess spoil, wood used for shoring and construction materials upon completion of the segment. Compact soil in trench and clean surrounding pavement areas to reduce blowing dust.

3. Provide temporary bridging across the trench at entries to residences and businesses. Otherwise, provide tape barriers to reduce the possibility of an accident.

4. Once work is complete on a segment, pavement surfaces and masonry works (curbs, abutments, stairs, drains, drives, etc.) should be repaired and returned to original condition.

55. The construction approach should minimize the time that any one segment is under construction or roadway/walkway left un-repaired to reduce the construction impact, done by limiting the length of open trench to 100 m or less.

56. The contractor should minimize use of heavy equipment in congested areas, conduct activities during daylight hours and apply water to suppress dust as needed. In heavily trafficked areas such as tourist sites and markets, the contractor should increase the work force to complete construction quickly, reduce dust by removal of excess earth, and avoid obstructing the paths of travel for pedestrians and vehicles.

57. The contractor should minimize downtime of existing water supply, limit shutdowns to less than four hours and notify the public in advance to store water as necessary.

58. The contractor should use tarpaulins to cover truck beds hauling sand, dirt or fill, avoid overfilling trucks and causing spillage along roadways, plan haul routes to avoid congested areas and narrow roads, and schedule transportation to avoid peak traffic periods. Excavated earth will be used for backfilling trenches; any excess should be minor.

59. The contractor should avoid trenching where damage might occur to buildings, and provide shoring and backfill with sand/cement admixture to prevent caving.

60. The public should be barred from construction areas, and excavations should be barricaded and marked. Workers should not be allowed to enter trenches deeper than waist height unless they are properly shored. Given that excavations will not be deep, pipe diameters relatively small, and that excavated materials will be used as backfill, the quantity of spoil will be minimal.

61. Movable sanitary facilities should be provided at the work site and kept clean, free of odors and usable. No materials should be stored onsite for longer than a day before their use. Excess materials should be removed after a segment is complete.

62. All roadway surfaces should be repaired as construction progresses; bid packages should contain a unit bid price for roadway repair, and for repair of any other facility, structure or surface that is likely to be damaged in quantity during construction.

4. Disinfection of Installed Water Pipe

63. Newly constructed or repaired water mains, tanks and reservoirs contain pollutants that accumulate during construction. These units can be disinfected through chlorination. Initial chlorine concentrations are made high enough (about 50 mg/L) to overcome the chlorine demand of contaminants. Chlorination is repeated until residual chlorine is one mg/L, after which the structure is flushed out before being placed into use. Installation contracts should include a bid item for disinfection of installed piping.

C. Operations

64. Impacts during operations concern environmental or public health. Poorly operated treatment plants pass pathogens; failure to chlorinate allows pathogens to survive in distribution systems; broken pipes and low pressure allow cross-contamination from sewers and soil organisms.

65. Modern, well-operated water treatment plants deliver a product water consistently free of coliform organisms and other pathogens, no matter how polluted the raw water may have been. Data show that flocculation, settling and sand filtration coupled with chlorination can produce an effluent containing one coliform organism per 100 ml (the historical standard for these plants) when influent contains as many as 6,000 coliform/100 ml.

66. Effective coagulation and sedimentation reduces turbidity to improve the effectiveness of filtration. Effective removal of bacteria by filtration relies on influent turbidity in the range of 7-14 NTU, after which sand filtration is capable of high removal efficiency. Regardless of the effectiveness of the treatment process, continuous chlorination at the head of the delivery system is necessary for delivery of safe water free of bacterial contamination, viruses and other pathogens. Chlorine residuals of 0.2 – 1 mg/L after 15 to 30 min of contact will generally produce a decontamination factor of 1000 (99.9% destruction). A 15 min residual of 0.5 mg/L appears to be a safe average.

67. Broken lines and low pressure provide means for entry of pathogens into distribution systems. The mechanics of this phenomenon are difficult to trace; however most modern systems guard against low pressure, when cross-contamination is potentially more likely in systems with high rates of unaccounted for water (e.g. systems with broken and leaky mains). Maintaining chlorine residual in the system is one way to guard against cross-contamination, as is sustaining adequate pressure in the system. A proposed technical assistance aims to provide capacity building for PWW staff in all aspects of operations and maintenance, which will ensure that high quality drinking water is provided through provincial systems.

68. Capacity building in the occupational and public safety aspects of operational use of chlorine will need to be included in the Loan. Of particular concern is the provision/procurement of adequate safety equipment at the site, to include eye wash stands refitted under the project and correct use of personal protective gear. Training must include emergency procedures for response in the event of leaks and spills, and means for conducting regular training of staff under normal operations, as well as simulated drills.

69. A sludge drying bed is being installed at the treatment plant works for dewatering filter backwash generated during operations. The small amount of materials derived from the drying operation can be safely landfilled at facilities operated by the municipality.

D. Sanitation

70. There is no physical intervention related to sanitation on the Project; therefore there is no direct environmental impact associated with any physical works. The absence of sanitation interventions to offset or mitigate the adverse effects of increased household, commercial and (potentially) industrial waste flows is a form of indirect or cumulative impact that is taken up in the next section.

E. Indirect, Cumulative and Induced Impacts

71. Water supply is an essential component of human welfare, and is essential for urban growth, both in terms of population density and the spread, or extension, of settlements into new areas. Growth in many towns in Cambodia has been constrained by limitations on water supply; even where actual numbers and area coverage are not factors, human health impacts stemming from inadequate household supply may occur.

72. Indirect, cumulative and induced impacts stemming from development of water supply systems have to do with the effects of urban growth. Most generally, urbanization is accompanied by congestion with concomitant effects on air pollution and overall quality of life. More specifically, the introduction of water supply into an area can cause rapid changes in land value, and the conversion of peri-urban or rural land into areas ripe for development. If land ownership is not clearly established ahead of time, the potential for land grabbing and displacement of households exists. In short, in the absence of land use controls, expansion of water supply systems aggravate uncontrolled development and consequent impacts on environment. New areas being served in Svay Rieng are already settled, so the aggravation of uncontrolled development does not occur.

73. The most clearly linked indirect impact of water supply expansion has to do with the disposal of increased quantities of wastewater from households and industrial/commercial users. Generally speaking, improved water supply should be accompanied by improvements in sanitation and drainage that mitigate the effect of increased discharges. Onsite sanitation is the norm throughout Southeast Asia, and many areas receiving water supply improvements also require improved onsite sanitation facilities, for homes not already equipped. Data obtained through the socioeconomic survey for the coverage area shows 90% of households equipped with pour flush toilets—a high percentage, indicating lack of sanitation should not be a constraining factor in advancing water supply coverage.

74. Septic systems may not function properly depending on local soil conditions; supernatants from septic systems installed for homes or commercial establishments may not percolate into the soil, and are routed to surface drains. Industrial and commercial wastewater discharges need more than simple removal from the living environment, requiring sufficient regulatory presence to insure that industries, hotels and markets install and consistently operate treatment systems. Improved drainage in areas newly served by water supply helps to alleviate some of the impact, but because these flows often concentrate partially treated effluents, the effect on a receiving stream can be injurious.

75. Impacts occur if drainage increases pollution load to receiving waters. In general, drainage systems suffer from a lack of investment in infrastructure, limited cooperation between government departments, clogging with solid waste and infilling/blockage by property owners. Drains receive urban run-off, solid waste and septic tank overflow, and contain high BOD, a measure of oxygen demand. These impacts may be alleviated by routing flows through constructed wetlands upstream (often along the boundaries) of receiving streams prior to final discharge. Access/use of suitable low-lying state-owned land should be secured for temporary use, requiring engagement of the Provincial Department of Land Management (DLM) and the custodial authority over the state-owned land.[7] The situation at Svay Rieng is that most septic tank supernatants will percolate into the sandy soil and that which flows overland will receive some 'treatment' in the shallow wetlands that course through the town.

76. The cumulative effect of discharges from many small urban drains on receiving water quality can be severe over the long term, and available solutions are inadequate to deal with the greater problem. Since water quality may be degraded in any open water bodies in the project area due to drainage discharges originating from increased water supply.

F. Resilience to Climate Change Impacts

1. Framework

77. The quantities of water supplied "at source" and the extent of water supply distribution to a recipient population provides the base case for comparison with future condi-

[7] The Fisheries Administration, for instance, is the custodial authority over seasonally submerged state-owned land in Cambodia.

tions under which the subproject is implemented and climate change effects take place. The subproject either improves, or is neutral with respect to, climate change resilience. A further issue concerns the exacerbation of health impacts due to climate change in the absence of effective sanitation and drainage in urban and peri-urban communities. Finally, whether subproject infrastructure is vulnerable to weather conditions brought about by climate change may be considered.

