Initial Environmental Examination

June 2017

Cambodia: Provincial Water Supply and Sanitation Project
Water Supply Subprojects

Prepared by Ministry of Public Works and Transport for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 15 June 2017)

Currency unit	–	riel (KR)
KR1.00	=	$0.000245
$1.00	=	KR4,087.00

ABBREVIATIONS

ADB	-	Asian Development Bank
CEMO	-	construction environmental monitoring officer
CLAC	-	commune land acquisition committee
CMP	-	construction management plan
DEIA	-	Department of Environmental Impact Assessment
DMS	-	detailed measurement survey
DPWT	-	Provincial Department of Public Works and Transport
EA	-	executing agency
EMP	-	environmental management plan
ES	-	environment specialist
GDR	-	General Department of Resettlement
GRM	-	grievance redress mechanism
GRP	-	glass reinforced plastic
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
IMO	-	independent monitoring organization
IRC	-	Inter-Ministerial Resettlement Committee
MIH	-	Ministry of Industry and Handicrafts
MoE	-	Ministry of Environment
MOWRAM	-	Ministry of Water Resources and Meteorology
MPW/100ml	-	most probable number (of bacteria) per 100 millilitres of water
NAPA	-	National Action Programme of Action (for climate change)
O&M	-	operation and maintenance
PIH	-	Provincial Department of Industry and Handicrafts
POE	-	Provincial Department of Environment
PGRC	-	provincial grievance redress committee
PIU	-	project implementation unit
PMU	-	project management unit
RGC	-	Royal Government of Cambodia
RWG	-	resettlement working group

NOTE

In this report, "$" refers to US dollars

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EXECUTIVE SUMMARY

1.1 Introduction

1. The Provincial Water Supply and Sanitation Project (PWSSP) will build on the investment made for the Urban Water Supply Project (UWSP) project to improve urban water supply services in provincial towns. The PWSSP is aligned with phase 3 of the government's rectangular strategy for growth, employment, equity, and efficiency, Cambodia's National Strategic Development Plan (NSDP) for 2014–2018. It will improve and expand urban water supply, wastewater and septage management services in the selected towns and comprises six subprojects, two of which are for the improvement and expansion of piped water supply coverage and four of which are for the improvement of wastewater and septage treatment and conveyance.

2. This initial environmental examination (IEE) is prepared per ADB's Safeguard Policy Statement of June 2009 and the Royal Government of Cambodia (RGC) Law on Environmental Protection and Natural Resource Management (December 1996). It covers two water supply subprojects that are to be implemented by the Ministry of Industry and Handicrafts (MIH), one in Kampong Cham and one in Battambang.

1.2 Description of the Project

3. The PWSSP outputs are: (i) water supply systems improved and service coverage increased through the development of new water supply intakes and treatment facilities, replacement of old water mains, and expansion of the distribution network; (ii) septage management and sewerage services provided through the provision of septage collection and treatment and the development of expanded sewerage systems; and (iii) project implementation and operation and maintenance (O&M) developed to complement ongoing institutional development and capacity building in procurement, financial management, and governance.

1.2.1 Battambang Water Supply

4. The Battambang Water Supply Subproject will expand the system to meet demand in growth areas within the city for 24-hour supply and improved water quality and to meet Cambodia's national drinking water standards. The subproject of Battambang water supply will comprise three components: the intake station, water treatment plant and water supply network. The subproject will increase service coverage toward achieving a targeted 85-100% by 2025 (Phase 1) and 95-100% by 2040 (Phase 2), with more communities nearby the town boundary to be included in 2025. On completion of the subproject works in 2022, a further 27,861 households with a population of 143,861 people will have access to the extended water supply network, including 74,520 women (50.8%).

5. The existing Battambang water supply system was upgraded in 2006 and in 2015 covered about 48% of the city's households with a total of 12,361 connections, and a beneficiary population of 69,939 persons and the system was expanded with construction of a new water treatment plant (WTP) commissioned in 2016, bringing a combined capacity of 33,520m^3/day, distributed through a 374km pipe network supplying a service area of 5,603ha. The combined water demand of domestic, commercial, industrial and public users is expected to rise to 31,497,675m^3/day in 2040. Water losses in 2015 were 10.96% of the total.

6. The proposed new WTP is located on public land belonging to the Department of Industry and Handicrafts (DIH) of Battambang with an area of 2.4ha and is approximately 4km from the town center. The proposed water intake station was originally to be placed on the river

embankment, in a location where the adjacent land giving access to the intake site was available for sale, but subsequently the owner has withdrawn the land from sale. Consequently, a site some 5.3 km upstream from the new JICA intake and adjacent to a local pagoda has been identified and will require an increase in the length of the raw water intake pipe to 6.6 km and an additional 1.6 km of raw water main. The proposed WTP will use similar treatment processes to those used in existing plants. Water will be extracted from the Sangké River. WTP construction will take place in 2 phases where phase I will increase production capacity to 50,000m^3/day for demand to 2025. The second phase works will increase production by a further 30,000m^3/day for the period between 2026 and 2040.

7. The water supply reticulation network will comprise the main transmission pipelines, the secondary distribution pipelines, and house connections and will be made of high density polyethylene (HDPE) with ductile cast iron (DCI) used in higher pressure situations, such as pump station pressure pipes. The transmission network is designed to have sufficient capacity to handle projected supplies in the existing and extended areas up to the year 2040. The water supply distribution pipes will be installed along road right-of-ways and where there is potential conflict with businesses occupying the road footpaths and squatter houses the pipes will be laid along the road edge or within the carriageway.

8. Pumping system improvements will also be in two phases, where phase I covers the period up to 2025 and phase 2 up to 2040. The total capacity of the pumping intake is 28,896m^3/d or about 334.5l/s. There are 2 duty pumps and a packaged booster system is proposed for use at the WTP.

9. The raw water transmission main from the intake to the water treatment plant is 630 mm diameter HDPE pipe with a flow velocity of 1.83 m/sec.

1.2.2 Kampong Cham Water Supply

10. The Kampong Cham water supply will improve the water supply system by expanding access to reliable 24 hours urban water supply in priority urban and suburban areas and will comprise three components: the intake station, water treatment plant and water supply network. On completion of the subproject works in 2022 a further 15,775 households with a population of 65,194 people will have access to the extended water supply network, including 33,249 women (51%).

11. In 2015 the Kampong Cham water system served 36,041 persons, about 79% of the total households (8,823) in the service area, with 6,931 connections. The existing WTP produces 8,000m^3/day and a new JICA funded WTP commissioned in July 2016, added an additional 11,500m^3/day. Water is sourced from groundwater bores (for the previous supply system) and the Mekong River, for the new recently commissioned extensions. The WTPs operate 24 hours/day and have a total capacity of 19,500m^3/day. The total piped network of 166.5km serves an overall coverage area of 4,311ha (43 km^2).

12. The water intake for the planned improvements to be constructed under the subproject will be located at the river margin approximately 50m downstream from the recently commissioned JICA funded intake station, on land allocated by the provincial governor. The structure will have adequate space for the installation of additional pumps for the capacity beyond 2026 to year 2040 (Phase 2). In the meantime, the pump and electrical facilities will be installed with capacity for year 2025 (Phase 1) requirements. The new WTP to cover the demand of 11,600m^3/day until 2025 is to be located in a public land some 3km from the present provincial waterworks office. A conventional treatment plant is proposed with processes similar

to the existing plants. The reticulation pipelines will consist of distribution pipelines comprising transmission mains, secondary pipelines and house connections. All distribution pipes will be HDPE. Ductile cast iron (DCI) may be used for pressure pipelines such as the raw water transmission main from the water intake to the WTP.

13. The proposed subproject components will supplement the existing system and support the Royal Government of Cambodia's (RGC's) policy on water supply in providing safe water to all people by 2025. To cover the water demand for the next 20 years (2040), and to achieve a connection coverage of 90-100% in Kampong Cham and 85% of the three communities nearby the town, the subproject provides for: (i) additional WTP capacity of at least 17,000m^3/day to provide sufficient capacity until 2040, (ii) 120km of reticulation network to extend the coverage area to 3,489 ha, (iii) provision in the medium term to serve a population (2025) of approximately 140,318 persons out of which 71,562 are women (50.9%) in 31,182 families.

14. An existing laboratory will be extended and equipped with further laboratory water quality testing equipment, basic tools, leak detection equipment and office equipment will be provided and training will be provided in water quality testing.

1.3 Policy Legal and Administrative Framework

15. National requirements for environmental management and assessment are set out in the Law on Environmental Protection and Natural Resource Management (December 1996), and the Sub-decree on Environmental Impact Assessment No. 72.ANRK.BK of August 1999. Article 6 of the Law on Environmental Protection and Natural Resource Management states that an environmental impact assessment (EIA) shall be carried out for every project and activity, private or public. A two-stage process is specified for environmental assessment, similar to that required by the ADB, whereby an Initial Environmental Impact Assessment (IEIA) is prepared for most projects. The IEIA may either suffice for environmental clearance, or form the basis for a more substantial EIA.

16. The primary responsibility for undertaking environmental assessment of projects, adherence to standards and monitoring lies with the Project Owner, the MIH and the PDIH of the province where the project is to take place.

1.4 Description of the Environment

17. The project towns are situated in the Tonlé Sap basin, on low lying land surrounding the Tonlé Sap great lake and its wetland periphery. In the Tonlé Sap basin the main rock types are sedimentary with intrusions of igneous rhyolite. The country is underlain by the relatively stable continental block and earthquake risks are low. Soils around the Tonlé Sap basin include podzols and saturated hydromorphic soils which have developed under conditions of poor drainage.

18. Cambodia has a moist tropical climate. The main wet season, the southwest monsoon, occurs between June and October. Average monthly rainfall is around 1,500mm varying considerably from year to year.

19. Water resources in the Tonlé Sap basin are relatively abundant, but the quality and quantity of available surface water varies and is vulnerable to sedimentation from river bank erosion and to the effects of damage to forested areas in the basin. Pollution is also a growing

problem. The total estimated ground-water resource in Cambodia[1] is around 17.6 billion m^3, readily recharged by rainwater. While the resource as a whole is copious, its distribution is uneven and groundwater is also used for irrigation in some locations.

20. Uneven rainfall distribution over the year, existing flooding and drought are expected to be influenced with climate change, exacerbating already high levels of variability of precipitation from year to year.

21. The project towns are provincial capitals, which are both expanding and increasing in population density. Ornamental trees have been planted along main streets, but as older buildings are becoming replaced with large retail facilities, hotels and apartment blocks, trees are often removed, with greater emphasis placed on green spaces and parks within the towns. The towns are expanding outwards, into low density residential areas at the periphery and farmland immediately beyond.

22. No known ancient relicts occur in the project towns, however some older buildings are distinctive and have some cultural value, though in many cases these are being replaced as the city centers intensify. Other items of cultural significance include church buildings, and monuments, many of which feature distinctive Khmer architecture and have been built since independence in 1946.

23. Public health in Cambodia is improving. For example, the under-five mortality rate decreased from 83 per 1,000 live births in 2005 to 28.7 per 1,000 in 2015. However, 15% of infant deaths are attributable to diarrheal diseases and therefore improving sanitary conditions remains an important challenge. In comparison to the development of water supplies in cities and towns in Cambodia, the wastewater sector is still in an early stage of development with the discharge of untreated wastewater into lakes and waterways commonplace.

24. Agriculture and tourism are the mainstays of the economy in the Tonlé Sap basin, though tourism takes place mainly in and around Siem Reap Province, associated with the Angkor temples.

25. Poverty is prevalent in the towns, an estimated 14% of households in the areas to be served by the subprojects are poor, approximately half these are very poor, using the Ministry of Planning categorization system IDPoor.[2]

26. Unexploded ordnance remaining from the earlier civil conflict remains in much of the country, though less so in urban environments where the ground and soil has been extensively disturbed in the decades since the period of civil conflict.

1.5 Anticipated Environmental Impacts and Mitigation Measures

1.5.1 Impacts related to location

27. Potential impacts were screened during the process of design review and IEE preparation.

[1] MOWRAM (2001) National Water Sector Profile, Kingdom of Cambodia. MOWRAM, Phnom Penh.
[2] ID Poor categorizes households as poor category 1 (P1 - very poor), poor category 2 (P2 - poor), or not poor, based on an assessment covering occupation, education and income as well as health and disabilities of all family members, housing status and conditions, access to watsan facilities, household debt, economic shocks, vulnerabilities and also any recent factors improving household livelihoods

28. The projects are located in urban or peri-urban areas. There will be limited effects on vegetation. No mature trees will be removed as a result of works within the towns.

29. Within the urban centres, construction activity of public infrastructure and private buildings has disturbed soils extensively over the past two decades since the civil conflict and resulting UXO, and therefore risks are limited although it will be necessary for contractors to be aware of potential risks and have procedures to ensure sites are free of UXO contamination.

30. A Resettlement Plan has been completed for the Battambang water supply subproject. Three affected households (AHs) will lose access to government owned productive land. For Kampong Cham, where there are no affected households, a due diligence report has been prepared.

1.5.2 Impacts related to construction

31. Pipe placing during or replacing during construction will involve impedance to traffic, including access to individual properties. The impact is temporary and will be mitigated by requiring the contractor to taking steps to provide information to the affected public, place appropriate signage, liaise regularly with traffic policy and schedule work to periods of low traffic as much as possible.

32. The works will cause noise and vibration which will be mitigated by providing information to the public, disallowing noise generating activities to take place outside daytime work hours and ensuring that all construction equipment and vehicles are kept in good working order with working exhaust mufflers.

33. Construction waste will include packaging of equipment, fuels, lubricants, materials, equipment and food. Import, use and disposal of any potentially hazardous materials must comply with the Sub-Decree on Solid Waste Management. ANRK.BK No. 36 of 27 April 1999, ensuring no illegal dumping of hazardous waste. All other solid waste will be taken to a landfill or municipal waste disposal site.

34. Release of silt from excavations from pipe trenches and foundations and temporary stockpiles of material will be mitigated by stabilization of soils once the pipes are in place, use of silt fences and avoiding excavation in wet weather.

35. Risks of soil and water pollution may arise from the use of vehicles and plant. The contractor will be required to ensure that vehicles and plant are maintained in sound operable condition, free of leaks and to prepare and submit a plan for spill management.

36. Pollution from exhaust fumes from vehicles and plant, and dust from the works will be limited by requiring vehicles and equipment to be well maintained and tuned and fitted with exhaust systems and for trucks are to be fitted with tarpaulins to cover loads when carrying fine material. Water will be applied to suppress dust around work sites where needed.

37. The use of plant and machinery, use of compressed air lines and cables and excavations are potential hazards to the public, risks are to be mitigated by providing notices to the public identifying hazards; erection of safety barriers/covers for area of open excavation and provision of watch persons to control access.

38. To ensure occupational health and safety, contractors will be required to appoint health and safety officers for each site with specific responsibilities and to provide personal protective equipment to the workforce, appropriate to each site.

1.5.3 Impacts Related to Operation

39. While water resources in Cambodia are abundant, levels of available surface and groundwater can vary. In Battambang, water will be drawn from the Sangké river which flows northwards through the city into the Tonlé Sap lake. Water is drawn from the river for irrigation use, and the adequacy of river levels to meet irrigation, water supply and environmental flow requirements during the dry seasons in low rainfall years are potentially of concern. However, a dam is planned for construction which will retain water in the river during the dry season. The water source for Kampong Cham is the Mekong river and the level of extraction will not be significant.

