

# Initial Environmental Examination

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## MFF 0054-VIE: Water Sector Investment Program – Tranche 2

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# **ENVIRONMENTAL MANAGEMENT PLAN**

**for**

## **Da Nang Water Supply Subproject:**

**RSC - C20247 (VIE): Supporting Viet Nam Water Sector Project PFR-2**

**Submitted  
to**

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## I. ABBREVIATIONS

CEMP:	-	Contractor Environmental Management Plan
DAWACO:	-	Da Nang Water Company
DDSC:	-	Detailed Design & Supervision Consultant
DoNRE:	-	Department of Natural Resources and Environment
DoH:	-	Department of Health
DoLISA:	-	Department of Labour, Invalids, & Social Assistance
DoT:	-	Department of Transport
EARF:	-	Environmental Assessment & Review Framework
EERP:	-	External (local) Emergency Response Procedures
EERT:	-	External (local) Emergency Response Team
EIA:	-	Environmental Impact Assessment
EMP:	-	Environmental Management Plan
EPC:	-	Environmental Protection Centre of DoNRE
EPRC:	-	Environmental Protection & Research Centre
ERC:	-	Emergency Response Coordinator
IEE:	-	Initial Environmental Evaluation
GERUCO:	-	Hydroelectric Company of Song Bac Dam & Reservoir
GoV:	-	Government of Viet Nam
LEP:	-	Law on Environmental Protection
MFF:	-	Multi-tranche Financing Facility
MoLISA:	-	Ministry of Labour, Invalids, and Social Assistance
PAM:	-	Project Administration Manual
PFR-2:	-	Second Periodic Funding Request
PMU:	-	Project Management Unit
PPC:	-	Provincial People Committee
PPMS:	-	Project Performance Management System
SERT:	-	Subproject Emergency Response Team
SERP:	-	Subproject Emergency Response Procedures
SPS:	-	Safeguard Policy Statement
WTP:	-	Water Treatment Plant
URENCO:	-	Wastewater & Solid Waste Management Company
UXO:	-	Unexploded Ordinance
WS:	-	Water Supply System

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## II. OVERVIEW

1. The environmental management plans (EMP) for the six water supply subprojects<sup>1</sup> that form the second Periodic Funding Request (PFR-2) of the Multi-tranche Financing Facility (MFF) for Support of the Water Sector in Viet Nam have been upgraded as part of the preparations of the subprojects. The original EMPs were developed with the initial environmental evaluations (IEE) or GoV<sup>2</sup> EIAs that were prepared for each subproject. The IEEs and EIAs for the subprojects including the IEE for the Da Nang Water Supply Project<sup>3</sup> are found under separate cover.

2. The upgrades to the EMPs stem from the findings of a recent review<sup>4</sup> of the IEEs and EIAs of the subprojects to ensure that potential environmental impacts of a water supply subproject are not overlooked, and moreover, that the EMP for each subproject addresses all potential impacts. The intention of the review was not for the IEE or GoV safeguard document to be modified, rather to identify required additions or changes to an IEE or EIA that could be addressed by updating the respective EMP. Thus, the upgraded EMPs are still supported the parent IEE/EIAs in preparation for the detailed designs of the subprojects.

3. Provided herein is the upgraded EMP for the Da Nang Water Supply subproject. The upgraded EMP is based closely on the original EMP in order to preserve the original potential impacts assessment reported in the IEE. The objective was not to create a new EMP, rather to add content and scope where necessary, and to incorporate subsequent project information such as that provided in the recent draft PAM<sup>5</sup>. The text of the original EMP is left as is and only edited and supplemented as needed.

4. A secondary, important objective of upgrading the six EMPs is to develop specific but consistent EMPs for the six water supply subprojects which will assist the overall implementation of environmental safeguards for the PFR-2. The other five upgraded EMPs are found under separate cover.

5. The original EMP for the Da Nang subproject and original EMPs for most of the other 5 subprojects were prepared in view of the environmental safeguard requirements of the ADB (SPS 2009)<sup>6</sup>, and the attendant Environmental Assessment & Review Framework<sup>7</sup> (EARF) that was developed to support the MFF.