2. Predicted Regional Climate Conditions due to Climate Change

78. As of December 2012[8], downscaling of the general circulation models (GCMs) to determine regional climate conditions under global climate change had not been accomplished for Cambodia. Thus predictions related to the effects of climate change on hydrometeorological parameters in Cambodia are uncertain and generally qualitative. Extreme events at different times of the year, different years, and variable frequencies of both flooding and drought are anticipated, with main impacts on agriculture and public infrastructure, but the extent and seasonality of flooding or drought in any particular area are unknown. Long range effects on water supply, especially groundwater availability and reserves, are not known.

3. Prioritization of Urban Water Supply under Climate Resilience Regimes

79. According to Cambodia's National Adaptation Programme of Action (NAPA), water availability and accessibility, and water quality, are two of 14 ranking criteria to be applied to non-health projects aimed at improving resilience. Among agriculture and water resource projects, only one – "Safer Water Supply for Rural Communities" – deals specifically with water supply, and received a ranking in importance of 10 out of 14 points. Among coastal zone projects, one addresses water supply for communities located in coastal provinces ("Community and Household Water Supply in Coastal Provinces"), which received a ranking of 12 out of 14 points. No projects identified through the NAPA participatory process target resilience of urban water supplies.

4. Subproject Interactions with Climate Change

80. The subproject improves climate change resilience by increasing the supply of water at-source; and by extending the reach of the distribution system to areas within the community that lack piped water supply. The subproject also introduces more energy efficient operations through better pump selection, improvement of iron/manganese filtration capacity, and change out of inverters on the clear water pumping system. To the extent that the community is lacking in piped water supply either from shortage of source quantities or due to inadequate distribution, the recipient populations are benefited. Drought conditions brought on by climate change exacerbate problems related to water shortages among communities not served by centralized supply. In other words, inadequate or paucity of supply is made worse when long periods of drought exhaust storage in tanks, onsite tube wells, ponds and streams and replenishment comes infrequently and too late. Drought conditions are made worse as a result of climate change, either from the length of drought periods or from lack of intermittent rains of quantity or duration to relieve drought conditions. Some 1,870 households are currently served by the Svay Rieng water supply system; potentially some 45,000 people could be served over the design horizon. The subproject has a beneficial impact on the community by providing alternative water supply in the face of drought brought on by climate change, and improves the resilience of the community both in terms of at-source supply as well as coverage.

81. The subproject is vulnerable to the effects of climate change in the following manner:

[8] This is reported under "POLICY BRIEF 4: Improving Hydro-Meteorological Information and Downscaling of Climate Predictions for Better Climate Change Adaptation Planning in Cambodia", prepared by Hatfield Consultants for The Royal Government of Cambodia (RGC) through the Climate Change Department of the Ministry of Environment (CCD-MoE) under the project entitled "Preparation of a Strategic Pilot Program for Climate Resilience (PPCR) Project" – Phase I (November 2010 to January 2013).

- Sources of supply could become depleted. Since the aquifers providing water to the wells in the area are replenished annually during the monsoons, the effects of reduced rainfall are likely to be insignificant in comparison with high rainfall events and the annual monsoon rains. Further, there is currently little or no use of the deep water aquifers in the area, so the potential for conflict over water use is insignificant.
- Ground heave due to excessive drying (and potentially wetting) could cause breakage of pipes in roadway shoulders and other locations. The use of high density polyethylene pipe (HDPE) in preference to PVC offsets this impact. HDPE is more flexible and will yield and deform rather than break.

82. Drainage conditions are worsened under climate change scenarios, whether stagnant and still water bodies during periods of drought that breed mosquitoes and harbor high numbers of enteric disease bacteria, or flooding conditions where drainage systems are overwhelmed and polluted water enters human living spaces. Well-built and durable sanitation and drainage appurtenances, drainage easements, clear, open flow channels, and downstream extensive systems for pollution abatement such as constructed wetlands provide the means to offset impacts from climate change and make communities more resilient.

83. No other aspects of the subproject appear affected by climate change.

G. Existing Facilities Audit

84. Appendix I of the ADB SPS (2009) requires that, "when the project involves existing activities or facilities, relevant external experts will perform environmental audits to determine the existence of any areas where the project may cause or is causing environmental risks or impacts." The rapid environmental assessment checklist (Appendix 1) includes a section in which the existing facilities have been audited to identify the presence of waste, spent, out-of-spec and discarded water treatment chemicals, oils, cleaning fluids and solvents, as well as contaminated soils that have or have the potential for causing environmental impacts or risks. Waste materials that pose a hazard to human health or the environment have not been identified at the facility. The director of the water supply agency confirms the absence of any such materials within the water supply system buildings or on property under the control of the water supply agency. There is no need to prepare a corrective action plan to dispose of materials of this nature or remediate soils or structures for purposes of reducing environmental impact and risk.

H. Summary

85. Potential impacts have been identified as follows: during the planning phase, impacts may occur if sources of raw water supply are not sustainable and deplete the aquifer, which is not the case under the present subproject. Also, project preparation should assure adequate funds for repair of road surfaces, driveways and other roadside features following installation of water distribution piping. These elements of work should be included as payment items in the bid price for construction contracts. Impacts during construction are mitigated through application of environmental guidelines that limit the extent of dust and air emissions, water quality impacts, and the degree to which access, egress and passage are afforded to the public and adjacent landholders during construction. Impacts during operation are mitigated by maintaining the water treatment system and assuring a chlorine residual is present in the distribution system.

86. Indirect, cumulative and induced impacts have been found to be insignificant with the exception of increased sanitation and drainage flows. The project enhances climate change resilience among the communities served. An existing facilities audit did not reveal the existence of any areas where the project may cause or is causing environmental risks or impacts, hence there is no need for preparation of a corrective action plan.

V. ENVIRONMENTAL MANAGEMENT PLAN

A. Review of Impacts

87. Table 5 summarizes the impacts in the approximate order that they have been discussed in the previous section. The table also summarizes the required mitigation measures, institutional responsibilities for assuring the mitigation action is carried out and costs, which are in all cases included in previously identified budgets for design, construction and operation of the systems.

B. Institutional Arrangements

88. The Department of Potable Water Supply (DPWS) at central level under Ministry of Industry and Handicraft (MIH) is the executing agency and will establish the Project management Unit (PMU) to execute the Project. The PMU will assign responsibility for environmental aspects to a particular individual as staff PMU Safeguard Management Officer (PSMO) who is engaged full time with implementation of the project to oversee work related to monitoring.[9] The Provincial Water Works (PWW) is the operator of the Svay Rieng water supply system and implementation agency for the subproject. PWW will establish a Project Implementation Unit (PIU) to undertake construction of the Subproject in Svay Rieng Province.

89. The PMU will engage Contractors for specific works, based on the subcontract packages considered most suitable for execution. Legal clauses regarding mitigation measures are required to be included in construction contract bidding documents and become part of contract agreements; a typical set of specifications are provided in Appendix 2. For the main construction contracts, the Contractor will be required to appoint a staff Construction Environmental Management Officer (CEMO) responsible for supervising implementation of mitigation measures during the execution of the contract. The contractor will be required to prepare a Construction Management Plan (CMP) to ensure construction, demolition and excavation that take place at building sites do not adversely affect health, safety, amenity, traffic or the environment in the surrounding area. The CEMO working with the Contractor's Site Manager is responsible for preparing this plan prior to the start of construction and receiving approval for the plan from the PMU before the start of construction. The CEMO will serve as a point of contact that is accountable for environmental aspects of the construction work. For smaller construction contracts or subcontracts, the (sub-) contractor will still be held accountable for implementation of mitigation measures through a system of quality assurance supervised by the PMU[10].

90. The PMU will be assisted by the Environmental Specialists (ES), consultants[11] who are part of the Design and Supervision Consultant (DSC) and support all the subprojects undertaken through the loan. Work will commence with updating and finalizing the IEE and its respective environmental mitigation measures and monitoring plan, submitting the plans on behalf of MIH to the Ministry of Environment, incorporating legal clauses regarding mitigation measures into construction contract bidding documents, assisting the PSMO in monitoring the implementation of those measures during the progress of construction, and preparing the environmental sections of semi-annual reports to be provided to ADB. The ES also will provide training to PMU and PIU staff, focusing on ADB safeguard policies and procedures, and use of verification checklists for monitoring environmental safeguards during construction. Table 6 describes the functions of various agen-

[9] While the PSMO is engaged fulltime with subproject execution, duties related to environmental management may constitute only a portion of his/her responsibilities.