40. The water treatment process will involve the use of lime and alum, some of which will be present in sludge produced during maintenance operations. While not toxic, alum can inhibit plant growth and should therefore be kept away from farms, gardens and forests. Mitigation will be by minimizing the quantity of solids generated by the water treatment process by controlled dosing for the coagulation processes and disposal of the sludge by land application, limiting application to minimize the potential for mobilization of metals into plant tissue and groundwater.

41. Chemicals used in treatment will include chlorine to be supplied and applied as sodium hyperchlorite in powder form. Chemicals need to be stored in secure storerooms on site, with access controlled by the plant management. Operators will be trained in safe handling and use of the chemicals. An operation manual that identifies potential hazards, provides operating procedures and accident mitigation will be provided, and training given in operation and maintenance.

42. The WTPs pose a potential hazard to the communities, particularly children. Each plant is to have a perimeter fence, which is to be checked regularly to control access.

1.5.4 Global, Transboundary and Cumulative Impacts

43. Supplies of safe water are vital for human health and for urban growth and sustainability. While investments in water supplies in Cambodia have been stepped up in recent years, limitations in water supply constrain growth and leave some urban dwellers without access to clean piped water. The build-up of capabilities to construct and maintain further water supplies is an important and positive cumulative impact.

44. However, increased water supplies also increase the quantity of wastewater which can exacerbate unsanitary conditions and increase pollution to local waterways where drainage systems are unable to cope with the additional flows. This cumulative impact is mitigated by parallel improvements in drainage and in sanitation.

1.5.5 Analysis of Alternatives

45. An alternative to the subprojects would be the deployment of investment funds in other towns or cities. However, the subprojects were chosen from among other candidate subprojects on the basis of feasibility, cost effectiveness, scale of impact, fit with national policy and ADB country strategy and financial capacity of the town administration. Regarding alternatives within the subprojects, these would concern the water source, water treatment method and the layout and pipe type for the water supply network. These alternatives form an essential part of the

subproject rationale and are described as part of the project description. The "no project" alternative would mean that a growing portion of the urban population in the towns would not have access to piped, clean water with consequent health hazards increased as populations both expand and intensify in the project towns.

1.6 Information Disclosure, Consultation and Participation

46. Consultation began early in the project preparation stage with visits to the subproject sites and consultations with MIH, PDIHs, utility operators, and with the local municipal and sangkat[3]/commune officials and village representatives. These included socio-economic surveys (SES) and focus group discussions (FGDs) for later community meetings for the disclosure of land acquisition and resettlement and the likely environmental and social impacts.

47. The socio-economic survey (SES) undertaken of the villages in the water supply and subproject areas in Battambang and Kampong Cham identified core problems of inadequate water supply and sanitation infrastructure and services, and identified the degradation of the natural environment and poor health conditions, especially for the poorer communities. Poor water supply coupled with poor sanitation was seen to be contributing to regular incidence of diarrhea and dysentery, major causes of death in infants. Women focal groups consulted during the SES indicated firm preference for piped water supplies over alternatives, and reported severe existing problems with current sources including dug wells and bore holes. The consultations identified few negative impacts from the proposed water supply improvements.

48. Negative impacts are primarily those associated with construction, including dust generation. Appropriate measures are included in the EMPs. Other negative impacts were largely deemed to be insignificant.

49. Meetings were held for the disclosure of the land acquisition, resettlement and compensation information. For Battambang, this comprised eleven public commune meetings convened in January and February 2017 involving 348 commune residents (188 female and 160 male). In Kampong Cham, four public commune meetings were convened during the same period involving 287 commune residents (103 female and 184 male). The contacted participants (i) showed high interest in the subproject and (ii) repeatedly mentioned their expectations towards the subproject, as water supply and sanitation are topics of high importance. The discussion with the participants concerned in general more wastewater operational matters including environmental matters and likely construction impacts rather than resettlement items.

50. The draft IEE and a Khmer translation of the executive summary will be provided to commune officials for public disclosure. Affected persons in the subproject area will kept informed of construction activities that are likely to cause noise and dust nuisance, or disruption to roads and pathways.

1.6.1 Grievance Redress Mechanism

51. A grievance redress mechanism (GRM) has been prepared for the project and is included in the IEE and Resettlement Plan documents. It provides a set of clear procedures to receive, record, and address any concerns or complaints raised and multiple entry points including verbal and written complaints, availability of a hotline number, anonymous drop-boxes and/or email. This grievance redress mechanism has been designed to address displaced

[3] A sangkat is an urban administrative division, referring to a part of a town or city, and equivalent to a village (phum) in rural areas.

households' grievances and complaints regarding land acquisition, compensation and resettlement in a timely and satisfactory manner. Costs associated with processing and addressing complaints are to be borne by the project.

1.7 Conclusion

52. The overall finding of the IEE is that the water supply subprojects will result in significant environmental benefits, by addressing access to clean water supplies and sanitary living conditions for households in the project towns. The anticipated environmental impacts are manageable through the effective implementation of the EMP and the loan covenants. No further environmental assessment is required, beyond the issues to be reviewed during detailed design.

2 Introduction

53. The provincial Water Supply and Sanitation Project (PWSSP) will build on the investment made for the Urban Water Supply Project (UWSP) project to improve urban water supply services in provincial towns. The PWSSP will improve and expand not only urban water supply, but also sanitation services in similar towns and contribute to the Government's target for 100% urban water supply coverage by 2025 as well as align with proposed government targets for urban sanitation.

54. The PWSSP is aligned with phase 3 of the government's rectangular strategy for growth, employment, equity, and efficiency, Cambodia's National Strategic Development Plan (NSDP) for 2014-2018. It is also consistent with Government Plans to facilitate private sector partnerships, to strengthen the management of public owned water works, and to integrate urban water supply with urban environmental management.

55. The PWSSP will improve and expand urban water supply, wastewater and septage management services in the selected towns and comprises six subprojects, two of which are for the improvement of urban water supply and four of which are for the improvement of wastewater and septage treatment and conveyance. The feasibility studies for the subprojects includes social and environmental safeguards assessment and management plans. This initial environmental examination (IEE) covers the water supply subprojects and is prepared according to the ADB's Safeguard Policy Statement of June 2009 and the Royal Government of Cambodia (RGC) Law on Environmental Protection and Natural Resource Management (December 1996), further guidance is provided in the Sub-decree on Environmental Impact Assessment (1999).

56. A Project Participation Plan has been developed to provide for sharing information on the Project with the beneficiary households, communities, and key stakeholders. The Participation Plan's (PP) purpose is to enable feedback from these groups and target beneficiaries about the potential impact and effectiveness of the PWSSP to enhance positive benefits and mitigate negative impacts, leading to improved design of the project, reduced risks and increased beneficiary impact for the targeted groups and strengthened local ownership. The plan outlines, for each stakeholder group, their involvement in the project, purpose and mechanisms for their participation, parties responsible for facilitating the consultation and participation, timing and costs. The PP together with the stakeholder communication strategy (SCS) serve to guide the PWSSP's implementation. Around 302,022 people in 71,592 households are expected to have access to the extended water supply and wastewater systems provided under the Project by 2022.

57. The PDIHs with the assistance of the PIAC will convene meetings and arrange focus group discussions with project beneficiaries, including poor and vulnerable households, female headed households and affected peoples, to inform them of project purpose, scope, benefits and construction schedules and elicit views and feedback. Feedback will be recorded and used to input into design and implementation. Participants will be asked about their views on the severity of construction impacts and perceptions on environmental issues. Feedback will be recorded by the PDIH and appropriate actions taken to guide design and influence construction impacts. the PIAC Environment Consultants will provide assistance in recording feedback and identifying appropriate actions to take to address the feedback.

3 Description of the Project

3.1 Provincial Water Supply and Sanitation Project

58. The Provincial Water Supply and Sanitation Project (PWSSP) is to improve and expand urban water supply in selected towns and wastewater and septage management services in the same or similar towns to contribute to the Government's targets for urban water supply and effective urban sanitation. The combined outputs will include: (i) water supply systems improved and service coverage increased through the development of new water supply intakes and treatment facilities, replacement of old water mains, and expansion of the distribution network; (ii) septage management and sewerage services provided through the provision of septage collection and treatment and the development of expanded sewerage systems; and (iii) project implementation and operation and maintenance (O&M) developed to complement ongoing institutional development and capacity building in procurement, financial management, and governance.

59. PWSSP is aligned with phase 3 of the government's rectangular strategy for growth, employment, equity, and efficiency, Cambodia's National Strategic Development Plan (NSDP) for 2014-2018, and Government Plans to facilitate private sector partnerships, to strengthen the management of public owned water works, and to integrate urban water supply and sanitation with urban environmental management. With development partner support, the urban water supply services in Cambodia have been significantly improved in the past three years. All provincial public waterworks (PWWs) are recording profits from their operations while providing improved quality of services. The wastewater subsector has also made positive steps forward in recent years, although this sector is in the early stages of its development. As urbanization continues and the city centers become larger the focus will move to the need for more efficient septic tank construction and maintenance for suburban areas and piped collection systems and treatment for the more densely populated core urban areas.

60. ADB is supporting the RGC to address the core problem of inadequate water supply and sanitation infrastructure and services with a programmed approach that envisages the combination of lending and non-lending assistance to finance infrastructure, institutional reforms, and capacity building based on a draft sector road map and investment program developed for a 20 year design horizon. The provincial Water Supply and Sanitation Project (PWSSP) will build on the investment made for the Urban Water Supply and Sanitation Project (UWSP), which is currently being implemented, to improve urban water supply services in provincial towns, while potential further investments could target other provincial and sub-provincial towns. The PWSSP will contribute to the Government's target for 100% urban water supply coverage by 2025 and align with proposed government targets for urban sanitation. In addition PWSSP will also contribute to a financial autonomy of the provincial public waterworks (PWWs).

61. The PWSSP will extend water supply coverage and treatment in Battambang, and Kampong Cham and sanitation coverage and wastewater treatment capacities with improved septage management in Battambang and Sihanoukville, and improved septage management in Kampong Cham. The project will also provide for the replacement of the failed interceptor sewer in the town of Siem Reap. This IEE relates to the proposed improvements of the water supply infrastructure and service coverage for Battambang and Kampong Cham.

4 Description of Water Supply Subprojects

4.1 Battambang Water Supply Subproject

4.1.1 Objectives

62. The water supply system will be expanded to areas within the town which have been identified as being in need by the Ministry of Industry and Handicrafts, to meet demand in the rapid expanding urban areas for access to 24-hour supply and improved water quality and to meet Cambodia's national drinking water standards. The subproject will comprise three components: the intake station, water treatment plant and water supply network.

63. The subproject will increase service coverage toward achieving a targeted 85-100% by 2025 (Phase 1) and 95-100% by 2040 (Phase 2), with more communities nearby the town boundary to be included for the Year 2025. On completion of the subproject works in 2022 a further 27,861 households with a population of 143,861 people will have access to the extended water supply network, including 74,520 women (50.8%).

4.1.2 Existing Water SupplyFacilities

64. The Battambang water supply system was upgraded in 2006 under ADB financing. In 2010, the RGC made a request to the Government of Japan (GoJ) for grant aid to support the construction of an additional New Water Treatment Plant (WTP) to cope with growing demand.

65. In 2015, Battambang town water supply covered about 48% of the total households with total of 12,361 connections, and a beneficiary population of 69,939 persons. The capacity of the Water Treatment Plant (WTP) is 11,520m^3/day, with an average production of 11,328m^3/day. The water source for the Battambang Waterworks is the Sangké River. The water supply system is operated continuously, 24 hours/day. The Battambang water supply is under the management of the provincial public water works (PWW) attached to the Department of Industry and Handicrafts (DIH) in Battambang Province. In July 2016, a new WTP (constructed under the second phase of the JICA funded project) was brought into operation with a capacity of an additional 22,000m^3/day. The JICA funded project also covered the construction of a new intake facility with a capacity of 24,000m^3/day, a 4.4km raw water transmission main and distribution pipelines totalling 65.5km. The water supply capacity for Battambang town is now 33,520m^3/day, distributed through a 374km pipe network supplying a service area of 5,603ha.

66. The combined water demand of domestic, commercial, industrial and public users in the existing water supply coverage in year 2015 is estimated at 3,703,626m^3/year, which is projected to rise to 63,629m^3/day or 23,224,585m^3/year in 2025 and 86,295m^3/day or 31,497,675m^3/year in 2040. Water losses in 2015 were 10.96% of the total.

4.1.3 Proposed Improvements

67. The proposed new WTP and extended distribution system has been studied by consultants engaged under the Cities Development Initiative for Asia (CDIA) who have completed a pre-engineering design and a feasibility study. The site for the WTP is located on public land belonging to the DIH of Battambang (land title No.02030802-1278) with an area of 2.4ha at Chrabkrosaing village, Vaot Kor commune, Battambang town as shown on **Figure 1**. Only 1.5 ha of the reserved land will be allocated to the WTP. The site is approximately 4km from the town center. The proposed water intake station was originally to be placed on the river

embankment, in a location where the adjacent land giving access to the intake site was available for sale, but subsequently the owner has withdrawn the land from sale. As a consequence a new site some 5.3km upstream from the new JICA intake and adjacent to a local pagoda has been identified. This new site has the agreement of the monks and local community. The new location for the intake shown in **Figure 2** will increase the length of the raw water intake pipe to 6.6 km and requires an additional 1.6 km of raw water main. The proposed WTP will use treatment plant processes similar to existing plants constructed with previous ADB and JICA financing. The WTP will extract water from the Sangké River with the construction of the WTP designed in 2 phases where the first phase I will have a production capacity of 50,000m^3/day for demand to 2025. The second phase works will be constructed on the remaining space within the allocated land and will have the capacity to produce a further 30,000m^3/day for the period between 2026 and 2040.