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<sup>1</sup> Subprojects in Hai Phong, Quang Tri, Thua Thien Hue, Da Nang, Dak Lak, and Binh Duong

<sup>2</sup> Government of Viet Nam (GoV) Environmental Impact Assessment (EIA)

<sup>3</sup> PPTA 7144, 2010. Initial Environmental Evaluation of Da Nang Water Supply Project, 54 pgs + Annexes.

<sup>4</sup> 2012. SC100149 VIE: Supporting Viet Nam Water Sector Project PFR-2, Interim report prepared for ADB, 29 pgs.

<sup>5</sup> ADB, 2011. Draft Project Administration Manual for Viet Nam Water Sector Investment Program, MFF-PFR-2, 53 pgs

<sup>6</sup> ADB, 2009. Safeguard Policy Statement.

<sup>7</sup> 2010. Environmental Assessment & Review Framework, prepared for RSC-C00751 VIE: Preparing Multi-tranche Financing Facility Supporting Viet Nam Water Sector

### **III. ENVIRONMENTAL MANAGEMENT PLAN**

#### **Da Nang Water Supply Sub-Project**

##### **A. Subproject Components**

At the time the EMP was upgraded the Da Nang subproject consisted of the following three components:

- 16 km raw water main (D1400) from planned Song Bac reservoir across Nam river, through Ba Na-Nui Nature Reserve, along highway 601 & Cu De river to the Hoa Lien WTP site;
- New WTP at Hoa Lien (120,000 – 240,000 m<sup>3</sup>/day); and
- Expansion of existing treated water distribution

##### **B. Institutional Arrangements and Responsibilities**

6. The environmental management of the subproject will occur in accordance with GoV policy on decentralization pursuant to Decree 131/2006/ND-CP on management and utilization of Official Development Assistance. The primary framework for the EMP<sup>8</sup> will be defined by the: 1) Da Nang Water Company (DAWACO) who is the project owner (PO) and sub-executing agency (EA); 2) a designated project management unit (PMU) to support DAWACO who will implement the three subproject components and the EMP; and 3) a Detailed Design and Supervision Consultant<sup>9</sup> (DDSC) who will assist with detailed designs of subproject, and update EMP to ensure EMP meets the final subproject designs. The ADB is responsible for monitoring to ensure subproject meets the environmental safeguards of the SPS (2009).

7. The EA (DAWACO) has the ultimate responsibility for implementation of the entire subproject, including finance and administration, technical and procurement matters, monitoring and evaluation, and environmental safeguards compliance. The DAWACO will operate the completed water supply system (WS).

8. The Department of Natural Resources and Environment (DoNRE) is the provincial agency which oversees environmental management of Da Nang. The DoNRE with District staff provides direction and support for environmental protection-related matters including application of the Law on Environmental protection (LEP 2005), and on use of the environmental policy and standards that are in place protect the environment (see Table 3).

9. The creation of the PMU follows Decision 53/2008/QD-UBND issued on December 2008 by the DNPC on the management of official development assistance (ODA) funds. Circular 03/2007/TT-BKH issued in March 2007 provides guidelines on the organizational structure and function of the PMU.

10. The PMU will have two operating groups: one for technical and administration matters, and another for planning and finance. The technical and administration group will be responsible for the detailed engineering and preparation of construction plans, and construction monitoring.

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<sup>8</sup> From footnote 5.

<sup>9</sup> DDSC contract expected to include construction supervision.

The planning and finance group will be responsible for overseeing the overall procurement process (starting from bid documents preparation for specific works, to bid evaluations, award recommendations, to payment for completed works) as well as for the overall financial monitoring of the project.

11. The PMU will be responsible for fulfilling the environmental safeguard requirements of the subproject with direct support from the DDSC. At the outset the PMU is responsible for updating the mitigation plan of the EMP to meet the detailed engineering designs of the raw water pipeline, WTP, & treated distribution network, and to include the mitigation requirements in the bid documents and construction contract documents.