[10] Subcontractors hired by the general contractor, or minor contracts undertaken at the site are required to be managed under the provisions of the main contract and in conformance with the CMP.

[11] Both international and national ES will be engaged. It is recommended that the international ES be engaged for four months over the project duration, and the national ES be engaged fulltime, to provide support to the PSMO for this and other subprojects.

cies engaged in the project, and a diagram illustrating the institutional arrangement is provided in Figure 9.

91. A timeline for updating the IEE as well as for inclusion of the EMP and special conditions in contract and/or bidding documents is as follows:

- Project design proceeds over a period of 5 months (anticipated)
- Monitoring of water quality over first two months
- Concurrently, IEE is updated with new design data
- By end of month 2, expected that issues related to design are resolved
- IEE undergoes translation (2 weeks)
- IEE submitted to DOE by mid-month 3 of design period
- DOE has 30 days to review/approve IEE
- IEE approved by mid-month 4 of design period
- ADB review runs concurrently with DOE review
- Final approval from ADB and the Government obtained before detailed design finalized in time for inclusion in procurement package

92. The Ministry of Environment (MOE) and the provincial Departments of Environment (PDOEs) play a role in submittal, review, and approval of the IEE, and monitoring and reporting. This work takes place during the implementation phase. The ES will revise and update the IEE based on final designs, and the document should be translated into Khmer prior to submittal to MOE DEIA, which will engage in the review process the provincial PDOE where the subproject takes place. Only after the DEIA approves the EMP for the subproject can a contract be signed between the IA and the contractor for the works. Following that, implementation can proceed with construction mitigation measures mostly in the hands of the contractor, and the ES, PDOE, PIU and PSMO working together to perform monitoring and reporting. It will be the job of the PIU supported by the ES to compile quarterly reports, which then are compiled into semi-annual safeguard monitoring reports by the PMU and DSC, supported by the ES. A sample environmental monitoring reporting form is shown in Appendix 4. The PSMO and PMU Project Director will be responsible for submittal of reporting to ADB.

Table 5: Potential Environmental Impacts and Mitigation Measures

Project Activity	Potential Negative Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
Design and Preconstruction				
Detailed Design and Preparation of Bid Documents	Hazardous road conditions, dust during/after construction.	Include unit cost for road repair and other forms of property damage as a bid item in the construction contract for water line installation.	DE, PMU	Design Office
Detailed Design and Preparation of Bid Documents	Arsenic present in newly installed wells poses health hazard	Hydrogeologist to assess presence of impermeable layer and potential for intrusion via well bores, and the method for well installation that will prevent the occurrence of cross-contamination. Sampling of existing wells and exploratory boreholes to determine the presence of arsenic and need for arsenic removal.	DE, PMU	Design Office
Construction				
Well drilling	Noise and air emissions	Minimize noise and air emissions through use of modern drilling equipment	Contractor	Part of contract cost
Well drilling	Area cleanliness	Minimize escape of drilling fluid and provide secondary containment to intercept materials that overflow the pit. After completion, allow materials to dry and re-grade the site, and remove excess material for disposal elsewhere.	Contractor	Part of contract cost
Well drilling	Water pollution	Prevent the escape to the ground of drilling chemicals and oil from the drilling rig through use of drip pans.	Contractor	Part of contract cost
Provision of worker facilities	Inconvenience to communities due to presence of workers	Provide suitable housing, adequate supplies of potable water, and toilet and bathing facilities within the housing area. Onsite facilities for preparing food need to be provided, or food service contracted.	Contractor	Part of contract cost
Provision of worker facilities	Solid waste and sanitary discharges from worker camps.	Provide means for disposing of wastewater from toilets, baths and food preparation areas either through a septic tank and soakaway, or holding tank with removal by vacuum truck. Solid waste should be collected at waste bins and disposed of properly offsite.	Contractor	Part of contract cost
Site access	Accident or injury to public.	The public should be barred from the site and children of workers should not be allowed within the work area.	Contractor	Part of contract cost
Labor hiring	Unsafe working conditions and injury.	Basic safety and health plan in place for workers; personal protective gear; suitable training or experience in the work; emergency care available on call; contractor to maintain a record of accidents.	Contractor	Part of contract cost
Site work	Accidents, injury.	Workplace should be kept orderly to reduce accidents. Deep excavations in unstable soils need to be shored, and below grade construction brought to grade quickly, then excavations closed.	Contractor	Part of contract cost
Site work	Sediment runoff	Surface soils should be graded-to-drain and protected to reduce erosion and sediment runoff. Silt fences may be required in locations where there are nearby bodies of water that could be affected by sediment.	Contractor	Part of contract cost
Site work	Air pollution and noise.	Restrict use of heavy equipment and material receipts to daylight hours. Apply water to suppress dust where needed.	Contractor	Part of contract cost
Pipe laying.	Sediment runoff	Exercise caution to prevent erosion losses, close excavations rapidly and stabilize soils once the pipeline is in place.	Contractor	Part of contract cost

Project Activity	Potential Negative Impact	Proposed Mitigation Measure	Institutional Responsibility	Cost Estimates
Pipe laying.	Damage to private property.	Return land to the original condition on completion.	PMU	Part of Resettlement Plan cost
Pipe laying.	Congestion and blockage of access to homes, buildings, shops and roadways	Complete work on a segment according to a progressive sequence of activity. Provide access by bridging trenches.	Contractor	Part of contract cost
Pipe laying.	Dust hazard and impediment to traffic flow.	Store bedding materials outside trafficked areas. Cover materials and/or suppress dust with water. Excess spoil from excavations will be minimal, but should be removed from site and either reused or disposed of appropriately with other construction wastes.	Contractor	Part of contract cost
Pipe laying.	Damage to buildings, walls and existing buried piping.	Avoid trenching in locations where damage might occur. If needed, provide shoring to assure no subsidence occurs.	Contractor	Part of contract cost
Pipe laying.	Accident and injury.	Excavations should be barricaded and marked. Workers should not be allowed to enter deep trenches unless they are properly shored.	Contractor	Part of contract cost
Pipe laying.	Traffic congestion and high dust levels.	Use tarpaulins to cover truck beds or avoid overfilling and spillage along roadways, plan routes to avoid congested areas and narrow roads, and schedule transportation to avoid peak traffic periods.	Contractor	Part of contract cost
Pipe laying.	Inconvenience to public	Plan construction to avoid repeated excavation in roads and easements	Contractor	Part of contract cost
Pipe laying.	Inconvenience to public	Provide movable sanitary facilities at the work site and maintain clean, free of odors and usable.	Contractor	Part of contract cost
Pipe laying/suspension of water supply service	Inconvenience and health risk.	Plan work to minimize duration of shutdown. Limit shutdown to less than four hours. Notify public in advance and advise to store water as necessary.	Contractor	Part of contract cost
Pipe laying.	Disturbance at schools, hospitals, tourism sites by noise, dust and impeded access	Increase work force to complete construction quickly in affected areas. Minimize dust / avoid obstruction of pedestrians and vehicles	Contractor	Part of contract cost
Pipeline commissioning.	Negative health impact.	Disinfect water mains, tanks and reservoirs by chlorination. Include a bid item for disinfection in piping installation contracts.		Part of contract cost
Operations				
Water system operations	Property damage, water quality impact	Operate and maintain facilities to treat filter backwash and sedimentation tank underflow. Remove solids and dispose of according to approved means.	DPWS/PWW	Part of operations cost
Water system operations	Negative health impact.	Chlorinate water supplies.	DPWS/PWW	Part of operations cost
Water system operations	Accident/Injury to workers	Provide capacity building for emergency response to chlorine gas leaks and spills; assure sufficient PPE and onsite emergency response equipment is included in the loan	DPWS/PWW, DE	Part of loan implementation
Water system operations	Negative health impact.	Detect and repair leaks and maintain sufficient pressure to prevent cross-contamination.	DPWS/PWW	Part of operations cost

Table 6: Roles and Responsibilities

Agency	Role
MIH—DPWS Project Management Unit (PMU)	Supervision and guidance; assist to appoint staff of PMU including Project Safeguard Management Officer (PSMO); recruit competent environmental specialists (ES) as part of the DSC to assist design team and PMU; submit IEE to Ministry of Environment (MOE) for approval; consolidate and submit semi-annual reports to ADB, ensure EMPs are satisfied in the design and construction of the subproject.
Provincial Water Works (PWW) PIU (Svay Rieng)	Assist the ES to monitor mitigation measures and implement grievance mechanism, prepare and conduct public consultations, monitor subproject activities and prepare quarterly environmental reporting at the subproject level.
Design and Supervision Consultant (DSC) National Environmental Specialist (ES)	Assist the PMU to review, update and submit IEE for approval by MOE; incorporate EMP requirements into design, specifications and construction contract; co-ordinate with other government agencies regarding environmental issues; organize and implement public consultation and grievance redress mechanism; monitor activities of design engineer and construction contractors to assure mitigation measures are implemented; incorporate environmental reporting into semi-annual progress reports.
Construction contractors	Implement environmental requirements related to construction; incorporate environmental costs into bid estimate; prepare a Construction Management Plan (CMP); appoint the Construction Environmental Management Officer (CEMO); assure all environmental requirements are followed.
MOE DEIA and PDOE	Review IEE and provide comment and approval; PDOE assists in monitoring implementation of mitigation measures
DPWS/MIH Lab	Implement water quality monitoring of raw and treated water supplies during operations

C. Environmental Monitoring Plan

93. Environmental monitoring extends during the implementation of the loan and engages the previously identified groups. Table 7 identifies the monitoring to be undertaken in respect to the mitigation measures previously identified. The PIU and ES are responsible for the bulk of the monitoring being undertaken during the design and construction periods. During operations, the Provincial Water Works is responsible.