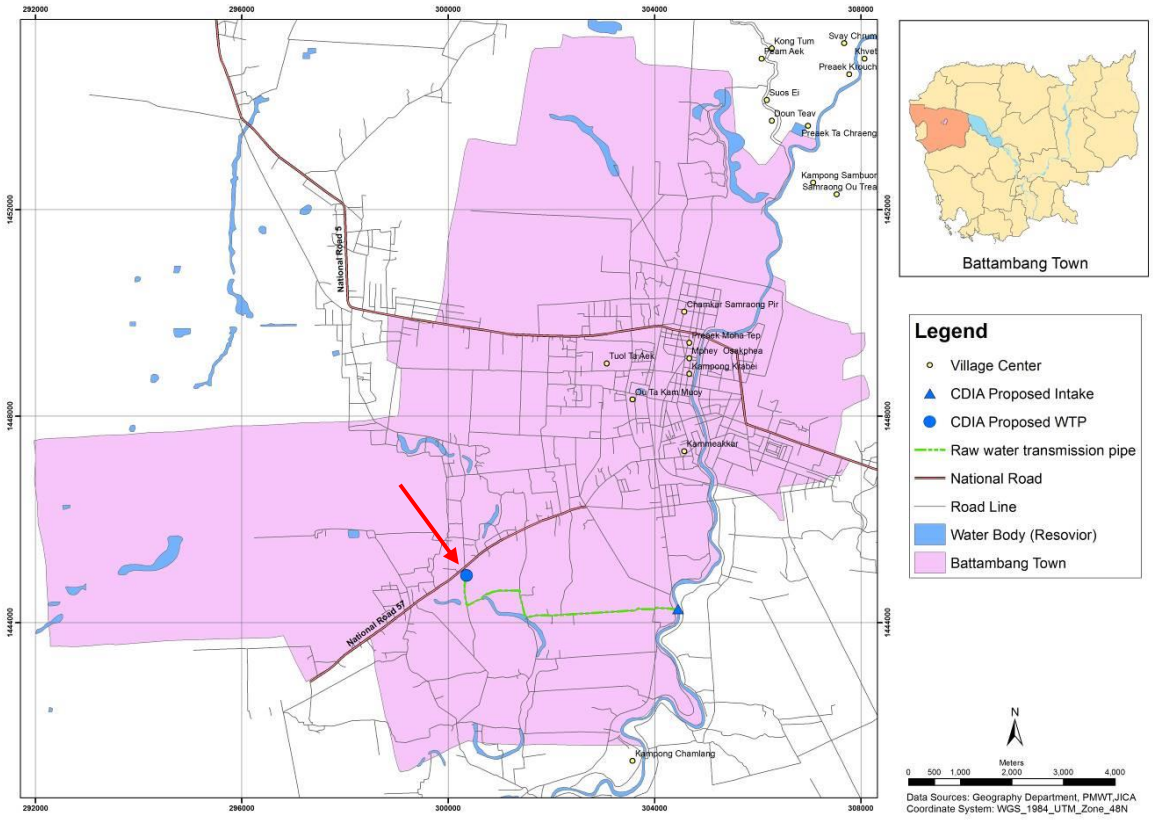


Figure 1: Location of New WTP

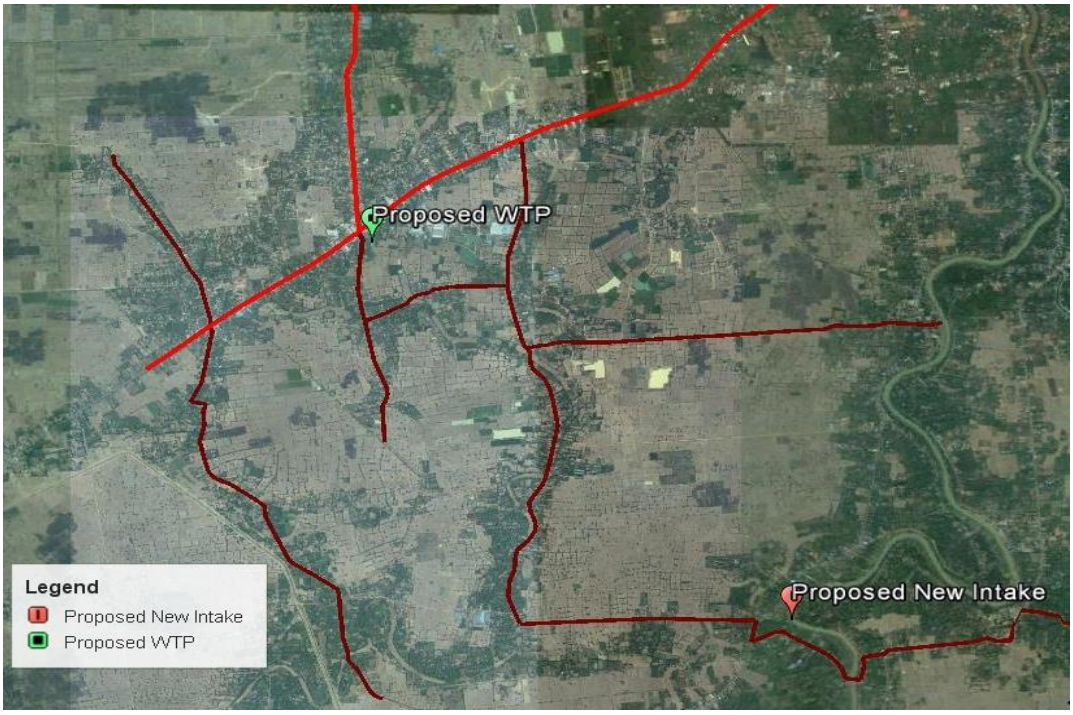
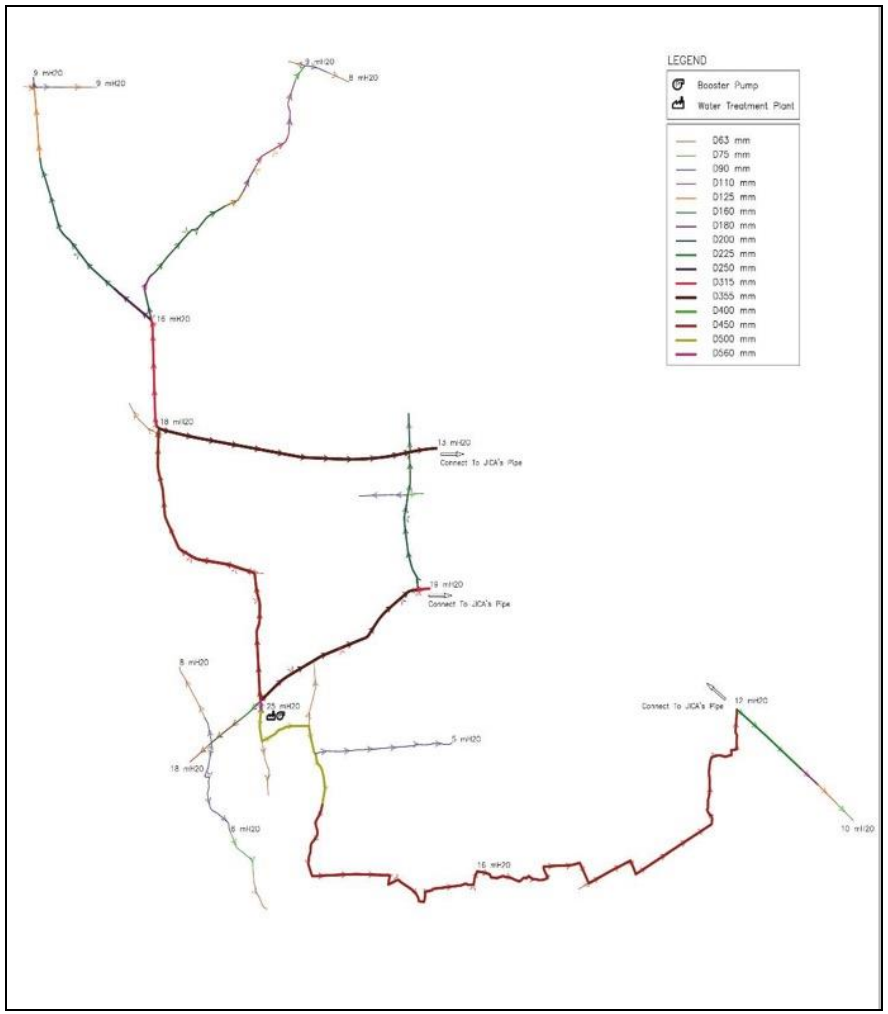


Figure 2: Proposed Intake Location

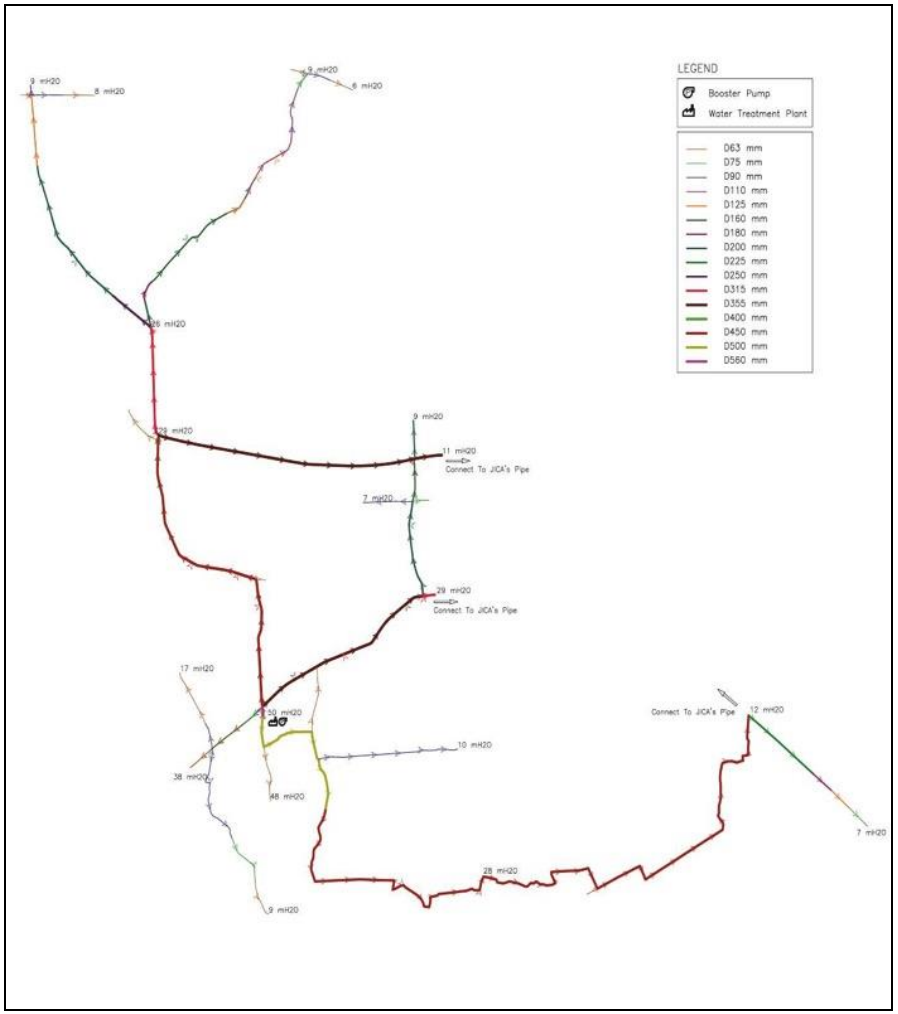
68. The water supply reticulation network will comprise the main transmission pipelines, the secondary distribution pipelines, and house connections. According to the CDIA design, all transmission and distribution pipes are to be of high density polyethylene (HDPE) with ductile cast iron (DCI) used in higher pressure situations, such as pump station pressure pipes. Piped water supplies shall be installed along the roads in priority locations with a potential for housing development and household connections. The main transmission network is designed to have sufficient capacity to handle projected supplies in the existing and extended areas up to year 2040. The water supply transmission and distribution pipes will be installed along road right-of-ways and where there is potential conflict with businesses occupying the road footpaths or squatter houses the pipes will be diverted and laid along the road edge or within the carriageway.

69. For the pumping system, the design is divided into 2 phases where phase I covers the period up to 2025 and phase 2 up to 2040. The pumping head is the summation of the static head, entrance head, friction loss in the suction pipe, discharge loss, and other losses at fittings and bends with the total dynamic head of 37m. The total capacity of the pumping intake is 28,896m^3/d or about 334.5l/s. There are 2 duty pumps with each pump having a capacity of 168 l/s. The diameter of suction pipe is approximately 450 mm and the discharge pipe is approximately 300mm with a flow velocity of 2.38 m/sec. A packaged booster system is proposed for use at the WTP because it has a relatively small footprint, is easy to install, and has a lower installation cost, requires only one electrical connection, does not require shaft/coupling alignments/adjustments, and has integrated controls

70. The raw water transmission main from the intake to the water treatment plant is 630 mm diameter HDPE pipe with a flow velocity of 1.83 m/sec.



Pipeline Layout by 2025



Pipeline Layout by 2040

Figure 3: Future Main Pipeline Layouts

4.2 Kampong Cham Water Supply Subproject

4.2.1 Objectives

71. Similar to the Battambang subproject the proposed investments for the Kampong Cham water supply aim at improving the water supply system by expanding access to reliable 24 hours urban water supply in the urban and suburban areas depicted in **Figure 4** to a meet rapidly expanding need for improved water quality meeting Cambodia's national drinking water standards. The subproject of Kampong Cham water supply will comprise three components: the intake station, water treatment plant and water supply network.

72. On completion of the subproject works in 2022 a further 15,775 households with a population of 65,194 people will have access to the extended water supply network, including 33,249 women.

4.2.2 Existing Water Supply Facilities

73. In 2015, the Kampong Cham water system served 36,041 persons, about 79% of the total households (8,823) in the service area, with 6,931 connections. The existing WTP produces 8,000m^3/day with a new JICA WTP which came on stream in July 2016, adding an additional 11,500m^3/day. The water sources are from groundwater bores (for the previous supply system) and the Mekong River, for the recently commissioned JICA water supply extensions. The system combining the previous and the new JICA WTPs is operated 24 hours/day. With the additional JICA improvements the total capacity of water treatment plants in Kampong Cham in 2016 is 19,500m^3/day. The total piped network of 166.5km serves an overall coverage area of 4,311ha (43km^2) including Ro-Ang and Ampil commune in Kampong Siem District.

4.2.3 Proposed Improvements

74. The location for the new intake station shown in **Figure 5** will be in Ti Dab village, Sangkat Kampong Cham, Kampong Cham town, at the river margin approximately 50 m downstream from the new intake station constructed with JICA support. The size of the land is more than enough for the construction of the intake station. The land is under the control of the provincial governor who has issued a letter, dated 19 September 2016, designating the land for the new intake station. The structure will be constructed with adequate space for the installation of additional pumps for the capacity beyond 2026 to year 2040 (Phase 2). In the meantime the pump and electrical facilities will be installed with capacity for year 2025 (Phase 1) requirements.

75. The new WTP to cover the demand until 2025 is to be located in a public land belonging to the Kampong Cham DIH with an area of 1.3 ha at Ta-Neng village, Sangkat Sambour Meas, Kampong Cham. It is located 3km from the present provincial waterworks office. A conventional treatment plant is proposed with processes similar to the existing plants funded by ADB and JICA. The proposed site is part of a reclaimed lake. It is under the control of the provincial governor and has been transferred to Kampong Cham Waterworks to use for the construction of the WTP.

76. The reticulation pipelines will consist of distribution pipelines comprising transmission mains, secondary pipelines and house connections. All distribution pipes will be HDPE. Ductile cast iron (DCI) may be used for pressure pipelines such as the raw water transmission main from the water intake to the WTP. The water supply distribution pipes will be installed along road right-of-ways and where there is potential conflict with businesses occupying the road footpaths or squatter houses the pipes will be diverted and laid along the road edge or within the carriageway. The pipe

distribution network is designed to supply the extended service areas and as well as infill development in the existing service areas.

77. The proposed subproject components will supplement the existing system and support the Government of Cambodia's (GoC's) policy on water supply in providing safe water to all people by 2025. To cover the water demand for the next 20 years (2040), and to achieve a connection coverage of 90-100% in Kampong Cham and 85% of the three communities nearby the town, the subproject provides for:

(i) Additional WTP capacity of at least 17,000m^3/day to provide sufficient capacity until 2040;
(ii) 120km of reticulation network to extend the coverage area to 3,489 ha;
(iii) Provision in the medium term to serve a population (to 2025) of approximately 140,318 persons out of which 71,562 are women (50.9%) in 31,182 families.