12. The PMU will be responsible for updating and overseeing implementation of the environmental monitoring plan of the EMP, undertaking environment-related investigations that may arise during subproject implementation in coordination with the Environmental Protection Centre (EPC) of the DONRE, to continue public consultations on the subproject starting during the pre-construction phase that were initiated during the IEE, and for responding to environment or nuisance-related complaints from residents or businesses affected by subproject implementation. An environment sub-unit under the PMU will be assigned take responsibility for the implementation of the EMP

13. Key duties of the PMU are summarized as follows:

- With DDSC review and update the EMP during detailed design and engineering phase to ensure EMP meets detailed subproject designs;
- As part of the EMP update, ensure that public consultations that continue through subproject implementation document concerns of stakeholders situated downstream of intake points or in-stream construction sites;
- Ensure safeguard requirements of the final EMP are adequately described in the bidding documents (instruction to bidders) so that contractors can prepare their respective site-specific CEMP<sup>10</sup> based on the final EMP, and ensure criteria for evaluating contractor bids and awarding construction packages include relevant safeguard requirements of the final EMP;
- Ensure construction contractors successfully implement impact mitigation measures of EMP as part of their CEMPs ;
- Coordinate with the DoNRE Environment Protection Center on regulatory compliance issues (e.g., for water quality in rivers affected by construction drainage or erosion from storage areas for excavated soil, noise and vibration from construction sites, sanitation in workers campsite, etc);
- Prepare terms of reference for the military to conduct surveys to detect unexploded ordnance, and ordnance disposal if necessary;
- Advise the PMU director on environment-related concerns arising during project construction, and recommend corrective measures;
- Disseminate to stakeholders the results of environmental monitoring and implementation of safeguards, especially among households or small businesses near the construction sites;

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<sup>10</sup> Contractors Environmental Management Plan

- Include monthly contractor reports in quarterly status reports to DAWACO on status of EMP & environment safeguards, and public stakeholder issues during construction phase of subproject; and
- Prepare ToRs for EPRC (see below) for implementation of monitoring plan of EMP, and for assistance with follow-up interviews and consultations with public stakeholders on issues and concerns arising during project construction.

14. The Environmental Protection Research Center (EPRC) of the University of Da Nang will be re-hired to implement the environmental monitoring plan of the EMP during the construction phase of the subproject using the environmental baseline data from the environment surveys of the IEE. It is anticipated that the EPRC will also be commissioned by DAWACO to implement the monitoring plan during the operation phase of the subproject with regular reporting to PMU.

15. The EPRC will also support PMU with the follow-on consultations and interviews with local residents to identify concerns or grievances arising during construction. The complete role and reporting protocol of the EPRC will be defined during the detailed design phase.

16. The contractor(s) of the various construction packages are responsible for developing the CEMP based on the final EMP, implementing the mitigations that are detailed in the CEMP, and for developing and implementing emergency response procedures for the subproject (see section III-G below). Contractors will be responsible for providing brief monthly reports to PMU on the environmental status and mitigation activity at construction areas.

17. The EPC of DoNRE may conduct random environmental monitoring and inspection before, during, and after construction, as well as in the event of emergencies. It will also review the monitoring reports of the EPRC. If abnormalities are found, the DONRE may impose fines and issue a notice of rectification with a specific deadline to the responsible entities. If complaints are formally received from the public through the People's Committee, the DONRE Environmental Protection Center will carry out verification inspections, as described in the grievance redress mechanism (see IEE).

18. The EA will develop a Project Performance Monitoring System (PPMS) to monitor the overall performance of the project<sup>11</sup>. The PPMS will include a broad range of indicators that address financial, technical-engineering, and operational components of the subproject during construction phase through to the operational phase. The PPMS will include key indicators of environmental safeguard compliance from the EMP (Table 5). The EA will refine the PPMS within 12 months of project implementation.

19. It is anticipated that an independent qualified institute will audit environmental safeguard compliance throughout the construction phase of the subproject. The auditor will be separate from the main project Auditor. Within three months after construction is completed, or no later than one year, an environmental acceptance monitoring and audit report on the completion of the project components will be prepared by the selected institute. The report will be reviewed and approved by the DoNRE and submitted to ADB.

### **C. Summary of Potential Impacts**

20. The IEE<sup>12</sup> of the Da Nang subproject indicated that the key potential impacts are primarily associated with the construction phase of the project. The potential impacts from the IEE are summarized in Table 1.

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<sup>11</sup> ADB 2011. Draft Project Administration Manual

<sup>12</sup> Footnote 3.