Figure 9: Organization for Environmental Management on Svay Rieng Subproject

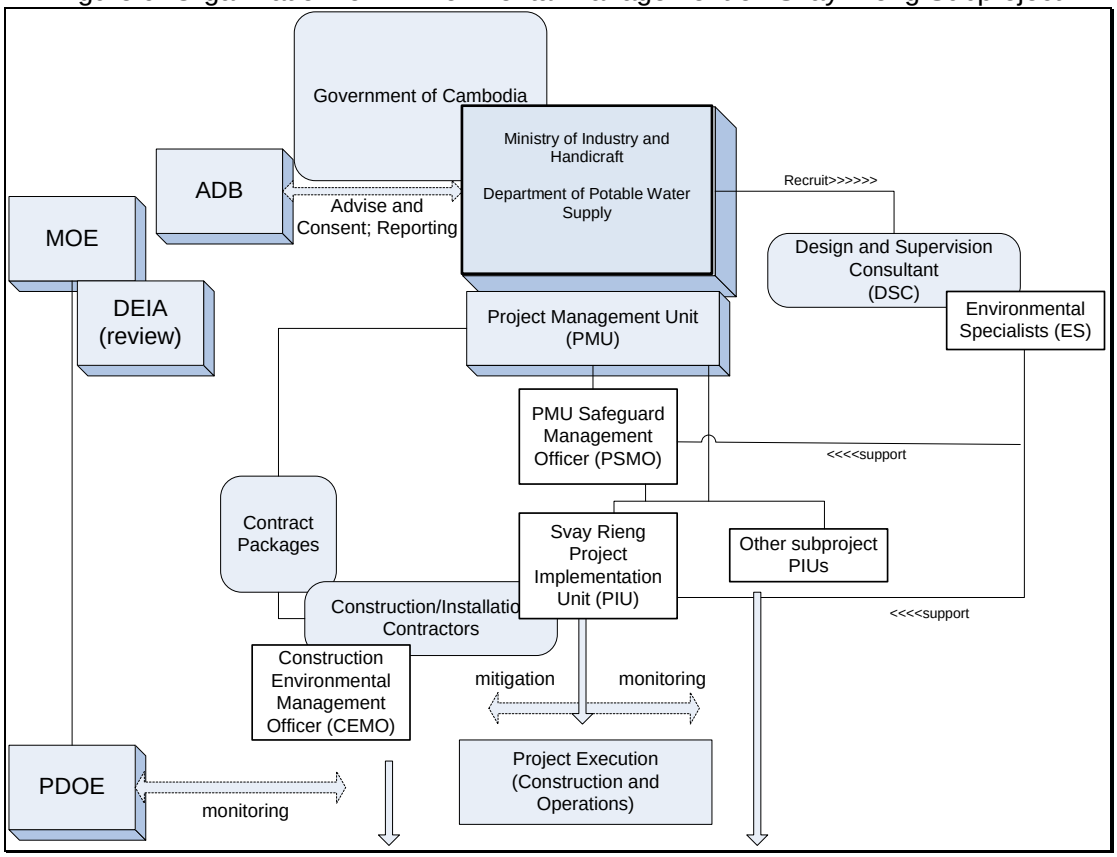


Table 7: Environmental Monitoring Plan

Mitigation Measure	Parameters to be Monitored	Location	Measurements	Monitoring Frequency	Responsibility for Monitoring	Cost to Monitor
Design and Preconstruction						
Include unit cost for road repair as a bid item in the construction contract for water line installation and for drainage pipe installation.	Components of Contract bid	Design Office; PMU	Review of Detailed Design Proposals.	At time of preparation	PSMO, ES, PDOE	No extra cost.
Assess presence of impermeable layer and potential for intrusion via well bores, method for well installation that will prevent the occurrence of cross-contamination. Sampling of existing wells and exploratory boreholes to determine the presence of arsenic and need for arsenic removal	MDSC performance	Design Office; PMU	Review of hydrogeological analysis	At time of preparation	PSMO, ES, PDOE	No extra cost.
Construction						
Minimize noise and air emissions through use of modern drilling equipment	Field Conditions	Well drilling site	Visual inspection	At start of work	PSMO, ES, PDOE	No extra cost.
Minimize escape of drilling fluid and provide secondary containment to intercept materials that overflow the pit. After completion, allow materials to dry and re-grade the site, and remove excess material for disposal elsewhere.	Field Conditions	Well drilling site	Visual inspection	Before work starts and after completion	PSMO, ES, PDOE	No extra cost.
Prevent the escape to the ground of drilling chemicals and oil from the drilling rig through use of drip pans.	Field Conditions	Well drilling site	Visual inspection	Continuously	PSMO, ES, PDOE	No extra cost.
Provide suitable housing, adequate supplies of potable water, and toilet and bathing facilities within the housing area. Onsite facilities for preparing food need to be provided, or food service contracted.	Field Conditions	Labor Camps	Visual inspection	At start of contract; quarterly	PSMO, ES, PDOE	No extra cost.
Provide means for disposing of wastewater from toilets, baths and food preparation areas either through a septic tank and soakaway, or holding tank with removal by vacuum truck. Solid waste should be collected at waste bins and disposed of properly offsite.	Field Conditions	Labor Camps	Visual inspection	At start of contract; quarterly	PSMO, ES, PDOE	No extra cost.
The public should be barred from the site as well as from worker housing areas.		Site locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Basic safety and health plan in place for workers; personal protective gear; suitable training or experience in the work; emergency care available on call; contractor to maintain a record of accidents.	Worker Provisions	Contractor's field office	Review of records	At beginning and end of contract	PSMO, ES, PDOE	No extra cost.
Workplace should be kept orderly to reduce accidents. Deep excavations in unstable soils need to be shored, and below grade construction brought to grade quickly, then excavations closed.	Field Conditions	Site locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Surface soils should be graded-to-drain and protected to reduce erosion and sediment runoff. Silt fences may be required in locations where there are nearby bodies of water that could be affected by sediment.	Field Conditions	Site locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Restrict use of heavy equipment and material receipts to daylight hours. Apply water to suppress dust where needed.	Field Conditions	Site locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Exercise caution to prevent erosion losses, close excavations rapidly and stabilize soils once the pipeline is in place.	Field Conditions	Site locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.