78. The proposed water treatment plant (WTP) will be phased initially to meet the demand of target year 2025 requiring a design capacity of 11,600m^3/day with the ability to be extended to provided the total capacity indicated in item (i) above for the phase 2 period between 2026 and 2040.

79. A laboratory supported by the JICA water supply project will be extended and further laboratory testing equipment, basic tools, leak detection equipment and office equipment will be provided for the new WTP.

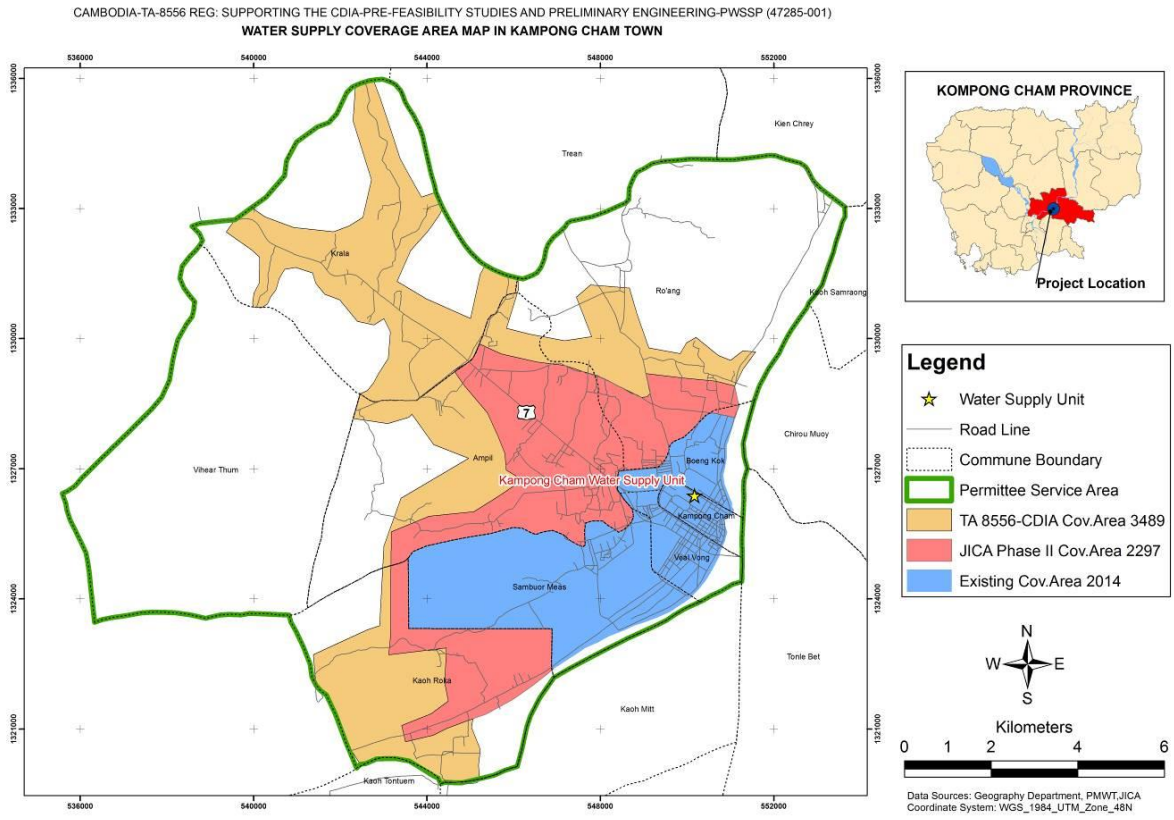


Figure 4: Proposed Water Supply Service Area

Figure 5: Water Intake and Water Treatment Plant Sites

5 Policy Legal and Administrative Framework

5.1 Legislation for Environmental Management

80. The primary legislation for environmental assessment in Cambodia is the Law on Environmental Protection and Natural Resource Management (December 1996), further guidance is provided in the Sub-decree on Environmental Impact Assessment No. 72.ANRK.BK of August 1999.

81. Article 6 of the Law on Environmental Protection and Natural Resource Management states that an environmental impact assessment (EIA) shall be prepared for every project and activity, private or public, and shall be reviewed and evaluated by the Ministry of Environment or its provincial departments before being submitted to the Royal Government of Cambodia (RGC) for

approval. General provisions for each EIA, the institutional responsibilities, and requirements for EIA procedures and conditions for approvals are covered in that Sub-decree. A two stage process is specified for environmental assessment, similar to that required by the ADB, whereby an Initial Environmental Impact Assessment (IEIA) is prepared for most projects. The IEIA may either suffice for environmental clearance, or form the basis for a more substantial EIA. An Annex of the Sub-decree specifies the types of project that require an IEIA and if appropriate, EIA. The required scope and format of the IEIA resembles that of the IEE required under ADB requirements (ADB Safeguards Policy Statement, 2009).

82. Under the Sub-decree, the Ministry of Environment (MoE) is responsible for review of IEIAs and EIAs and to collaborate with the line ministries. The MoE has the authority to approve or reject a project. The Council for the Development of Cambodia (CDC) has overall jurisdiction over projects and also has the power to comment and require amendments or additions to IEIAs and EIAs. The MoE has further responsibility in the monitoring of project implementation. The MoE implements these responsibilities through its Department of Environmental Impact Assessment and Monitoring. Besides the MoE, other ministries with responsibility for the project have the right to examine and approve projects, following MoE review.

83. The primary responsibility for undertaking environmental assessment of projects lies with the Project Owner, and the assessment work is carried out by the Project Owner or consultants retained for the purpose. The owner of the water supply subprojects is the MIH and the PDIH of the province where the project is to take place.

84. The specified IEIA/EIA process consists of the identification of environmental impacts, review and examination of alternatives to the proposed project and the communication of information to stakeholders. A report format is also specified in Annex 7 of the Sub-decree. In the case of both IEIAs and EIAs, MoE is required to respond, providing findings and recommendations to the Project Owner, within thirty working days of submission.

85. Article 1 of the Sub-decree states that public participation is to be encouraged in the implementation of the IEIA process so that the conceptual inputs and suggestions of the public are to be taken into account for consideration prior to the implementation of any project.

86. Consultation was carried out with the MOE, which established MOE are supportive of the project in view of the urgency to expand water supply and sanitation in major towns to address environmental pollution and public health issues. The MOE clarified national requirements for environmental approvals. Water treatment plants that will supply more than 10,000 users and all new wastewater treatment projects require an Environmental Impact Assessment (EIA) under the Sub-Decree on Environmental Impact Assessment (1999). The Battambang and Kampong Cham subprojects both involve water treatment plants that will supply more than 10,000 users, and will therefore require EIAs for project approval. EIAs for these subprojects will be prepared during the detailed engineering design stage.

5.2 Cambodian Environmental Standards

87. Following promulgation of the Law on Environmental Protection and Natural Resource Management a number of sub-decrees have been issued that provide requirements on specific aspects of environmental protection. These include the Sub-Decree on Management of Solid Waste (1999), the Sub-Decree on Water Pollution Control (1999) and the Sub-Decree on the Control of Air Pollution and Noise Disturbance (2000).

88. The **Sub-Decree on Solid Waste Management**, ANRK.BK No. 36 of 27 April 1999 includes requirements for the handling and disposal of hazardous, or potentially hazardous waste. Some specialist lubricants, paints or other chemicals may be used in construction and their import, handling and disposal needs to comply with the requirements. Requirements are set out in Chapter 3 of the sub-decree and include allocating responsibility to the owner (or user) for temporary storage in a safe manner, and reporting to the Ministry of Environment on the type and amount of the waste, sources, packing and transport arrangement and process and management. The sub-decree also requires the Ministry of Environment to issue Prakas on standard relating to permissible quantities of toxins or hazardous substances contained in hazardous waste for disposal. Prakas № 387 (MOE), Implementation of Standard Limitation of Poisonous Quantity or Hazardous Substance Permitted for Disposal, was issued on 30 September 2015.

89. The Sub-Decree on Water Pollution Control, No. 27 ANRK.BK issued 6 April 1999 sets standards to safeguard human health and biodiversity conservation.

90. The Sub-Decree on the Control of Air Pollution and Noise Disturbance, No. 42 ANK/BK issued 9 June 2000, is to protect the quality of environment and public health from air pollutants and noise pollution and applies to all movable sources and immovable sources of air and noise pollution. It sets ambient air quality standards (Table 1) and maximum permitted noise levels (Table 2).

Table 1: Ambient Air Quality Standards

Parameters	**Period 1h Average mg/m^3**	**Period 8h Average mg/m^3**	**Period 24h Average mg/m^3**	**Period 1year Average mg/m^3**
Carbon monoxide (CO)	40	20	-	-
Nitrogen dioxide (NO_2)	0.3	-	0.1	-
Sulfur dioxide (SO_2)	0.5	-	0.3	0.1
Ozone (O_3)	0.2	-	-	-
Lead (Pb)	-	-	0.005	-
Total Suspended Particulate matter (TSP)	-	-	0.33	0.1

Table 2: Maximum Permitted Noise Level in Public and Residential Areas (dB (A))

Location	**Period**		
	06:00 to 18:00	**18:00 to 22:00**	**22:00 to 06:00**
Silence Area - Hospital - Library - School - Nursery	45	40	35
Resident Area - Hotel - Administration place	60	50	45

Location	Period		
	06:00 to 18:00	**18:00 to 22:00**	**22:00 to 06:00**
- House			
Commercial, Services Areas and mix	70	65	50
Small Industrial factories intermingling in residential areas	75	70	50

91. The sub-decree No. 42 also provides for monitoring of air quality (chapter 4), however a country synthesis report on Air Quality Management states that this only takes place regularly in Phnom Penh[4] and this remains the case.

92. National water quality standards for drinking water are set out in standards published by the MIH in 2005. Table 3 displays the standards for each quality parameter.

Table 3: Cambodian National Drinking Water Quality Standards

Parameter	Unit	Maximum Value
Micro-organisms		
E-coli	MPN/100ml	0
Chemicals		
Aluminum (Al)	mg/l	0.2
Ammonia (NH3)	mg/l	1.5
Arsenic (As)	mg/l	0.05
Barium (Ba)	mg/l	0.7
Cadmium (Cd)	mg/l	0.003
Chloride (Cl^-)	mg/l	250
Residue chlorine	mg/l	0.1-1.0
Chromium (Cr)	mg/l	0.05
Copper (Cu)	mg/l	1
Fluoride (F)	mg/l	1.5
Total Hardness (CaCO3)	mg/l	300
Iron (Fe)	mg/l	0.3
Lead (Pb)	mg/l	0.01
Manganese (Mn)	mg/l	0.1
Mercury (Hg)	mg/l	0,001

[4] Asian Development Bank and the Clean Air Initiative for Asian Cities (CAI-Asia) Center. (2006) Country Synthesis Report on Air Quality Management, Manila.

Nitrate (NO3)	mg/l	50
Nitrite (NO2)	mg/l	3
Sodium (Na)	mg/l	250
Sulphate (PO4)	mg/l	250
Zinc (Zn)	mg/l	3

5.3 Environmental Health and Safety Guidelines of the International Finance Corporation

93. The International Finance Corporation (IFC) of the World Bank Group provide Environmental, Health, and Safety (EHS) Guidelines, which are technical reference documents, occasionally updated, to promote good industry practice. These include guidelines for water and sanitation. The EHS Guidelines give performance levels and management measures that are generally considered to be achievable for new facilities with existing technology at reasonable cost. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures are recommended, justification is called for, demonstrating that the choice for any alternate performance levels is protective of human health and the environment.

94. For water supply, the EHS provides guidance on impacts and management in a number of relevant areas, including water withdrawal, water treatment and water distribution. For water treatment, recommended measures include designing the treatment system to minimize the quantity of solids and imposing restrictions on land application (if applicable); recycling filter backwash into the treatment process. For systems that use hazardous chemicals, to prevent, minimize, and control potential environmental impacts associated with the storage, handling and use of the chemicals. In the case of sodium hypochlorite, supplied in tablet or powder form, recommendations cover storage in cool dry, dark conditions for periods of a month or less, isolation of storage areas from the site where the dosage is applied, minimizing the quantities stored on site and development of a plan for responding to accidental release.

95. For water distribution, emphasis is given to design and operation of the system to maintain pressure to protect water quality and ensure delivery. Measures to prevent leaks and loss of pressure include high construction standards and regular inspection and maintenance.

96. Regarding occupational health and safety, the guidelines recommend training in safe handling practices using hazardous chemicals, and restriction of access to water treatment facilities by the use of perimeter fencing, lockable gates, lighting and appropriate security measures.

97. With regard to performance standards, the guidelines recommend adherence to national quality standards, throughout the distribution network. The Drinking Water Quality Standards Document of the MIH confirms that standards were based on the World Health Organization drinking water quality guidelines and those of other countries with particular adaptation to the water quality problems encountered in Cambodia.

5.4 ADB Environmental Safeguard Requirements

98. The ADB environment safeguards requirements are set out in the Safeguard Policy Statement (SPS 2009). All ADB-financed projects must undergo environmental assessment, with

management plans prepared as appropriate, to avoid adverse impacts of projects on the environment and affected people, minimize, mitigate, and/or compensate for adverse project impacts when avoidance is not possible, and help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks. The process commences with environmental screening and categorization using checklists developed by the ADB to determine (i) the significance of potential impacts or risks of the project to the environment, (ii) level of assessment and institutional resources required to address the safeguards issues, and (iii) information disclosure and consultation requirements of the project. Based on screening projects can be categorized as A, if impacts are irreversible, diverse, or unprecedented and over a wider area. For category A projects a full environmental impact assessment (EIA) is required. Category B applies if environmental impacts which are site specific, less adverse than those of Category A and an initial environmental examination (IEE) is required. Category C applies to project is likely to have minimal or no adverse environmental impacts, in which case no EIA or IEE is required. are the smallest and least complex and does not require an EIA or IEE. The proposed subprojects are classified as Category B and require an IEE. The IEE is discussed with the executing agency (EA) and other stakeholders and upon approval is disclosed on the ADB website.

99. The SPS further requires the development of an environmental management plan (EMP), specifying the required mitigation and monitoring and who is responsible for implementation. Monitoring of EMP implementation by the EA is reported to ADB.

5.5 Climate Change Considerations

100. Water supply and sanitation services are vulnerable to projected changes in climate conditions including storm events and periods of drought. The ADB requires screening for climate risk and climate risk and vulnerability assessments (CRVA) and identification of climate-proofing options at the project level. The requirements for Water Supply and Sanitation Projects are set out in Guidelines for Climate Proofing Investment in the Water Sector: Water Supply and Sanitation (2016). The CRVA includes identifying climate related risks, the drivers of vulnerability, development of climate change scenarios and an assessment of impacts on the project. A Climate Risk and Vulnerability Assessment has been prepared for this project,

6 Description of the Environment

6.1 Physical Resources

6.1.1 Topography, Geology and Soils

101. The project towns are situated in the Tonlé Sap basin, on low lying land surrounding the Tonlé Sap great lake and its wetland periphery. Underlying rock is generally sedimentary, deposited during the Mezozoic geological era (70 – 250 million years ago). The main rock types are consolidated shale, slate, sandstone, conglomerate and limestone. Intrusions of igneous granite like rock, of a type known as rhyolite, occur over the landscape, as small, generally conical shaped hills. Raised limestone outcrops also occur.