Mitigation Measure	Parameters to be Monitored	Location	Measurements	Monitoring Frequency	Responsibility for Monitoring	Cost to Monitor
Compensate property damage under the Resettlement and Compensation Plan. Return land to the original condition on completion.	Terms of Compensation Plan	Pipe laying locations	Review of compensation claims and awards	Monthly	PSMO, ES, PDOE	No extra cost.
Complete work on a segment according to a progressive sequence of activity. Provide access by bridging trenches.	Field Conditions	Pipe laying locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Store bedding materials outside trafficked areas. Cover materials and/or suppress dust with water. Remove excess.	Field Conditions	Pipe laying locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Avoid trenching in locations where damage might occur. If needed, provide shoring to assure no subsidence occurs.	Field Conditions	Pipe laying locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Excavations should be barricaded and marked. Workers should not be allowed to enter trenches greater than waste deep unless they are properly shored.	Field Conditions	Pipe laying locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Use tarpaulins to cover truck beds or avoid overfilling and spillage along roadways, plan routes to avoid congested areas and narrow roads, and schedule transportation to avoid peak traffic periods.	Field Conditions	Roadways and haul routes	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Plan construction to avoid repeated excavation in roads and easements	Field Conditions	Pipe laying locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Provide movable sanitary facilities at the work site and maintain the site clean, free of odors and usable.	Field Conditions	Pipe laying locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Plan work to minimize duration of shutdown. Limit shutdown to less than four hours. Notify public in advance and advise to store water as necessary.	Community acceptance	Community	Visual inspection	Whenever shutdowns are needed	PSMO, ES, PDOE	No extra cost.
Increase work force to complete construction quickly in affected areas. Minimize dust / avoid obstruction of pedestrians and vehicles	Field Conditions	Pipe laying locations	Visual inspection	Weekly	PSMO, ES, PDOE	No extra cost.
Purchase land as described in Resettlement Framework	Terms of Compensation plan	PMU office	Review of compensation claims and awards	Monthly	PSMO, ES, PDOE	No extra cost.
Disinfect water mains, tanks and reservoirs by chlorination. Include a bid item for disinfection in piping installation contracts.	Terms of contract documents	PMU office	Review of bid documents and contractor performance	Draft contract stage; during performance	PSMO, ES, PDOE	No extra cost.
OPERATIONS						
Operate and maintain facilities to treat filter backwash and sedimentation tank underflow. Remove solids and dispose of according to approved means.	Effluent TSS	Water Treatment Plant	TSS in effluent	Quarterly	DPWS/PWW	$200/yr
Chlorinate water supplies.	Chlorine residual	Treatment plant	Chlorine residual	Weekly	DPWS/PWW	$600/yr
Detect and repair leaks and maintain sufficient pressure to prevent cross-contamination.	System Pressure	Distribution system	System pressure	Weekly	DPWS/PWW	None

D. Water Quality Monitoring

1. Types, Frequency and Timing

94. Immediately upon mobilizing the hydrogeologist during detailed design and implementation, repeated samples of well water from the existing deep wells and any newly developed, test, or surrogate wells should be analyzed for standard parameters: temperature, color, turbidity, pH, total dissolved solids and conductivity; as well as for iron, manganese and arsenic. At least 10 sets of data should be used to determine acceptability of the raw water source and be incorporated into the treatment system design.

95. Concerns about surface water quality impacts during construction will be met by observing site conditions. In any case, these are minor impacts, and no direct water quality monitoring of surface water is needed.

96. Recommended protocols for monitoring raw water quality used in production operations (the raw water source) and finished water quality are already in place by DPWS in which a number of parameters are monitored (Table 8). Treated water quality should be within the limits set by the DPWS/MIH. It is important to consistently monitor raw and finished water quality, produce consistent data outputs, and analyze data for the purpose of maintaining and improving operations.

97. Other operations monitoring may be required. For instance, some operators measure select parameters downstream of the sedimentation tank in order to track performance of flocculation and settling in response to adjustments in chemical addition rate. Sampling and analysis may be performed at greater or lesser frequencies than specified herein to adjust performance. Actual parameters may differ depending on the source of supply (ground or surface water). The monitoring proposed herein is part of the operating unit's protocols, and is supported by MIH's Water Quality Lab, hence there is no additional cost associated with the proposal.

Table 8: Drinking Water Quality Parameters and Frequency

Parameter	*Raw Water*	*Treated*	*Notes*
Essential Items (Analyze Daily)	✓		
-Color	✓	✓	
-Turbidity	✓	✓	
-pH	✓	✓	
-TDS	✓	✓	Or conductivity
-Residual Chlorine		✓	Multiple locations in pipeline
Important Items (Analyze every 3 months)			
-Taste		✓	
-Odor		✓	
-Mn	✓	✓	
-Zn	✓	✓	
-SO_4	✓	✓	
-Cu	✓	✓	
-H_2S	✓	✓	
-Hardness	✓	✓	
-Al	✓	✓	
-Cl^-	✓	✓	
-Fe	✓	✓	
-NH_3-N	✓	✓	
-E. Coli	✓	✓	
-Total Coliform	✓	✓	
Other possible analyses			
-Alkalinity	✓	✓	Some ops measure daily
-Organic carbon content	✓	✓	Permanganate test (COD)
-arsenic	✓	✓	Until satisfied none is present exceeding 50 µg/L

2. Sampling Locations

98. The location of raw water quality sampling is at an offtake from the wellhead. Treated water quality monitoring takes place at the end of the treatment plant. Monitoring chlorine residual is done at various locations in the distribution system.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project Stakeholders

99. The primary stakeholders are the citizens of Svay Rieng who will benefit from improved water supply. Among this group, outlying communities that have previously not been connected to community water supply see the greatest change in their circumstance, whereas others will experience improved service, including higher quality water and increased quantities.

100. The Provincial Water Works (PWW) is a key stakeholder that holds the interests of the community to be its primary mission. The subproject concept and design are driven by PWW perceived needs for rehabilitation of system elements within the constraints of the available budget, and the PPTA team consulted regularly with the PWW to achieve good alignment of the subproject elements and current system needs. Furthermore the IEE has been reviewed by DPWS and concurrence has been reached on the contents of the EMP.

B. General Awareness of Project

101. During field work on environmental and social components, people were told about the subproject in their area, and asked about conditions regarding water supply, sanitation and drainage. Individual informants provided valuable information on current access to water supply, their daily routines in obtaining water, seasonal conditions that affect is availability, and requirements for household use. As part of the field work, individuals were informed about the proposed project and their responses noted. The social component combined focus group discussions with socioeconomic survey work, and conducted random sampling surveys that focused on local experience and perceptions of thematic issues like sanitation practice and water supply quantity and quality.

C. Formal Public Consultation regarding Environmental and Social Issues

1. Meetings

102. A meeting was held in Svay Rieng, combining resettlement and environmental components of project activity. Initial discussions were held with the DPWS director and staff to understand the proposed system components and operational constraints. Following that, a meeting was held on the grounds of the water treatment plant. About 30 persons attended the meeting representing commune leaders and ordinary citizens. The PWW organized the meeting and participated in the question-and-answer session. The meeting was publicized in advance by word of mouth through commune/village and government leaders.

2. Information Dissemination

103. A general description of the project was prepared in Khmer language, using visual means to provide some detail about the project proposal. A hand-out in Khmer was provided and used in the presentation. Environmental and social impacts identified by the project team were reviewed, as described in the IEE. Attendance lists were completed at the meeting and are included in Appendix 3.

3. Information Solicitation

104. The public in attendance was informed about the general purpose of the meeting: to ascertain the public's views on the project, suggestions for improvement, and concerns about environmental and social impact. Questions and comments were solicited, and ample time provided for attendees to react and respond. Responses were recorded on

specially prepared forms, noting the name, age, sex and occupation of the respondent, and the nature of the response. These are provided in Appendix 3.

4. Respondent Issues

105. Responses were positive, in favor of the project. People expressed concern about damage to roads and private property due to the installation of pipelines, an issue that is addressed in the IEE. No other specific issue of environmental concern was raised during the consultation. Other concerns centered around the price for connecting to the system and suggested that a installment plan be established to help poorer households. This suggestion has been forwarded to the financial consultant for the project. There was general all-round support and enthusiasm for the project.

5. Further Public Consultation

106. Further consultation should be held at the outset of procurement for the construction of civil works under the project. This is in order to notify the community that work will commence on the project, to review environmental issues of concern, and to inform the public of the grievance redress mechanism established under the project.

D. Disclosure

107. Details of the subproject were disclosed through a process of public consultation described above. Further to that, MIH shall provide the relevant environmental information for this subproject, including information from the IEE to affected people in a timely manner, in an accessible place, and in a form and language(s) understandable to them by providing a copy of the IEE in Khmer language at the PWW office for review by interested parties. In addition, ADB will post on its website the subproject IEE, updates prepared during the project implementation period, and environmental monitoring reports prepared during the implementation period.

VII. GRIEVANCE REDRESS MECHANISM

108. Grievances related to both environmental and resettlement issues are addressed through the Grievance Redress Mechanism (GRM). In order to ensure that complaints from all affected persons (APs) on any aspect of environment, land acquisition, compensation and resettlement are addressed in a timely and satisfactory manner, and that all possible avenues are available to APs to air their grievances, a well defined grievance redress mechanism will be established. All APs can send any questions to the implementing agency about their rights in relation with redress of environmental problems and entitlements. APs are not required to pay any fee in order to file a complaint at any level. The GRM has been explained in the public information booklet distributed to all APs, and is explained here in relation to complaints related to environmental impacts.

109. Stage 1 - Complaints from APs on any aspect of environmental impacts or the resettlement program shall first be lodged verbally or in written form to the commune leader. The commune leader along with the members of the provincial resettlement subcommittee working group (PRSC-WG) will meet to decide on a course of action within 15 days from the day it is lodged.

110. Stage 2 - If no understanding or amicable solution can be reached, or if no response from the commune chief is received by the AP within 15 days of registering the complaint, he/she can appeal directly to the PRSG-WG. APs will be heard in person by the vice chairman of the PRSC-WG and APs will be invited to produce documents which support his/her claim. The complaint must be settled within 60 days of registering the original complaint. The PRSC-WG will provide a decision within 30 days of the registering of the appeal.

111. Stage 3 - If the AP is not satisfied with the decision of the PRSC-WG, or in the absence of any response, the AP can appeal to the Interministerial Resettlement Commit-

tee-Resettlement Department (IRC-RD). The IRC-RD has 30 days to provide a resolution of the problem from the day it is lodged.

112. Stage 4 - If the AP is still not satisfied with the decision of the IRC-RD on appeal, or in absence of any response from the IRC-RD within the stipulated time, the AP, as a last resort, may submit his/her case to court of law, whose judgment is final. APs may also ask for resolution from ADB's responsible project officer consistent with the provision of the ADB's accountability mechanism. They can file their complaint through the ADB resident mission in Phnom Penh for transmittal to the ADB headquarters in Manila.

113. At each stage the governing official is responsible for recording the minutes of meetings, maintaining files on all complaints, and for distributing copies of all decisions to the PMU and lower level bodies, including commune/village officials and affected parties and households.

VIII. FINDINGS AND RECOMMENDATION

114. No residual chemicals, waste oil or contaminated earth has been identified at the site, so there is no need for preparing a corrective action plan (CAP) for the facility.

A. Findings

115. The Initial Environmental Examination for this subproject provides a review of the proposed infrastructure and its interactions with the surrounding environment, and analyzes potential impacts due to design, construction and operations, with the objective of determining the timing, scale and intensity of impacts. The review and analysis shows that significant negative impacts are unlikely to occur. Because water supply is an important infrastructure improvement that runs concurrently with – and are essential for – economic development, the main impact is expected to be beneficial. Furthermore, good engineering practice in the design, installation and operations of water supply systems mitigate substantially the environmental impacts noted herein.

116. There are ways in which the environmental performance of the project can be improved, and the IEE provides recommendations in regard to these opportunities. The majority of negative impacts that have been identified are associated with construction and installation of the proposed works. These are short term and localized, hence are impacts of minor significance that are minimized by application of safeguards that are common in the construction industry. Environmental criteria for construction are recommended to mitigate construction impacts, and are included as a separate appendix.

117. Negative environmental impacts occurring during the operation of the project are few. These are mainly concerned with maintaining water supply systems so that safe water, free of pathogens, can be delivered. Recommendations are made regarding chlorination and prevention of cross-contamination in the distribution system, to be carried out by the Department of Potable Water Supply. Monitoring treated water quality and chlorine residual in the distribution lines is necessary for assuring safe supply, and is already a routine activity by government water supply agencies.

118. Public consultation has been conducted to make clear to the directly affected communities the potential social and environmental impacts as identified by the environmental and social reviews. A Public consultation was held in Svay Rieng to review the subproject. The public consultation is documented in the subproject IEE. No significant issues were raised during the public consultation that have not been addressed in the IEE, nor were there issues that pose a significant constraint on implementation of the proposed subproject. A proposal has been described for continuing the process of public consultation during construction that includes mechanisms for disclosure and for redress of grievances that arise during the construction phase.

B. Recommendation

119. Environmental safeguards involve enhancing performance of the water treatment system, mitigation of construction impacts by means of environmental requirements placed on the construction contractor, and operations and maintenance of the completed system to guarantee high quality of potable water. Sanitation and drainage have been addressed in terms of indirect and cumulative impacts.

120. The water quality of newly developed, test, or surrogate wells should be tested on a repeat basis to provide data for design and to assure that arsenic is not present in excess of national limits.

121. Mitigation measures to be undertaken during construction cover hiring of workers, provision of facilities for worker housing and sustenance, site work and pipe laying, temporary suspension of water supply and pipeline commissioning. Recommendations are aimed at maintaining access to residences and businesses, reducing dust, noise pollution and congestion at the site and along roadways and haul routes, provision of alternative services for water supply when the system needs to be shut down, disinfecting completed distribution mains prior to commissioning, provisions for worker housing, sanitation and waste management, and worker safety and health.

122. Mitigation measures for implementation during operations include chlorination of water supplies, periodic testing to assure good bacteriological quality, and maintenance of system pressures to prevent cross-contamination in distribution systems.

IX. CONCLUSIONS

123. The environmental impacts of the proposed improvements in water supply infrastructure for Svay Rieng have been assessed by the Initial Environmental Examination reported in this document, conducted according to ADB guidelines. Issues related to involuntary resettlement were assessed by a parallel process of resettlement planning and determined to be insignificant, in that no involuntary land acquisition will occur within the scope of the subproject.

124. The overall conclusion of both processes is that providing the mitigation, compensation and enhancement measures are implemented in full, there should be no significant negative environmental impact as a result of location, planning, design, construction and operation of the project. There are benefits stemming from recommended mitigation and enhancement measures, and major improvements in quality of life and individual and public health once the project is in operation.

125. Further work on the IEE will be required prior to implementation to update the mitigation proposals and identify any associated costs, to be performed by the Environmental Specialist working with the Design Supervision Consultant. There is no additional environmental assessment work required at this stage to comply with ADB policy or national law.

Appendix 1: Rapid Environmental Assessment (REA) Checklist

Country/Project Title:	Cambodia / Urban Water Supply Project (Svay Rieng)
Sector Division:	Urban Development and Water

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area…			
▪ Densely populated?		✓	
▪ Heavy with development activities?		✓	
▪ Adjacent to or within any environmentally sensitive areas?			
• Cultural heritage site		✓	
• Protected Area		✓	
• Wetland	✓		Adjacent bodies of water not affected by the subproject.
• Mangrove		✓	
• Estuarine		✓	
• Buffer zone of protected area		✓	
• Special area for protecting biodiversity		✓	
• Bay		✓	
B. Potential Environmental Impacts Will the Project cause…			
▪ pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		✓	
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		✓	
▪ hazard of land subsidence caused by excessive ground water pumping?		✓	
▪ social conflicts arising from displacement of communities ?		✓	
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		✓	
▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?	✓		**Water is treated for iron and manganese removal.**
▪ delivery of unsafe water to distribution system?		✓	
▪ inadequate protection of intake works or wells, leading to pollution of water supply?		✓	

Screening Questions	Yes	No	Remarks
▪ over pumping of ground water, leading to salinization and ground subsidence?		✓	
▪ excessive algal growth in storage reservoir?		✓	
▪ increase in production of sewage beyond capabilities of community facilities?		✓	
▪ inadequate disposal of sludge from water treatment plants?		✓	
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		✓	
▪ impairments associated with transmission lines and access roads?		✓	
▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		✓	
▪ health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and operation?	✓		**Capacity building plan for handling chlorine; prior experience of workers (existing system has chlorine gas delivery system)**
▪ dislocation or involuntary resettlement of people?		✓	
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		✓	
▪ noise and dust from construction activities?	✓		**Moderate effects; mitigated through standard means**
▪ increased road traffic due to interference of construction activities?		✓	
▪ continuing soil erosion/silt runoff from construction operations?	✓		**Moderate effects; mitigated through standard means**
▪ delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?		✓	
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		✓	
▪ accidental leakage of chlorine gas?	✓		**Capacity building in safe handling of chlorine gas provided under the project**
▪ excessive abstraction of water affecting downstream water users?		✓	
▪ competing uses of water?		✓	
▪ increased sewage flow due to increased water supply		✓	
▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant		✓	

Screening Questions	Yes	No	Remarks
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	
▪ social conflicts if workers from other regions or countries are hired?		✓	
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?		✓	
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		✓	

Preliminary Climate Risk Screening Screening Questions		Score	Remarks[12]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	0	
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	1	Design to consider sustainable groundwater levels
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s) ?	0	
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.

Result of Initial Screening (Low, Medium, High): Medium

[12] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Appendix 2: Environmental Specifications for Contract Tender Documents

General

1. The contractor will post a public notice regarding the nature, extent and cost of the project at the start of the construction zone; and post notices announcing the grievance redress mechanism in local government offices and in strategic places of the subproject's area of influence.