102. Soils around the Tonlé Sap basin include podzols, which developed under forest vegetation, and saturated hydromorphic soils which have developed under conditions of poor drainage.

103. Cambodia has a moist tropical climate, consistent of its location just 10-13 degrees north of the equator. The climate features warm to hot temperatures throughout the year and an annual monsoon cycle of alternating wet and dry seasons. The main wet season, the southwest monsoon, occurs between June and October, when reduced air pressures over Central Asia cause air to be

drawn landward from the Indian Ocean. Approximately 80% of all rainfall occurs during this season. Conversely, during the cooler months between November and May, air flows over Cambodia originate from Central Asia and are drier, resulting in cooler and less rainy weather. Average monthly rainfall is around 1,500mm. However, total rainfall can vary considerably from year to year, resulting in occasional years of severe flooding and conversely, years of significantly low rainfall. Both can result in severe difficulties, as the floods of the late 1990's have demonstrated. Years of low rainfall may raise the risks of water use conflicts in some areas. The average daily temperature in Cambodia is 28^{o}C, temperatures can fall to 17^{o}C in January and be as high as 40^{o}C in May and June.

104. Earthquake risks in Cambodia are generally low, as the country is underlain by the relatively stable continental block. The margins of the Mekong basin, mainly in neighboring countries do experience earthquakes and tremors though seldom exceeding 6.5 on the Richter scale.

6.1.2 Water Resources

105. Water resources in the Tonlé Sap basin are relatively abundant, fed by precipitation and the inflow from the Mekong river. They are however increasingly vulnerable to damage through the impedance of drainage flows by roads and the effects of irrigation and resource conflicts can occur.

106. The quality and quantity of available surface water varies. Within the Tonlé Sap basin, there are 11 sub-basins among which annual flows vary significantly, and in some smaller rivers the flows regularly cease for a period during the dry season. Flows are often affected by river diversion, in several cases dating from the Angkorian period as the construction of canals and of large artificial lakes was a feature of the ancient Khmer civilization. The diversion of streams and construction of bunds to retain water on rice fields causes greater evapotranspiration, and reduced flow in the rivers, particularly at the onset of the dry season.

107. Surface water quality is vulnerable to sedimentation from river bank erosion and to the effects of damage to forested areas in the basin, which has occurred prolifically in recent decades when natural forest logging intensified. Pollution is also a growing problem, mainly associated with poor solid and liquid waste disposal practices in large and small towns. Levels of coliform bacteria and biological oxygen demand of surface water are often high, particularly during the dry season.

108. The total estimated ground-water resource in Cambodia[5] is around 17.6 billion m^3, readily recharged by rainwater. While the resource as a whole is copious, its distribution is uneven and where groundwater is extracted for irrigation use as well as water supply, resource conflicts may potentially arise.

109. Water quality testing does not take place on a regular basis at water supply facilities around the country. While MIH have the mandate for water testing and require all public waterworks to conduct water quality testing every three months, this does not currently take place.

110. RGC drinking water quality standards prepared by the (former) Ministry of Industry, Mines and Energy in 2004 set out responsibilities for water quality monitoring and guidance on frequency, method and parameters to be monitored. These were upheld by standards prepared by the Ministry of Industry and Handicrafts in 2015. However, required water quality monitoring does not take place due to logistical and budgetary constraints. Outside the government structure, the

[5] MOWRAM (2001) National Water Sector Profile, Kingdom of Cambodia. MOWRAM, Phnom Penh.

Mekong River Commission undertakes regular water quality monitoring, though this is confined to permanent stations on the Mekong River or major tributaries, therefore there are no stations near Sihanoukville or Battambang. One station is situated at Kampong Cham. Published data reports present findings according to quality class. Water quality at Kampong Cham was reported as B (Good) on as scale of A (High) to E (Very Poor). Mekong River Commission (2015).[6]

6.1.3 Ambient Air and Noise Quality

111. The project towns are seeing an increase in population density and traffic, which have a noticeable effect on noise levels and air quality. Regular, systematic monitoring of air quality, while mandated in the Sub-Decree on the Control of Air Pollution and Noise Disturbance, (2000), does not currently take place outside Phnom Penh (as mentioned in section 5.2).

6.1.4 Climate Change

112. The availability of water resources is vital for both water and agriculture in Cambodia and highly vulnerable to climate change as confirmed by the National Adaptation Program of Action. Increased rainfall variability impacts on surface and ground-water availability including potable water supplies. The effects of climate change predicted in Cambodia include (i) an increase in ambient temperature consistent with the phenomenon of global warming; (ii) a prolonged hot period of the year with a longer and warmer dry season; and (iii) a later, briefer and more intense wet season, resulting in higher levels of precipitation. Climate related hazards also include flooding, which although it is a a natural occurrence in much of the country, can reach extreme levels and cause damage to infrastructure, as seen during typhoon Ketzana in October 2009. Devastating floods used to occur about every five years (in 1961, 1966, 1978, 1984, 1991, and 1996). Recently, however, damaging floods have occurred almost every year since 1999, with floods in 2000 and 2011 particularly severe. Also of significance to water availability is the distribution of precipitation over the year and periods of drought can appear. These aspects have been reviewed in a Climate Risk and Vulnerability Assessment .

113. A Climate Risk and Vulnerability Assessment has been prepared for this project, based on site visits and projections for the project sites. Projections show that the increase in intensity of rainfall during extreme weather events does not vary across the country. The 1 in 10 year event by 2030 under RCP 8.5[7] will experience a 4 % increase in 1 hour rainfall intensity and by 2050 under RCP 8.5 there will be a 7% increase in 1 hour rainfall intensity. The 1 in 100 year event by 2030 under RCP 8.5 will experience a 7 % increase in 1 hour rainfall intensity and by 2050 under RCP 8.5 there will be a 12% increase in 1 hour rainfall intensity. The projected results show that by the year 2050 daily peak temperatures could reach 49.5^{o}C. This would be a 1 in 100 year event. A more common scenario would be daily peak temperatures reaching 47^{o}C which would be a 1 in 10 year event. The highest probability of a severe drought occurring is 7.5% by the year 2050 in Battambang, equating to a 1 in 13 year event.

[6] Mekong River Commission (2015). 2013 Lower Mekong Regional Water Quality Monitoring Report. Technical Paper No.51.

[7] Representative Concentration Pathways (RCPs) are four greenhouse gas concentration (not emissions) trajectories adopted by the IPCC for its fifth Assessment Report (AR5) in 2014. They represent four possible climate futures, all of which are considered possible depending on how much greenhouse gases are emitted in the years to come. The four RCPs, RCP2.6, RCP4.5, RCP6, and RCP8.5, are named after a possible range of radiative forcing values in the year 2100 relative to pre-industrial values. RCP 2.6 assumes that global annual GHG emissions (measured in CO2-equivalents) peak between 2010-2020, with emissions declining substantially thereafter. Emissions in RCP 4.5 peak around 2040, then decline In RCP 6, emissions peak around 2080, then decline. In RCP 8.5, emissions continue to rise throughout the 21st century, this is the most pessimistic, extreme scenario.

6.2 Ecological Resources

6.2.1 Overview

114. The project towns are provincial capitals, which are both expanding and increasing in population density. Ornamental trees have been planted along main streets, but as older buildings are becoming replaced with large retail facilities, hotels and apartment blocks, trees are often removed, with greater emphasis placed on green spaces and parks within the towns. The towns are expanding outwards, into low density residential areas at the periphery and farmland immediately beyond.

115. The towns are situated to the south of the Tonlé Sap lake. The Tonlé Sap lake has a unique annual cycle in which water from the Mekong river flows inwards continuously for approximately half of the year, and this water drains out steadily for the other half of the year. This has resulted in a correspondingly unique ecosystem dominated by species that are adapted to thrive in the substantial zone around the lake that endures major changes in dry and inundated conditions and has significant biodiversity conservation value. The lake, its wetland margin including unique "flooded forests" and a surrounding buffer zone form the Tonlé Sap Biosphere Reserve. The provincial towns lie outside the Tonlé Sap Biosphere Reserve however stormwater and wastewater from the towns flows towards the reserve.

6.3 Items of Historical and Cultural Significance

116. The highly significant remnants of the Angkorian civilization, which occupied much of what is now north and northwest Cambodia from the ninth to the fifteenth centuries, generally lie outside the modern cities. They are important economic assets, supporting a major tourism industry though this is centered in the province of Siem Reap, with less tourism in the two towns.

117. The development of the project towns was strongly influenced by the French colonial era from 1867 to 1946 and buildings from that era are distinctive and remain in parts of each town, though many of the larger administrative buildings have been replaced during recent decades, while some commercial and residential buildings are being replaced as the city centers intensify. Other items of cultural significance include colonial era buildings, and monuments, many of which feature distinctive Khmer architecture and have been built since independence in 1946.

6.4 Human and Economic Development

6.4.1 Health

118. Public health in Cambodia, is improving, for example the under-five mortality rate decreased from 83 per 1,000 live births in 2005 to 28.7 per 1,000 in 2015 but remains a significant challenge. A significant portion of the population does not have access to piped water supply and fewer have access to improved sanitation. An estimated 14% of infant deaths are attributed to diarrheal diseases. In comparison to the development of water supplies in Phnom Penh and the provincial towns in Cambodia, the wastewater sector is still in an early stage of development with the discharge of untreated wastewater into lakes and waterways commonplace, even in the capital, Phnom Penh placing communities living near discharge areas and affected waterways at risk.

6.4.2 Livelihoods

119. Agriculture and tourism are the mainstays of the economy in the Tonlé Sap basin, particularly around Battambang and Kampong Cham. Battambang in particularly has long been

renown for quality rice, fruit and vegetable production. Plantation based industries including rubber, oil palm and fruit orchards are becoming prolific particularly around Kampong Cham.

i. Poverty

120. A socio-economic survey of the areas to be serviced by sanitation improvements for the project was undertaken during the PPTA. Fourteen percent of households were found to be poor, approximately half which are very poor, using the Ministry of Planning categorization system IDPoor. IDPoor uses a proxy means test with participatory elements, categorizing HHs as poor category 1 (P1 - very poor), poor category 2 (P2 - poor), after an assessment of occupation, education and income, health and disabilities of all family members, housing status and conditions, access to water and sanitation facilities, household debt, economic shocks and vulnerabilities.

6.4.3 Ethnic Groups

121. The main ethnic minority populations in Cambodia are the Cham, the Chinese, the Vietnamese and the Khmer Loeu. The Khmer Loeu are indigenous hill tribes and are more often amongst the poorest and most vulnerable.

6.4.4 Unexploded Ordnance

122. Unexploded ordnance remaining from the earlier period of civil conflict is widespread around the country, resulting from both aerial drops and from ground fighting. Clearance of areas either known or suspected to contain live ordnance is a slow and expensive process, but is taking place steadily, in much of the country. Unexploded devices are typically encountered when ploughing fields, searching for scrap metal and even by children playing. Due to the prolonged and complex nature of the conflict in the region, the placing of ordnance is difficult to predict and, except where thorough clearance has taken place, or in areas that are frequented by people and livestock. Where there is a significant risk of the presence of unexploded ordnance, specialist clearance and/or verification services are necessary.

7 Anticipated Environmental Impacts and Mitigation Measures

7.1 Method of Assessment

123. The potential impacts were screened during the process of design review and IEE preparation, to identify potential impacts related to location, construction and operation, stakeholders were consulted, suitable mitigation measures and an environmental management plan developed. The area of influence for each subproject comprises the inner core areas of the towns where water supply services will be improved, the pipeline alignments leading to the water treatment facilities and the sites of the treatment facilities.

7.2 Environmental Impacts Related to Location

124. The projects are located in urban or peri-urban areas. In the town centres, intensive development of public infrastructure including roads, commercial and residential buildings, replacing older buildings with modern multistorey buildings has taken place and is ongoing. These developments increase the density of both commercial entities and private dwellings, generating greater demand for clean water supplies. The subprojects directly address this problem. A major

positive impact on the urban and periurban environment in the subproject towns is therefore predicted.

125. **Effects on vegetation**. Pipe laying and replacement in the city centres will not involve removal of street trees, and urban parks will not be affected. Where water treatment plants are to be constructed in Battambang and Kampong Cham and immediately outside the project towns, where wastewater treatment plants will be constructed

126. **Unexploded Ordnance (UXO) risks**. The subproject work sites are in urban areas and are occupied by the urban populations. Consultations with provincial government agencies, communes and village chiefs has not identified any potential risk of UXO. Bid documents will emphasize the need for contractors to be aware of the risk with a requirement to consult the provincial, district and village administrations regarding potential risks and to plan their work accordingly. Where unexpected UXO are encountered the contract documents shall require that work is to cease until the UXO contamination has been identified and any necessary clearance and decontamination has been undertaken by a specialized contractor, managed by the respective PMU and PIU. A clearance certificate and appropriate supporting documentation must be submitted to the Government and ADB before any works start in areas where the presence of UXO is suspected.

127. **Loss of land and effects on property**. Impacts on public and private property are limited. Within the towns, pipe laying will entail disruption to traffic and access to individual properties. These effects are temporary and concrete aprons and similar structures will be reinstated as part of the works. In the case of Battambang, land will be required for the new wastewater treatment plant.

128. A Resettlement Plan has been completed for the Battambang water supply subproject. It found that the subproject involves physical changes through civil works mainly within existing corridors of impacts along pubic right-of-ways and site specific land requirements for wastewater treatment facilities. The PPTA team undertook (i) a preliminary measurement survey (PMS), and (ii) a socio-economic survey of affected households (SESAH) subsequent to the feasibility study and preliminary design. The surveys found that three affected households (AHs) will lose access to government owned productive land. No private land or primary structures will be lost, and no relocation will occur. Where pipes are to be laid within the public right of way, an estimated 82 road access points to private properties will be affected and reinstated as part of construction work. No trees, crops or services will be affected. The four AHs that will lose productive land will be compensated in cash. Depending on their decision, to be made in 2018, the income situation has to be re-surveyed and support is to be provided by the Interministerial Resettlement Committee to ensure income restoration to a minimum of pre-project level. Two of the AHs, housing 10 affected persons, are socially vulnerable. All 3 AHs with 19 APs are severely affected by more than 10% loss of their total productive land, which they rent or are allowed to use.

129. Screening in Kampong Cham similarly confirmed that there will be no permanent impacts on property, income, land or trees, but there will be temporary impacts where access to properties is affected during construction but is to be reinstated.

7.3 Impacts due to Construction

130. **Impedance of traffic**. Pipe placing or replacing will involve impedance to traffic, including access to individual properties. The input is temporary and will be mitigated by requiring the contractor to (i) provide notices to the public advising of timing and duration of construction work and the effects on traffic routes during construction; (ii) place "safety first" traffic signs and warning signs, (iii) identify and mark detours when necessary, (iv) arrange temporary traffic signals, (v)

liaise regularly with traffic police (vi) clearly demarcate construction sites and (vii) to the extent practicable, schedule work that blocks roadways to periods of low traffic.

131. **Noise pollution and vibration**. Excavation and pipe laying within the town centres will cause noise and vibration, as will the improvement of the wastewater treatment plant at Sihanoukville and the construction of the new wastewater treatment plant at Battambang. To mitigate the contractor will be required to (i) provide information on scheduled work to affected persons through direct liaison and via the local media about the timing and duration of the works (ii) limit construction activities to normal daylight working hours (iii) adhere to the planned work schedule and (iv) ensure that all construction equipment and vehicles are kept in good working order with working mufflers and noise compression.

132. **Waste Generation**. Construction waste will include packaging of equipment, fuels, lubricants, materials, equipment and food. Some specialist lubricants and paint for marking may be hazardous. Imports of such materials for the work and their disposal of surplus materials and of packaging must comply with the Sub-Decree on Solid Waste Management. ANRK.BK No. 36 of 27 April 1999, ensuring no illegal dumping of hazardous waste. All other solid waste will be taken to a landfill or municipal waste disposal site.

133. **Release of silt**. Excavations from pipe trenches and foundations for structures will involve making temporary stockpiles of material that will either be removed or re-used as backfill. To prevent salt release contractors will be required to exercise caution to prevent erosion losses, ensuring that (i) excavated areas are rapidly refilled on completion of works (ii) stabilize soils once the pipeline is in place (iii) place silt fences around temporary piles of excavated material and (iv) avoid excavation of trenches in wet weather to the extent practicable.

134. **Soil and water pollution**. The use of vehicles and plant can cause risks of soil and water pollution, in the event of leaks and spills of fuel, lubricants, hydraulic fluid or other fluids used for vehicle operation. To reduce risks and limit impacts the contractor will be required to ensure that vehicles and plant are maintained in sound operable condition, free of leaks and that the condition of vehicles and equipment is regularly checked. The contractor will prepare and submit a plan for spill management, including provision of spill kits, training/briefing of workers on procedures on handling spills and allocation of responsibility within the contractor's team for ensuring that spill kits are available and that workers know how to use them.

135. **Air and dust pollution**. Potential sources of air pollution are exhaust fumes from vehicles and plant, dust from transport of construction and waste materials and areas around work sites where soil and debris is deposited. The mitigation measures are to require vehicles and equipment to be well maintained and tuned and fitted with exhaust baffles. Trucks are to be fitted with tarpaulins to cover loads when carrying fine material. Water will be applied to suppress dust around work sites where needed.

136. **Community health and safety risks**. The use of plant and machinery, use of compressed air lines and cables and excavations are all potential hazards to the public. Risks are to be mitigated by providing notices to the public identifying hazards; erection of safety barriers/covers for area of open excavation and provision of watch person to control access.

137. **Occupational Health and Safety**. To reduce day to day risks associated with working with heavy equipment in trafficked areas, contractors will be required to appoint health and safety officers for each site and to ensure regular briefing of the construction workforce on health and

safety issues. Personal protective equipment to be provided to the workforce, appropriate to each site..

7.4 Impacts during Operation

138. **Water availability**. Both schemes will utilize surface water resources. In the case of Battambang, the water will be sourced from the Sangké river which is situated entirely in the Tonlé Sap basin and drains into the Tonlé Sap lake. The availability of water in the river is very variable from year to year, and this is likely to be exacerbated with climate change. Water is extracted upstream of the city for irrigation purposes and as yet there is no formal agreement between the MIH and Ministry of Water Resources and Meteorology (MOWRAM) on water sharing. During the dry season, water levels may be sufficient for most years but during a dry year, when there has been relatively little precipitation in the Tonlé Sap basin, reserves may not suffice to meet the demands of irrigation, water supply and environmental flow to sustain the aquatic ecosystem in the river downstream of the intake. It is understood that a dam is under construction downstream of the city, the crest of which is approximately equal to the maximum lake level. This is expected to ameliorate the effects of water shortages during dry years. However regular monitoring of river levels will provide data that enables informed planning and formation of agreements with other water users and a river level logger should be installed in the Sangké river along with assistance in establishing regular collection and recording of data.

139. In Kampong Cham, water will be sourced from the Mekong river. From data provided to the CDIA team, the minimum monthly average flow of the Mekong at Kampong Cham is 2,200m^3/s, and the maximum monthly average flow is is 34,400m^3/s. The combined requirement of both the existing and WTPs are is 0.36m^3/s in 2025 and 0.53m^3/s 2040. The year 2040 requirement is therefore 0.02% of the minimum monthly average flow.

140. **Water Safety**. Develop and comply with requirements of the Water Safety Plan developed by the Provincial waterworks. The project is providing support to Provincial waterworks in the preparation of water safety plans. Water safety plans are being promoted by the WHO, and their objectives are to ensure safe drinking-water through good water supply practice, encompassing the prevention of contamination of source waters, appropriate treatment of the water to remove contamination and meet water quality targets; and prevention of re-contamination during storage, distribution and handling of the water. Plans are formed on the basis of examining the system from the catchment, through treatment to distribution, prioritizing the risks and ensuring that control measures are in place to bring risks to an acceptable level. Appropriate templates for water safety plans, following the model developed by the WHO, have been prepared and support will be given to Provincial waterworks during the project in their preparation and implementation.

141. **Disposal of Sludge**. The water treatment process will involve the use of lime and alum, and generation of sludge with traces of these chemicals in it. While not generally harmful, alum can inhibit plant growth and should therefore be kept away from farms, gardens and forests. The impact is mitigated by minimizing the quantity of solids generated by the water treatment process by controlled dosing for the coagulation processes. Sludge should be disposed of by land application limiting application rates to about 20 dry metric tons per hectare to minimize the potential for mobilization of metals into plant tissue and groundwater, in accordance with EHS standards.

142. **Handling of Chemicals** Water treatment will involve the use of chemicals for flocculation and disinfection, most significantly chlorine. Risks will be mitigated by supplying and applying chlorine as sodium hyperchlorite in powder form. Chemicals need to be stored in secure

storerooms on site, with access controlled by the plant management. Operators will be trained in safe handling and use of the chemicals. An operation manual that identifies potential hazards, provides operating procedures and accident mitigation will be provided, and training given in operation and maintenance.

143. **Operator occupational Health and Safety**. In addition to training, including training in recognizing and rectifying risks and hazards, the provision of personal safety equipment and its continuous use is necessary. issued and worn. Health and safety recognized as primary an employer responsibility.

144. **Community Health and Safety**. The water treatment plants are potentially hazardous, particularly to children. Regular checking of the perimeter fence to ensure it is effective to prevent members of the public from entering the WTP, and control of access is necessary to reduce or eliminate these dangers.

145. **Impacts of Climate Change**. The projected increases in intensity of drought events and increased temperature entail water supply risks, particularly for Battambang where the volume of available water is influenced by upstream offtake for irrigation. At present information on offtake quantities is not available as the major upstream irrigation dam is still undergoing commissioning trials which may take 2 years to complete. Further, there is a dam under construction downstream, the impacts of which are yet to be assessed. The project includes support to the preparation of water safety plans (described in section 7.4), which will include provision for public awareness and O&M training to enable management of water shortages during drought events. The Kampong Cham water supply site occupies a site adjacent to the existing Water Treatment Plant, in an area classed as being exposed to Moderate Risk of flooding. The CRVA recommends that designs for flood protection should allow an increase of 12% on short duration rainfall intensity.

146. **Risk of pipe failure**. Failure of the water supply pipes would cause sudden and unexpected reduction of service to users reliant on a constant supply of clean water to maintain sanitary living conditions, and possible ingress of contaminants into the pipe network, posing health risks to users. The risks are mitigated by early detection. This is achieved by regular inspection to monitor leaks and any blockages. Training in O&M, provision of site log books and help ensure regular inspection.

147. **Greenhouse Gas Emissions**. The systems will require electrical power for both treatment and distribution, resulting in increased carbon emissions. Baseline levels, under the "without project" scenario are zero, as there is currently no treatment or distribution system to the households who will be connected during the implementation of the subproject. The expected emissions from power consumption under the "with project" scenario for the two subprojects is 14.53 kilotons of CO_2 equivalent per year, of which 11.79 kilotons will be contributed by the Battambang subproject and 2.74 from the Kampong Cham subproject[8].

7.5 Global, Transboundary and Cumulative Impacts

148. The proposed improvements will occur within and around the project towns. The environmental impacts identified through screening will almost all be confined to the towns and their immediate environment.

[8] AFD team calculations

149. Supplies of safe water are vital for human health and for urban growth and sustainability. While investments in water supplies in Cambodia have been stepped up in recent years, limitations in water supply constrain growth and leave some urban dwellers without access to clean piped water. The build-up of capabilities to construct and maintain further water supplies is an important and positive cumulative impact.

150. However, increased water supplies also increase the quantity of wastewater which can exacerbate unsanitary conditions and increase pollution to local waterways where drainage systems are unable to cope with the additional flows. This cumulative impact is mitigated by parallel improvements in drainage and in sanitation.

8 Analysis of Alternatives

8.1 Alternatives to the Subprojects

151. An alternative to the subprojects would be the use of investment funds to contribute to the Government's target for 100% urban water supply and improved sanitation coverage by 2025, in different towns and in water supply improvements rather than sanitation. The subprojects were chosen from among other candidate subprojects on the basis of feasibility, cost effectiveness, scale of impact, fit with national policy and ADB country strategy and financial capacity of the town administration.

8.2 Alternatives within the Subprojects

152. The scope of the subprojects is largely defined by the needs to extend and improve the water supply systems in each town. Alternatives would concern the water source, water treatment method and the layout and pipe type for the water supply network. These alternatives form an essential part of the subproject rationale and are described as part of the project description.

8.3 The no project alternative

153. The subproject is designed to extend water supply to members of the urban population who do not at present have access to clean, piped water, and to strengthen and improve efficiency and longevity of existing parts of each system. The subproject designs takes into account future water supply demand and in its absence a growing portion of Cambodia's urban population would not have access to piped, clean water.

9 Information Disclosure, Consultation and Participation

9.1 Consultations and information disclosure during subproject design

154. Consultation began early in the project preparation stage with visits to the subproject sites and discussions with the provincial officers relating to preliminaryengineering designs prepared by the CDIA consultants. Consultation has continued and will continue throughout project preparation and implementation, to provide timely disclosure of relevant and adequate information in an understandable and readily accessible form to key stakeholders. Consultation was organised to occur in an atmosphere free of intimidation or coercion, was gender inclusive and enabled the incorporation of all relevant views into the project design and arrangements for implementation.

155. The consultation involved MIH, their provincial PDIHs, utility operators, the local municipal and sangkat/commune officials and village representatives. Transparent consultation processes were also adopted for public village meetings during the socio-economic surveys (SES) and focus group discussions (FGDs) and in the course of subsequent public meetings to explain the pre-

engineering designs and for disclosure of land acquisition and resettlement and the likely environmental and social impacts. The environmental considerations have therefore been identified with the provincial authorities, the commune/sangkat authorities and their communities. The information made available includes the specific activities, schedules, anticipated environment and social impacts and mitigation measures and monitoring processes. Comments received in the course of the village meetings and the other discussions with respect to environmental concerns have been incorporated into the mitigation measures proposed for detailed design and implementation. All persons met have been informed about the subproject in general and the environmental aspects in particular.

9.1.1 Feedback

Impacts on Health

156. An extensive socio-economic survey (SES) was undertaken of the villages in the water supply and wastewater/sanitation subproject areas in Battambang, Kampong Cham, Sihanoukville and Siem Reap at the outset of the PPTA activities. Core problems of inadequate water supply and sanitation infrastructure and services identified the degradation of the natural environment and poor health conditions, especially for the poorer communities. Poor water supply coupled with poor sanitation was seen to be contributing to regular incidence of diarrhea and dysentery, major causes of death in infants. Poor water and sanitation was also seen to be contributing to growth stunting in young children. Lack of sanitation was also linked to kidney and urinary tract diseases especially in women who may “hold back” rather than go outside at night to urinate. Many households (HHs) reported diarrhea in infants up to 5 years of age, and this is seen to be due to unclean water and poor sanitation.

Water Use

157. Women focal groups consulted during the SES indicated a much greater preference for piped water for all domestic uses, particularly drinking, cooking and bathing, as piped water was considered cleaner and better tasting, and was thought to offer less chance of contracting diarrhea or skin complaints. Water from dug wells and bore holes was regarded as smelly, having a poor taste and red color (iron contamination), being harder (soap not lathering), particularly in the dry season when water sources are prone to shortages and under stress. Water taste and smell was stated as being more predominant in the wet season, most likely from the short circuiting of contamination and pathogens directly to the underground aquifers, streams and ponds when water tables are high and areas are flooded. The women consulted welcomed the opportunity presented by the water supply subprojects of having good quality water available 24 hours a day and most HHs in the project service areas for these subprojects are eager to be connected to water and sewage systems. Dry season water supplies were identified as being under stress requiring HHs to restrict water to essential use.

158. Women FGDs in the water supply subproject towns of Battambang and Kampong Cham considered the best solution to water supply issues was connection to piped mains supply seeing it as safe and clean and reliable. All women consulted agreed that paying for a HH connection was money well spent with the majority of women suggesting they would start saving to ensure that the HH could pay for the water connection.

Possible Project Negative Impacts

159. The consultations identified few negative impacts from the proposed sanitation improvements, and any negative impacts identified are more than mitigated by overwhelmingly positive benefits from the improved water supplies.

160. As indicated above other negative impacts identified included possible disruption to property access and dust from construction activities. This is seen to impact more on women given that they may have to assist young children to get to school, go to the market and also stay at home to look after sick family members, given that increased and uncontrolled dust during construction could contribute to an increase in respiratory disorders (such as asthma and bronchitis), illnesses that are more likely to affect the very young and very old. However, the dust generated by pipe installation will be kept to a minimum and the effect will be temporary, lasting around 1-2 days and localised. Most pipelines are not immediately adjacent to dwellings. Dust control measures such as spraying water over loose soil, sweeping and clearance of spilled spoil were advanced by the respondents as a method to reduce dust in construction areas, under requirements that can be incorporated into the civil works contracts for the subprojects. Appropriate measures are included in the environmental management plans (EMPs). Other negative impacts were largely deemed to be insignificant.

9.2 Continuing Consultation with Resettlement Surveys and Consultation

161. The disclosure of the land acquisition, resettlement and compensation information, consultation and participation of residents for the subprojects took place in a series of public meetings during January and February 2017. This involved fieldwork (detailed measurement surveys (DMS), household surveys, consultation meetings in villages and transect walks) performed by the PWW/DPWT and the PPTA consultants. The consultation involved a description of project (and each respective subproject) and its current status; a general introduction into resettlement; an explanation of the Grievance Redress Mechanism; coverage of the likely construction impacts with particular reference to pipes in public right-of-ways; and clarification on environmental construction management relating to traffic and traffic management, access to properties, construction impacts including noise, dust and air pollution, operation of construction equipment and hours of operation, and environmental considerations.

162. **Battambang water supply subproject:** Eleven (11) public commune meetings convened in January and February 2017 involving 348 commune residents (188 female and 160 male).

163. **Kampong Cham water supply subproject:** Four (4) public commune meetings convened during the same period involving 287 commune residents (103 female and 184 male).