Worker Provisions

2. GOC criteria for minimum age, wage and living provisions, benefits, hours of work, overtime arrangements and overtime compensation, and leave for illness, maternity, vacation or holiday should be met for all workers. The Contractor will conform to national law in relation to hiring and employment; and will comply with the principle of equal opportunity, fair treatment, and nondiscrimination with respect to the employment relationship; except that hiring of project-affected persons, residents of project-affected administrative units and disadvantaged groups is encouraged.

3. The contractor shall implement a safety and accident prevention program involving provision, training and use of safety equipment; minimum skills qualifications for operators and drivers; and record keeping related to accidents.

4. The Contractor will provide Personal Protective Equipment (PPE) to workers that offer adequate protection to the worker without incurring unnecessary inconvenience in its use[13]. Proper maintenance of PPE, including cleaning when dirty and replacement when damaged or worn out; and proper use of PPE should be part of training programs, as appropriate.

5. The contractor will maintain first aid kits onsite along with instructions for use, and personnel trained in basic first aid emergency response measures; and emergency care should be available on call.
6. Laborers and others resident at the site will be provided with lodging in a camp setting, potable water supply, food service facilities, adequate means for maintaining personal hygiene and solid/liquid waste disposal, and onsite facilities for preparing food, or food service contracted.
7. The contractor will provide means for disposing of wastewater from toilets, baths and food preparation areas either through a septic tank and soakaway, or holding tank with removal by vacuum truck. Solid waste should be collected at waste bins and disposed of properly offsite.
8. The public should be barred from the site as well as from worker housing areas.

9. HIV/AIDS awareness should be incorporated into the contractor's policy and outreach toward workers.

[13] Depending on the application PPE may include safety glasses with or without side-shields, and protective shades; plastic helmets with top and side impact protection; hearing protectors (ear plugs or ear muffs); safety shoes and boots for protection against moving & falling objects, liquids and chemicals; gloves made of rubber or synthetic materials; facemasks with appropriate filters for dust removal and air purification; single or multi-gas personal monitors; portable or supplied air; on-site rescue equipment, and insulating clothing, body suits and aprons of appropriate materials.

Use of Land for Construction Purposes

10. The contractor will obtain approval from landowners for temporary use of land for labor camps and construction yards. Local authorities will be consulted on locations, which will in no case be close to sensitive receptors such as hospitals, schools and residential communities.

11. The contractor will not encroach upon vacant land or cause damage to adjacent properties. The Contractor will execute a plan for preventing firewood gathering in the project area and prohibit among workers possession of instruments or poisonous substances for killing or capturing fish or wildlife.

12. Cutting trees is prohibited except inside the construction zone. Trees to be removed must be specified in the Project plans and specifications.

13. No fuel, oil, or parts cleaning fluids shall be spilled, wasted or disposed of at the project site. Secondary containment (earth or concrete berm) at least equal to the capacity of the fuel storage tank shall be provided at fueling stations.

14. After completion of occupancy, all affected areas within the general project boundary shall be graded to their original elevation that allows positive drainage. Machinery, equipment, structures, contaminated earth, plant matter and waste or unused materials shall be removed and disposed of properly.

Conduct of Work

15. The workplace should be kept orderly to reduce accidents. Deep excavations in unstable soils need to be shored, and below grade construction brought to grade quickly, then excavations closed. The contractor will:

    a. Restrict use of heavy equipment and material receipts to daylight hours. Apply water to suppress dust where needed.

    b. Exercise caution to prevent erosion losses, close excavations rapidly and stabilize soils once the pipeline is in place.

    c. Return land to the original condition on completion.

    d. Complete work on a segment according to a progressive sequence of activity. Provide access by bridging trenches.

    e. Store bedding materials outside trafficked areas. Cover materials and/or suppress dust with water. Remove excess.

    f. Avoid stockpiling materials, equipment and supplies at the site.

    g. Avoid trenching in locations where damage might occur. If needed, provide shoring to assure no subsidence occurs.

    h. Excavations should be barricaded and marked. Workers should not be allowed to enter trenches greater than waste deep unless they are properly shored.

i. Use tarpaulins to cover truck beds or avoid overfilling and spillage along roadways, plan routes to avoid congested areas and narrow roads, and schedule transportation to avoid peak traffic periods.

j. Plan construction to avoid repeated excavation in roads and easements.

k. Provide movable sanitary facilities at the work site and maintain the site clean, free of odors and usable.

l. Plan work to minimize duration of shutdown. Limit shutdown to less than four hours. Notify public in advance and advise to store water as necessary.

m. Increase work force to complete construction quickly in affected areas. Minimize dust / avoid obstruction of pedestrians and vehicles

Sediment Controls

16. Areas to be cleared and excavated are limited to areas where construction will take place. Areas will be protected from flowing water including sheet runoff. The contractor will limit sediment loss from exposed surfaces. Existing drainage patterns should be maintained during construction.

17. Discharge of wastewater into water bodies is prohibited as is the discharge of wash water from concrete trucks to waterways. . Land clearing activity will be suspended during rains to limit sediment loss.

Community Values

18. Vehicles will operate within the legal speed limits in populated areas. The operation of moving equipment in locations accessible to the public will be done in a manner so as to prevent the occurrence of incidents and accidents.

19. The contractor is responsible for regular spraying of roadway surfaces in use as haul routes and of sites under construction where these locations are accessed by the public. The contractor will remove excess debris during construction and after completion of the item of work.

20. The Contractor will post flagmen at intersections of transit paths for construction vehicles and local traffic, and along traffic lanes where work is in progress. Traffic detours will be clearly marked.

21. The contractor will provide a path for transit of pedestrians and vehicular traffic through the construction area; and barricade open excavations to prevent injury to the public.

22. The contractor will provide temporary access to affected properties and reinstate permanent access on completion of work; minimize the area under construction at any one time and the duration of works at any one location; and minimize impacts on infrastructure, access and services.

23. The contractor will install signs and lighting, where there is nighttime traffic, in the vicinity of works on public roads, and restrict access to the construction site to the public.

Site Conditions and Haul Routes

24. At the start of construction, the contractor will provide a Construction Management Plan for development of the construction zone, worker camps, equipment yards, and haul roads.

25. Haul routes will minimize interference with ongoing activity in the area. Routes shall be approved by the PMU. Haul roads and transport/equipment routes shall be kept within the construction zone, unless authorized by the PMU.

Disinfection of Pipes, Tanks and Equipment

26. The Contractor will disinfect water mains, tanks and reservoirs by chlorination and include a bid item for disinfection in piping installation contracts.

Appendix 3: Public Consultation at Svay Rieng

ADB TA 8125-CAM
Cambodia Urban Water Supply Project
Environmental and Social Public Consultation Response Form

Province: Svay Rieng	District: Svay Rieng Town	Commune: Svay Rieng
Date: 11/06/13	Time: 2:00 – 3:30 pm	Attendance (no.): 30 (13 female)
Statements and Inquiries Provided by Attendees:		
No.1 Name: Sum Sakhorn	Sex: Male Age: **57**	Occupation: Commune Chief (Kuy Trabek)
Statement or Inquiry: The area along the road may be affected adversely in our area, but will be insignificant. But don't do the project during the election! Also, please show some consideration for the entrance pathways to and from homes during the construction.		
Response if any: Mitigations are included in the plan for the contractor.		
No.2 Name: Touch Thy	Sex: Male Age: **58**	Occupation: First deputy chief of Svay Commune
Statement or Inquiry: we are tired of the existing water supply system. It is very old and worn out. Some improvements were made under UN Habitat, but water quality is still poor. So we've been hearing again and again about getting a better system – we are tired! Because of that I am not sure whether people will be glad to hear about this project, but I will inform them it is coming.		
Response if any: (by Director) we have had many projects to repair the WS system, and to replace parts, but we are unable to resolve all the problems. Now this project will install new lines that should be in place and function for 30-40 years. So there will be no more disturbance in your community to do more. And realize that all projects have impacts and cause inconvenience, but please support our work! We will repair the damages after completing.		
No.3 Name: Hun Savan	Sex: Male Age: **56**	Occupation: Commune Chief (Prey Chhlak)
Statement or Inquiry: The provincial plan calls for extending the water supply system, so I support your proposal 100%. Before people in my village didn't understand the health benefits of clean water, but now they do. Nearby areas have piped water. But please ensure the water quality will be good. Our village has been asking for it. Many homes are on unsanitary wells and there is a health impact; we need clean water.		
Response if any:		
No.4 Name: Nuon Sophal	Sex: Male Age: **60**	Occupation: Chief of Prey Chhlak village
Statement or Inquiry: I represent the people in my village and I support the project. But the service fee is too high. The electricity fee has gone down; why not water? As far as inconvenience during construction, the community will help to minimize the problem.		
Response if any: (by Director) If it were up to me I would connect people at no cost. But we must purchase supplies and materials to make the connection. But the cost to you is the actual cost, none of the money is used elsewhere. The installation, after it is done, belongs to you.		
No.5 Name: Chan Hasa	Sex: Female Age: **53**	Occupation: Villager of Chong Prek
Statement or Inquiry: Is it possible to pay for the connection on an installment plan?		

Response if any: (by Director): We will look into the possibility of paying for the service fee on installments.

Note:

On 11 June 2013 the environmental consultative meeting was conducted in Svar Rieng Town. Thirty (30) participants attended, including villagers and village chiefs from communes making up the proposed service area.

Attendant List of Environmental Public Consultation
Province: Svay Rieng
Date: June 11, 2013

No.	Name	Sex	Age	Village/Office	Signature/thumb
1.	[illegible]	M	56	[illegible]	
2	[illegible]	M	58	[illegible]	
3	[illegible]	M	61	[illegible]	
4	[illegible]	M	60	[illegible]	
5	[illegible]	F	55	[illegible]	
6	[illegible]	M	60	[illegible]	
7	[illegible]	M	45	[illegible]	
8	[illegible]	M	58	[illegible]	
9	[illegible]	F	25	[illegible]	
10	[illegible]	M	64	[illegible]	
11	[illegible]	M	38	[illegible]	
12	[illegible]	M	39	[illegible]	
13	[illegible]	M	47	[illegible]	
14	[illegible]	M	34	[illegible]	
15	[illegible]	M	30	[illegible]	
16	[illegible]	M	57	[illegible]	
17	[illegible]	M	50	[illegible]	
18	[illegible]	M	54	[illegible]	
19	[illegible]	M	47	[illegible]	
20	[illegible]	M	63	[illegible]	

No.	Name	Sex	Age	Village/Office	Signature/thumb
20	[illegible]	M	32	[illegible]	
21	[illegible]	M	58	[illegible]	
22	[illegible]	M	53	[illegible]	
24	[illegible]	[illegible]	42	[illegible]	
25	[illegible]	M	62	[illegible]	
26	[illegible]	M	67	[illegible]	
27	[illegible]	[illegible]	29	[illegible]	
28	[illegible]	[illegible]	[illegible]	[illegible]	
29	[illegible]	[illegible]	62	[illegible]	
30	[illegible]	[illegible]	54	[illegible]	

Presentation Frames:

Sheet 1:

Construction Impacts:

Construction impacts during

- Construction of facilities
- Hiring of workers
- Transport of construction materials

Impacts affect

- workers
- surrounding community
- environmental resources (air and water)

Safeguards

- Community
- Workers
- Environmental resources (air and water)

Sheet 2:

To protect the community:

- Compensate damage.
- Complete work and repair roads quickly.
- Provide access for homes and shops.
- Minimize dust and obstruction of pedestrians and vehicles.
- Provide sanitary facilities.
- Disinfect completed water mains.

Sheet 3:

To provide for workers health and safety:

- Worker housing, water, toilet and bathing facilities
- Disposal of wastewater and solid waste
- Safety and health plan for workers
- Workplace kept orderly to reduce accidents.

To protect air and water:

- Reduce erosion and sediment runoff.
- Restrict noisy activities to daylight hours.
- Apply water along roadways to suppress dust.

Sheet 4:

OPERATIONS IMPACTS

Operations impacts affect community health and water quality.

- Limit waste from treatment operation.
- Chlorinate water supplies.
- Maintain system pressure to prevent cross-contamination.

Appendix 4: Sample Environmental Monitoring Reporting Form

TEMPLATE/FORMAT

Safeguard Monitoring Report

Summary:
(to be included as part of the *main* Report)

- **Summary of EMP/RP Implementation**
- **Description of monitoring activities** carried out (e.g. field visits, survey questionnaire, public consultation meetings, focus group discussions, etc)
- **Key issues**, any **corrective actions** already taken, and any **grievances**
- Recommendations

Safeguards Monitoring Report
(to be included in the annex/appendix of the *main* Report)

1. Introduction and Project Overview

Project Number and Title:		
Safeguards Category	Environment	
	Indigenous Peoples	
	Involuntary Resettlement	
Reporting period:		
Last report date:		
Key subproject activities since last report:	This section can include, among others, the following: • Activities of Proponent • Progress of Work (% physical completion) • Changes of Surrounding Environment • Status of Permits / Consents	
Report prepared by:		

2. Environmental Performance Monitoring

a. Summary of Compliance with EMAP Requirements (Environmental Performance)

EMAP Requirements	Compliance Status (Yes, No, Partial)	Comment or Reasons for Non-Compliance	Issues for Further Action
Use environmental impact as main heading and EMAP as listing (see example below)	Use EMoP list as basis for rating/evaluating compliance (see example below)		
Rise of employment opportunities: • Job openings of the project should give priority to local communities. • Recruitment of local laborers should be stipulated in the	• Field inspections and interviews with communities - DONE • Note each complaint case in the field – 3 COMPLAINTS RECEIVED		

contract for construction	• Set up grievance centre and report as part of monitoring action plan – NOT DONE		

b. Issues for Further Action

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			
List of EMoP measures or activities not completed (last column of previous table)			
New Issues from This Report			

c. Other activities

- Other issues not covered by EMAP/EMoP
- Environmental monitoring as required by GOI (e.g., air quality, water sampling)

3. Involuntary Resettlement Performance Monitoring

a. Summary of Compliance with RP Requirements

RP Requirements	Compliance status Yes/No/Partial	Comment or Reasons for Compliance, Partial Compliance/Non-Compliance	Issues for Further Action[14]
Establishment of personnel in PMU/PIU			
Public consultation and socialization process		Provide information on: • Public consultation, participation activities carried out • Inclusive dates of these activities To be elaborated on in Item 5	

[14] To be elaborated further in table 3.b (Issues for Further Action)

Land area to be acquired is identified and finalised			
Land acquisition completed			
Establishment of Resettlement Site(s)		Please state: • Number of AHs to be relocated as per agreed RP • Number of AHs already relocated • Number of houses built • Status of installation of community facilities to be provided as per agreed RP	
Compensation payments for affected assets is completed		Please state: • Total Number of Eligible AHs and APs (as per agreed RP) • Number of AHs and APs compensated as of this monitoring period • Total Budget allocation as per agreed RP • Total budget disbursed to AHs as of this monitoring period	
Transport assistance for relocating affected households		As above	
Additional assistance to vulnerable affected household		Please state: • Total Number of vulnerable AHs and APs (as per agreed RP) • Agreed forms of assistance as per RP • Number of AHs and APs assisted as of this monitoring period	
Income Restoration Program		Please state progress per income restoration feature/activity and actual period of implementation	
Temporary impacts have been addressed (affected properties restored to at least pre-project conditions)		Please state: • Total Number of AHs affected by temporary impacts as per agreed RP • Actual Number of AHs and total area affected by temporary impacts (if this differs from the projected number, such as in cases of unforeseen project impacts) • Status of restoring affected property	
Capacity building activities			

b. Issues for Further Action

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			
List of RP activities not completed (last column of previous table)			
New Issues from This Report			

4. Occupational, Health and Safety (OHS) Performance Monitoring

a. OHS for worker

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			
New Issues from This Report			

b. Public Safety

Issue	Required Action	Responsibility and Timing	Resolution
Old Issues from Previous Reports			
New Issues from This Report			

5. Information Disclosure and Socialization including Capability Building

- Field Visits (sites visited, dates, persons met)
- Public Consultations and meetings (Date; time; location; agenda; number of participants disaggregated by sex and ethnic group, not including project staff; Issues raised by participants and how these were addressed by the project team)
- Training (Nature of training, number of participants disaggregated by gender and ethnicity, date, location, etc.)
- Press/Media Releases
- Material development/production (e.g., brochure, leaflet, posters)

6. Grievance Redress Mechanism

Summary:

- Number of new grievances, if any, since last monitoring period: ____
- Number of grievances resolved: _____
- Number of outstanding grievances: _____

Type of Grievance	Details (Date, person, address, contact details, etc.)	Required Action, Responsibility and Timing	Resolution
Old Issues from Previous Reports			
New Issues from This Report			

7. Conclusion

- Important results from the implementation of EMAP/EMoP and RP monitoring
- Recommendations to improve EMAP/EMoP and RP management, implementation, and monitoring

8. Attachments

- Consents / permits

- Monitoring data (water quality, air quality, etc.)
- Photographs
- Maps