164. The contacted participants (i) showed high interest in the subproject and (ii) repeatedly mentioned their expectations towards the subproject, as water supply and sanitation are topics of high importance. The discussion with the participants concerned in general more wastewater operational matters including environmental matters and likely construction impacts rather than resettlement items.

9.3 Further Information Disclosure and Public Consultation

10 **This draft IEE and a Khmer translation of the executive summary will be provided to commune officials for public disclosure. Affected persons in the subproject area will be kept informed of construction activities that are likely to cause noise**

and dust nuisance, or disruption to roads and pathways and will be made aware of the grievance redress mechanism and consultations will take place regularly to gain feedback and ensure that impacts are being adequately managedGrievance Redress Mechanism

165. PMUs will be established in the General Department of Potable Water Supply within MIH. The PMU will be responsible for implementing environmental requirements, including the Grievance Redress Mechanism (GRM). The GRM is project specific and covers environmental as well as resettlement safeguards and appears in each project EMP and resettlement plan (RP). It proovides for receipt and management of any public concerns or issues which may arise due to the subprojects. The GRM comprises: (i) a set of clear procedures for the project to receive, record, and address any concerns which are raised; (ii) specific contact details for individuals at the commune chief, PMUs/PIUs or contractors, and (iii) the POE.

166. All contractors and work staff will be briefed by the PMU/PIUs on the GRM. Contractors and workers will be instructed to be courteous to local residents and, in the event they are approached by the general public with an issue, to immediately halt their work and report the issue to the foreman. The foreman will immediately report the issue to the PMU/PIU for action.

167. There are multiple entry points to the GRM, including face-to-face meetings, written complaints, telephone conversations, anonymous drop-boxes for written comments, and/or e-mail. All concerns received will be treated confidentially and professionally. The identity of individuals will not be circulated among subproject agencies or staff and will only be shared with senior staff, and then only when there is clear justification. In the construction period and the initial operational period covered by loan covenants. The PMUs will report on GRM to ADB, including complaints and their resolution in the quarterly project progress reports and semi-annual environmental monitoring reports up to the project completion report.

168. Basic steps for resolving complaints are as follows:

Step 1: For environmental problems during the construction and operational stages, the affected person (AP) can register his/her complaint directly with the contractors or with the PMU complaint center phone. A joint hotline for resettlement and environment issues will be established within PMU. Complaints related to land acquisition and resettlement issues can be directed through the commune and relevant agencies in accordance with the RP. Contractors are required to set up a complaint hotline and designate a person in charge of handling complaints, and advertise the hotline number at the main entrance to each construction site, together with the hotline number of the PMU complaint center. The contractors are required to maintain and update a Complaint Register to document all complaints. The contractors are also required to respond to the complainant in writing within 7 calendar days on their proposed solution and how it will be implemented. If the problem is resolved and the complainant is satisfied with the solution, this can be recorded by the PMU or PIU complaint center and follow-up should be carried out. The contractors are required to report complaints received, handled, resolved and unresolved to the PMU complaint center immediately, and to the IA and PMU monthly (through progress reporting).

Step 2: If no appropriate solution can be found during step 1, the contractor has the obligation to forward the complaint to the PMU/PIU complaint center, and the local POE. The POE shall immediately notify PMU/PIU upon receiving the complaint. For

an oral complaint, proper written records shall be made. Once a complaint is registered and put on file, the PMU complaints center will immediately notify ADB and others concerned to discuss acceptable solutions. The PMU complaint center will assess the eligibility of the complaint, identify the solution and provide a clear reply for the complainant within 14 calendar days.The PMU/PIU complaint center will also inform the ADB project team and submit all relevant documents. Meanwhile, the PMU/PIU complaint center will convey the complaint/grievance and suggested solution to the contractors, IA and/or facility operator in a timely manner. The contractors will implement the agreed redress solution and report the outcome to the PMU/PIU complaint center within fifteen (15) working days.

Step 3: In case no solution can be identified by the PMU complaint center, or the complainant is not satisfied with the proposed solution, the PMU complaint center will organize, within 14 calendar days, a multi-stakeholder hearing (meeting) involving all relevant stakeholders (including the complainant, IA, contractors, and local POE). The hearing shall identify a solution acceptable to all, and formulate an action plan.

169. The tracking and documenting of grievance resolutions by PMU/PIU will include the following elements: (i) tracking forms and procedures for gathering information from project personnel and complainant(s); (ii) regular updating of the GRM database by the PMU environmental safeguards officer; (iii) processes for informing stakeholders about the status of a case; and (iv) procedures to retrieve data for reporting purposes, including the periodic reports to the ADB.

170. At any time, an AP may contact ADB (Southeast Asia Department) directly, including the ADB Cambodia Resident Mission.

171. If the above steps are unsuccessful, persons who are, or may in the future be, adversely affected by the project may submit complaints to ADB's Accountability Mechanism. The Accountability Mechanism provides an independent forum and process whereby people adversely affected by ADB-assisted projects can voice, and seek a resolution of their problems, as well as report alleged violations of ADB's operational policies and procedures. Before submitting a complaint to the Accountability Mechanism, affected people should make a good faith effort to solve their problems by working with the concerned ADB operations department. Only after doing that, and if they are still dissatisfied, should they approach the Accountability Mechanism.[9]

11 Conclusion

172. The overall finding of the IEE is that the water supply subprojects will result in significant environmental benefits, by addressing access to clean water supplies and sanitary living conditions for households in the project towns. The water supply subprojects will not have significant adverse environmental impacts and potential adverse impacts are manageable through the effective implementation of the EMP. No further environmental assessment is therefore required, beyond the issues to be reviewed during detailed design.

173. The water supply subprojects classification of Category B is ~~confirmed~~.

[9] See: http://compliance.adb.org/

ENVIRONMENTAL MANAGEMENT PLAN:

Water Supply Subprojects

1 Environmental Management Plan

1.1 Objectives

1. This EMP sets out the needs for environmental management of the water supply subprojects of the PWSSP in terms of institutional responsibilities to ensure mitigation and monitoring takes place during the pre-construction, construction and operation phases of each subproject, meeting the requirements of the RGC and the ADB's SPS.

1.2 Institutional Responsibilities

2. The PWSSP is scheduled for implementation over 5 years from December 2017 to December 2022. The PWSSP has two Executing Agencies; MIH is the Executing Agency for the water supply subprojects and MPWT is the Executing Agency for the wastewater and septage management improvement and the Siem Reap interceptor sewer replacement subprojects. The MIH's overall function covers the facilitation, coordination and development of urban water systems, including water extraction, treatment and distribution.

3. The PWSSP is scheduled for implementation over 5 years from December 2017 to December 2022 and a Coordinating Committee (CC) will be established for project and sector coordination between MIH and MPWT. MIH will have responsibility for the coordination and consolidation of reports to MEF and ADB and will recruit the Project Implementation Assistance Consultants (PIAC) to assist the Project Management Units (PMUs) and Project Implementation Units (PIUs).

4. Two PMUs will be established in: (i) the General Department of Potable Water Supply (GDPWS) within MIH for the water supply subprojects; and, (ii) the General Department of Public Works (GDPW) within MPWT for the wastewater and septage subprojects, with full-time staff to execute and manage the Project. Each PMU will have appointed procurement officers and an environmental safeguards officer who will be responsible for EMP implementation for the subprojects. International and national environment consultants will be recruited through the PIAC consulting services to support the PMUs and provincial PIUs with supervision of implementation of the EMPs.

5. PIUs will be established in the provincial Public Water Works (PWWs) at Battambang and Kampong Cham, and the provincial Departments of Public Works and Transport (DPWTs) at Battambang, Kampong Cham, Sihanoukville and Siem Reap, with responsibility for daily oversight and supervision of subproject implementation. The PWWS and DPWTs will be the Implementing Agencies (IAs) and the PIUs will also be fully staffed to ensure that there is sufficient resource capacity for effective and efficient oversight of construction activities.

6. A Coordinating Committee (CC) will be established for project and sector coordination between MIH and MPWT. MIH will have responsibility for the coordination and consolidation of reports to MEF and ADB and will recruit the Project Implementation Assistance Consultants (PIAC) to assist the Project Management Units (PMUs) and Project Implementation Units (PIUs).

7. MIH and MPWT will be the respective subproject owners, within the meaning of the Law on Environmental Protection and Natural Resource Management (December 1996) with further guidance provided in the Subdecree on Environmental Assessment No. 72 ANRK.BK of August 1999. These laws require an environmental impact assessment (EIA) for every private or public project or activity, with the review and evaluation of the EIA by the Department of Environment

Impact Assessment (DEIA) within the Ministry of Environment (MOE). The infrastructure subprojects for PWSSP require an IEIA following a format resembling that of the IEE. Based on the IEIA it will be determined if a more detailed IEIA is needed.

8. MOE and the POEs play a role in submittal, review, and approval of the IEE, and monitoring and reporting. This work takes place during the implementation phase. The Environmental Consultants attached to PIAC will revise and update the IEE based on final designs, and the document should be translated into Khmer prior to submittal to MOE, which will engage the POE from the province where the subproject is to take place in the review process. Only after ADB approves and discloses the updated IEE and DEIA approves the EMP for the subproject can a contract be signed between the IA and the contractor for the works. The PIU supported by the PIAC Environment Consultants will provide environmental inputs for the quarterly project progress reports, and to prepare semi-annual safeguard monitoring reports, supported by the ES. The PMU will be responsible for submittal of reports to the EA and ADB.

9. The roles and responsibilities for the project are summarised below:

Table 4: Institutional Responsibilities for Environmental Management

Entity	Environmental Roles and Responsibilities
MIH	(i) Executing agency of the project responsible for overall project implementation and compliance with loan covenants and IEEs/EMPs.
MPWT	(i) Implementing Agency for wastewater subprojects
PMUs	(i) Responsible for project management, coordination, monitoring and supervision, including ensuring implementation of environmental mitigation and monitoring measures, (ii) Ensure timely submission for Government approvals related to environmental management; (iii) Ensure that the project's environmental management plans included in the IEEs are incorporated in the bidding documents and contract documents for all civil works; (iv) Review and approval of designs prepared by Contractors for works procured as Design and Build contracts; (v) Ensure EMPs are updated following detailed engineering design as necessary (vi) Review the CEMPs prepared by the Contractors for compliance with standards set in the EMP, instruct revisions as necessary, and approve prior to commencement of construction (vii) Ensure public disclosure of relevant project information and ongoing public consultation as per the EMP requirements; (viii) Co-ordinate and report on the project specific safeguards GRM, ensure that necessary actions to resolve complaints are taken, documented and reported; (ix) Ensure monitoring of environmental parameters specified in the EMPs; (x) Ensure compliance with loan covenants in accordance with agreed formats and frameworks; (xi) Oversee monthly environmental monitoring of the project and submit semi-annual environmental monitoring reports to ADB for disclosure on ADB's website; (xii) Oversee project compliance with relevant national and provincial requirements and co-ordinate with the relevant agencies;

Entity	Environmental Roles and Responsibilities
	(xiii) Review and validate semi-annual environmental monitoring reports prepared with the assistance of the PIAC; (xiv) Lead follow-up consultation meetings with relevant institutions, stakeholders and affected persons on environmental issues; (xv) With the assistance of the PIAC, undertake regular construction site inspections and oversee implementation of the CEMPs by contractors;
PIAC	(i) For works procured as Design and Build contracts, review designs in detail, checking for compliance with requirements in the EMPs, and advise PMU of any necessary revisions to the IEE and EMP prior to approval; (ii) Support PMUs with update of IEEs/EMPs following detailed engineering design; (iii) Check Bill of Quantities to ensure Contractors made adequate provisions for environmental mitigation and monitoring; (iv) On behalf of PMUs, and working with PIUs supervise the civil works packages and implementation of EMP mitigation and monitoring measures.
PIAC Environment Specialists (International and National)	(i) Review the detailed designs prepared for each subproject for compliance with the EMPs prepared during the PPTA. Update the IEEs and EMPs to reflect changes, modifications and additions that have potential impacts during construction and operation phases of the subprojects. (ii) Examine the CEMPs prepared by contractors for compliance with the EMP and advise PMU of revisions that need to be incorporated prior to approval and commencement of civil works; (iii) Ensure that all associated project facilities have the required permits prior to commencement of civil works; (iv) Brief PIAC engineering and PIU supervision staff on EMP provisions and provide checklists to ensure that they will be able to adequately supervise on a day-to-day basis the contractors and sub-contractors with regard to proper and timely implementation of mitigation measures specified in the EMP; (v) Monitor implementation of environmental mitigation measures and environmental performance of contractors based on the EMP schedule and assist MIH / MPWT in the preparation of semi-annual environmental monitoring reports for submission to ADB; (vi) Undertake training for the MIH/PMU, MPWT/PMU and PIU staff on environmental management and monitoring, to build their capacity in these areas. The training will be implemented through on-the-job training and workshops based on the provisions of the EMP; and (vii) Ensure that the affected stakeholders and sensitive receptors (eg. hospitals, schools, temples) are regularly updated on project activities and are aware of the multiple entry points to the project safeguards GRM.
Construction Contractor	(i) In the case of Design and Build contracts, prepare detailed designs in compliance with the EMPs for each subproject (ii) Appoint an Environment, Health and Safety Officer to manage, monitor and report on EMP implementation; (iii) Prepare site-specific CEMP containing the method statements for compliance with environmental management standards in the EMPs;

Entity	Environmental Roles and Responsibilities
	(iv) Allocate sufficient funding for proper and timely implementation of environmental mitigation and monitoring measures; (v) Conduct daily inspection of the site and ensure the implementation of the CEMP during the construction phase; (vi) Prepare/submit monthly reports on mitigation and monitoring activities to the PMUs through the PIAC; and (vii) Act as the local entry point for the project GRM, conduct immediate investigation of any complaint, report all complaints and their resolution to the PMUs. Ensure the timely and appropriate resolution of the complaint or incident in accordance with the GRM.
ADB	(i) Monitor and supervise the overall environmental performance of the project, review the semi-annual environmental monitoring reports and disclose the reports on ADB website in accordance with ADB Public Communications Policy (2011); and (ii) Conduct missions to review environmental compliance and provide advice on corrective actions.

1.2.1 Capacities for Environmental Management

Review of Environmental Assessments and Issuance of Environmental Licences

10. The PMUs within the General Department of Public Water Supply (GDPWS) within MIH and the General Department of Public Works within MPWT are yet to be established. As such there are no staff currently dedicated to environmental planning for PWSSP. Also within both general departments there is no strong mandate for environmental management, other than the responsibilities flowing from, but limited to specific projects. Technical staff do have some capacity to manage infrastructure on a broad, strategic level as well as on a day to day level. In order to be able to review environmental assessments, technical staff members need to acquire an understanding of the principles and processes of environmental assessment. This should be sufficient to enable the staff of both general departments to engage and direct consultants in the preparation of environmental assessments.

11. MOE has requested that the project provide for adequate consulting services to prepare the domestic environmental assessments of subprojects following final design, to help ensure that the IEEs and the EMPs are completed to an adequate standard, with appropriate provisions for monitoring and training of the staff of Provincial Waterworks.

Preparation of contract documentation

12. Support to the PMU for the procurement of civil works, consulting services and equipment will be provided by the PIAC. The PMU Consultants will be responsible for the inclusion of EMPs, including monitoring and reporting requirements, into bidding documents.

Capacities relating to environmental management during construction

13. MIH staff have some experience or capacity in the implementation of EMPs, been acquired mainly on past or ongoing projects in the sector, but few staff are familiar with the requirements. Support for EMP implementation, including inspection of ongoing and completed work to check for compliance with EMP provisions and preparation of progress reports to government and ADB, will be provided by the implementation consultants. In order to be able to undertake these functions,

technical staff from each ministry need to have an understanding of contractual arrangements for construction, and the provisions under each EMP.

14. Local contractors will be engaged for some packages. Few contracting firms in Cambodia have experience of environmental management, particularly preparation and implementation of CEMPs. Guidance in CEMP preparation can be provided to contractors by the implementation consultants.

Capacities relating to operation and maintenance of infrastructure:

15. Adequate operation and maintenance of water and sanitation infrastructure has not taken place to the standard and extent necessary to keep sanitation infrastructure in operable condition. This is one of the reasons that the proposed subprojects are necessary. The two ministries require assistance in ensuring competent operation, regular and periodic maintenance and phased replacement and upgrading of assets.

1.3 Capacity Development

16. The project will include on-the-job training for MIH, MPWT and PWW, DPWT staff in project management, implementation of urban water supply and sanitation projects, and O&M. This will be provided through project implementation support services for the project management units (PMUs) from design through to construction monitoring and commissioning. It will also support safeguards implementation and monitoring, gender and community social development, accounting and financial management, procurement, and disbursement.

1.4 For water supply the project design includes (i) capacity building support in management, technical, planning, and regulation to accelerate the ongoing sector reform and improve utility performance ready for financial autonomy for all PWWs, and (ii) application PPWSA's experience through peer-to-peer learning to enhance efficiency and improve service delivery with improved O&M capacity.Impacts and Mitigation

17. Table 5 summarizes the potential impacts and mitigation measures for the four wastewater subprojects in relation to location, construction and operation identified in the IEE.

18. Costs of applying the mitigation measures are included in the infrastructure construction and operating costs and therefore not EMP costs per se. Contractors will need to budget for costs of undertaking the required mitigation measures in their bid price.

Table 5: Environmental Management Plan

Impacts	Location	Mitigation Measures	Source of Funds	Responsibility for Implementation	Responsibility for Supervision
Pre-Construction Stage					
Effects on private property or land	Battambang	Implementation of Resettlement Plan / Land Acquisition and Compensation Plan	Quoted in Resettlement Plan	PDIH	GDR
Disturbance of Unexploded Ordnance	Battambang Kampong Cham	Consultations with district government agencies, communes and village chiefs has not identified any potential risk of UXO. Where unexpected UXO are encountered work is to cease and clearance and decontamination is to be undertaken by a registered agency.	Construction Cost	Contractor	PIAC
Construction Impacts	Battambang, Kampong Cham	Preparation of Contractor's Environmental Management Plan providing specific detail in relation to chosen construction methods	Construction Cost	Contractor	PIAC
General impacts on local residents	Battambang, Kampong Cham	Provision of information to the public on Grievance Redress Mechanism	Project Management Cost	PMO / PIU	-
Climate risk and vulnerability mitigation	Battambang, Kampong Cham	Incorporation of recommendations from CRVA into detailed design	Design cost	PMO / PIU / PIAC	-

Impacts	Location	Mitigation Measures	Source of Funds	Responsibility for Implementation	Responsibility for Supervision
Construction stage impacts					
Impeding access to property or facilities, or traffic disruption during the installation of pipe system.	Battambang Kampong Cham	Notices to the public, placing safety first traffic signs, planned detours, temporary traffic signals, cooperation with traffic police; fencing off the construction sites, scheduling work that blocks roadways to periods of low traffic.	Construction Cost	Contractor	PIAC
Noise pollution and vibration	Battambang Kampong Cham	Providing information to the affected persons through direct liaison and via the local media about the timing and duration of the works. Construction activities will be limited to normal daylight working hours. A work schedule will be followed. All construction equipment and vehicles will be in good working order with working mufflers and noise compression.	Construction Cost	Contractor	PIAC
Waste generation from construction activities	Battambang Kampong Cham	All solid waste must be disposed of at a landfill or approved disposal site. Importation and disposal of all materials including lubricants and fluids used with the operation of vehicles and plant and paints shall comply with legislation and not include any banned materials must comply with the Sub-Decree on Solid Waste Management. ANRK.BK No. 36 of 27 April 1999	Construction Cost	Contractor	PIAC

Impacts	Location	Mitigation Measures	Source of Funds	Responsibility for Implementation	Responsibility for Supervision
Release of silt	Battambang, Kampong Cham	Exercise caution to prevent erosion losses, close excavations rapidly and stabilize soils once the pipeline is in place. Use of silt fences around temporary piles of excavated material. Avoid excavation of trenches in wet weather to the extent practicable.	Construction Cost	Contractor	PIAC
Soil and water pollution	Battambang, Kampong Cham	Vehicles and plant are to be maintained in sound operable condition, free of leaks. The condition of vehicles and equipment will be periodically checked. Contractor to prepare and submit a plan for spill management, including provision of spill kits, training/briefing of workers on procedures on handling spills and allocation of responsibility within the contractor's team for ensuring that spill kits are available and that workers know how to use them.	Construction Cost	Contractor	PIAC
Air and dust pollution	Battambang, Kampong Cham	Require vehicles and equipment to be well maintained and tuned and fitted with exhaust baffles. Trucks to be fitted with Tarpaulins to cover loads when carrying fine material. Apply water to suppress dust where needed and sweep to remove and clear spoil on surfaces.	Construction Cost	Contractor	PIAC
Community health and safety hazards	Battambang, Kampong Cham	Notice to the public identifying hazards. Erection of safety barriers/covers for area of open excavation and provision of watch person to control access.	Construction Cost	Contractor	PIAC

Impacts	Location	Mitigation Measures	Source of Funds	Responsibility for Implementation	Responsibility for Supervision
Occupational health and safety hazards	Battambang, Kampong Cham	Contractors to appoint health and safety officers for each site and to ensure regular briefing of construction workforce on health and safety issues. Adequate personal protective equipment to be provided to the workforce.	Construction Cost	Contractor	PIAC
Impacts During Operation					
Dry season water availability	Battambang	Installation of a river level data logger and allocation of responsibility to collect and record data	Project cost, estimated at $15,000	PDIH	MIH
Solid waste residue generated by water treatment	Battambang, Kampong Cham WTPs	Minimize the quantity of solids generated by the water treatment process through optimizing coagulation processes. Dispose of lime sludge by land application, limiting application rates to about 20 dry metric tons per hectare to minimize the potential for mobilization of metals into plant tissue and groundwater. Dispose of ferric and alum sludge by land application in accordance with IFC standards.	Operation Cost	PDIH	MIH

Impacts	Location	Mitigation Measures	Source of Funds	Responsibility for Implementation	Responsibility for Supervision
Use of chemicals in water treatment	Battambang, Kampong Cham	Store reagents such as sodium hypochlorite in cool dry, and dark conditions for no more than one year, and use equipment constructed of corrosion resistant materials. Isolate ammonia storage and feed areas from chlorine and hypochlorite storage and feed areas. Develop and implement a prevention program that includes identification of potential hazards, safe operating procedures and accident mitigation procedures. Training to be provided in maintenance, and accident mitigation procedures.	Operation Cost	PDIH Implementation consultants	MIH
Water and water source quality control	Battambang, Kampong Cham	Periodically control of water quality in order to avoid any contamination and to keep good water supply quality. Comply with requirements of PWW Water Safety Plan.	Operation Cost	PDIH	MIH
Operator occupational health and safety	Battambang, Kampong Cham	Operators trained to recognize risks and hazards. Personal safety equipment issued and worn. Health and safety recognized as primary employer responsibility. Training for working in deep access structure provided, Pipe outlets fitted with safety chains for use when operatives are working in the manholes	Operation Cost	DPWT - Operator	MPWT

1.5 Public Consultation and Information Disclosure

19. The IEE, including a Khmer translation of the executive summary and this EMP will be provided to commune officials for public disclosure.

20. The Contractors will keep affected persons in the subproject area informed of construction activities that are likely to cause noise and dust nuisance, or disruption to roads and pathways and that they are made aware of the grievance redress mechanism.

21. The PMUs will arrange quarterly consultations with the public to gain feedback and ensure that impacts are being adequately managed.

1.6 Environmental Monitoring

1.6.1 Monitoring Plan

22. The design of the environmental monitoring system is based on an analysis of the key environmental performance issues associated with each stage of the subproject, set out in Table 6 below.

Table 6: Analysis of Environmental Monitoring Needs

Phase	Key Environmental Performance Issues	Environmental Performance Indicator	Means of Monitoring
Design/Preconstruction	Inclusion of mitigation measures in design/build and/or detailed design documentation and construction activities	Compliance with EMP for design	Compliance monitoring
Construction	Adherence to provisions in the EMP to mitigate construction impacts	Compliance with EMP	Compliance monitoring
	Direct effects on communities from impacts such as accidental damage, dust generation, noise generation and safety	Views and opinions of communities	Community feedback Grievance redress mechanism
Operation	Reliability of access to clean piped water	Connections to the piped water supply and installation of sanitation facilities	Project progress and completion reports Community feedback
	Water quality	Water quality	Testing of samples

23. Three areas of environmental monitoring are identified: compliance monitoring, community feedback and water quality monitoring. These are in addition to monitoring measures in the Design and Monitoring Framework for the PWSSP.

- Compliance Monitoring, to ensure that mitigation specified in the EMP is carried out to an adequate standard
- Community feedback, under the Community Action and Participation Program for the project
- Water quality monitoring, prior to construction to establish baseline parameters, during construction and during operation.

24. Compliance monitoring is required during detailed design and construction for the subproject, to ensure that mitigation specified in the EMP is carried out to an adequate standard. Compliance monitoring is a function of the PIU and its cost of this monitoring is part of the running cost of the PIU.

25. Community feedback provides for the monitoring of environmental indicators gauged by public perception. Appropriate indicators are:

- Quality and taste of water from the piped supply
- Incidence of water related diseases

26. Costs of environmental assessment and monitoring during construction are project costs. Environmental monitoring during operation is carried out by the DPWT, and costs will be met from O&M budgets prepared and managed by the DPWT.

Table 7: Environmental Monitoring Plan

Impact to be Monitored	Means of Monitoring	Construction Phase			Operation Phase		
		Frequency	Responsible Agency	Indicative Annual Cost	Frequency	Responsible Agency	Indicative Annual Cost
Water Quality	Community Feedback: Changes in water quality as perceived by project beneficiaries	To be established by PIAC	PIU	Covered in project participation plan	To be established by PIAC	PDIH	Operational Cost
	Laboratory testing of samples of raw water	Prior to construc-tion	PDIH	TBA	As required for WSP	PDIH	Normal Operating Cost
	inspection at WTP of	At comm.-	Contractor	Construction cost	As required	PDIH	Normal operating

	samples of treated water	issioning and at change of seasons during first year of operation			for WSP		cost
	Laboratory testing of samples of treated water	N/a	N/a	N/a	As required for WSP	PDIH	Operational Cost
Comp-liance with EMP	Inspections	As set up by super-visiting engineers	PMU / PIAC	Included in project manage-ment and consultancy cost	To be established by PIAC	PDIH	Operational Cost
Ade-quacy of water supply quantity	Community Feedback: Changes in water quality as perceived by project beneficiaries	To be established by PIAC	PIU	Minor	To be established by PIAC	PDIH	Minor

1.6.2 Reporting

27. EMP compliance monitoring will be undertaken by the PIU, with support of the PIAC. Effects will be monitored by means of community feedback and laboratory testing. Consistent with reporting requirements set out in the Project Administration Manual (PAM) PMU will prepare reports to be consolidated by MIH and sent to ADB on a quarterly basis, giving overall project progress with coverage of environmental issues and semi-annual environmental monitoring will be similarly prepared and sent to ADB. To facilitate monitoring and enable responses to emerging issues, monthly reports will be prepared by the PIUs. Table 8 provides the reporting schedule.

Table 8: Reporting Schedule

Type	Prepared by	Environmental Monitoring Coverage	Submitted to	Frequency
Project Progress reports	PMU with assistance by PIAC, consolidated by MIH	Summary of monitoring activity and issues arising	ADB	Quarterly

Type	Prepared by	Environmental Monitoring Coverage	Submitted to	Frequency
Environmental Monitoring Reports	PMU with assistance by PIAC, consolidated by MIH	Project activities over reporting period; Progress with EMP implementation including monitoring activities; Issues arising and action taken	ADB	Semi-annually
Project Completion Report	PMU with assistance by PIAC, consolidated by MIH	Summary of EMP implementation activities, issues arising, action taken; lessons learned.	ADB	Once, following physical completion
Construction Progress Report	PIU with assistance from PIAC and information provided by the contractor	Summary of compliance with EMP	PIU	Monthly

28. Monthly reporting to the PMU should provide an accurate summary of issues arising and action taken, so that the PMU is aware of major or emerging issues that need to be addressed, and can readily compile quarterly project progress reports. A recommended format appears below.

Recommended Monthly Report Format

Reporting Particulars

Reporting Period	
Name and position of person compiling the report	
Date of completion	
Circulation list	

Status of the Subproject

Current Status (provide completion dates as applicable)					
Identification	**Preparation** (including IEE/EMP)	**Approval**	**No Objection**	**Procurement**	**Completion**

Compliance with EMP

Mitigation measures included in the EMP being included in the design and/or implemented yes/no
If no, particulars of non compliance:

Mitigation Measure	Party Responsible for	Nature of Non Compliance	Action Taken/Recommended

	Implementation		

Significant Events or Developments During the Period

Describe:

(i) Significant construction that has taken place for each subproject
(ii) Storm events that have occurred at subproject sites
(iii) Any notable incidents

Water Sample Test Results

Location	Parameter	Maximum Value	Measured Value

Community Consultations

Date	Location	Outcomes	Issues Arising	Action Taken

Complaints Received

Date	Location	GRM Process Followed yes/no	Action Taken yes/no

Action

Describe:

(i) Action recommended in the report on the previous period and progress
(iv) Action to be taken to address issues arising from monitoring activities

Commentary

Provide any explanatory notes on the findings, and any issues to do with follow up action

Photographs

Provide photographs to illustrate issues relating to issues arising from complaints, good or bad construction practice and general construction progress.

Recommended Semi-Annual Report Format

1. Introduction

Reporting Period	
Name and position of person compiling the report	
Date of completion	
Circulation list	

2. Description of the Project and Environment

Summary from IEE so that the report can be "stand alone", including any updates (eg major storm events, major developments in the subproject vicinity)

3. Project Construction Progress

4. Institutional Arrangements for EMP Implementation

Summary from IEE, amended/updated as necessary

5. Internal Environmental Supervision

a) Supervision Activities

b) Status of compliance with the EMP

c) Issues arising and action taken

5. External Environmental Monitoring and Assessment

a) Introduction

b) Water Quality Monitoring and Assessment

c) Air Quality Monitoring and Assessment

d) Assessment of compliance with EMP

e) Findings from stakeholder consultations

f) Summary of major issues based on monitoring results

6. Recommendations

Including corrective measures if necessary

7. Conclusion

Appendices:

Monitoring Reports

Location Maps

Photographs

Other items that support the text of the report