**Table 1. Summary of Key Potential Impacts from IEE**

<b>Construction Phase</b>
1) Excavation work for the pipeline trenches will produce spoil; heaps of excavated soil beside the trench could obstruct community access, and erosion from spoil storage areas could silt up nearby streams and drains. Dry heaps could cause dust nuisance.
2) Excavation work for the pipeline trenches will produce spoil; heaps of excavated soil beside the trench could obstruct community access, and erosion from spoil storage areas could silt up nearby streams and drains. Dry heaps could cause dust nuisance.
3) Obstruction to traffic flow during raw water pipeline construction, exacerbated by the narrow road and work spaces: <ul style="list-style-type: none"> <li>• Local residents could be cut off from the road due to the trench-building;</li> <li>• Increased traffic of dump trucks carrying spoils to and from storage areas;</li> <li>• Air pollution from excavation and transport equipment;</li> <li>• Traffic hazard to pedestrians, especially school children and elderly;</li> </ul>
4) Nuisance and public safety hazards caused by pipeline excavation and pipe-laying activities in urban areas;
5) Accidental detonation of unexploded ordnance (UXO) during pipeline excavations
<b>Operation Phase</b>
6) Hazard created by water treatment process chemicals with chlorine being the most hazardous.
7) Disposal of water treatment sludge and wastes from WTP operation.
8) Increase in the volume of municipal wastewater generated.

21. The potential impact(s) that was also identified briefly in the IEE, and which needs additional assessment and clarification at detailed design stage are potential impacts of the segment of raw water pipeline that will be placed inside the Ba Na-Nui Nature reserve.

# **1. Public Consultation**

22. An extensive public consultation on the subproject was conducted as part of the IEE. Public meetings were held to review the placement of the raw water pipeline along highway 601

from Song Bac reservoir to the Hoa Lien WTP including construction of the new Hoa Lien WTP. District & commune PCs, and hamlet leaders attended along with the Womens Union, Farmers Associations, and over 100 individual residents at two meeting locations. Overall the participants agreed with the strong need for additional water supply. Issues identified included:

- (a) traffic congestion during construction;
- (b) safety hazards due to truck traffic & unfenced excavation pits;
- (c) dust, vehicle exhaust, smoke, noise, and spoil spilled on the road during transport of construction excavated materials;
- (d) waste from construction and clogging of drains; and
- (e) influx of migrant workers and possible undesirable behavior such as gambling and trouble-making.

23. All issues raised during consultations are addressed by upgraded EMP. As part of the initiation of the public grievance redress mechanism (see IEE) during pre-construction phase, the public consultation process must be continued. Disclosure of the EMP to stakeholders should also occur during pre-construction phase (see PAM).

**a. Downstream Affected Persons**

24. Subsequent consultations with the public must explicitly document concerns of residents, businesses or other stakeholders that are situated downstream of the final intake location at the Song Bac reservoir, and below the Nam river crossing of the raw water pipeline.

**D. Mitigation Plan**

25. The mitigation measures of the original EMP of the IEE have been expanded with detail and scope into a comprehensive mitigation plan (Table 2). The plan addresses the environmental issues and concerns that were raised at the stakeholder meetings during the IEE.

26. The mitigation plan identifies responsible parties, location, and indicative costs, and timing. The mitigation plan combines the construction phase activities common to all components while highlighting activities and mitigations specific to a single component. The mitigation plan needs to be updated to meet the detailed designs of the subproject.

**Table 2. Environmental Impact Mitigation Plan**

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
Pre-construction Detailed Design Phase								
Confirmation of required resettlement and temporary relocations	No community impacts	1. Affected persons well informed well ahead of project implementation.	At intake at Song Bac reservoir, along raw water pipeline, at WTP, & along distribution network	Before subproject implemented	See resettlement plan	See resettlement plan	DAWACO / PMU <sup>13</sup>	Resettlement committees
Disclosure, & engagement of community	No community impacts	2. Implement information disclosure and activate grievance redress mechanism (see IEE)	At all construction sites.	Beginning of subproject	Quarterly	No marginal cost <sup>14</sup>	DAWACO	PMU
GoV approvals	No negative impact	3. Notify DoNRE of project initiation to ensure GoV EIA requirements approved , and obtain required project permits and certificates.	Entire subproject	Before construction	As required	No marginal cost	PPC & DDSC <sup>15</sup>	PMU
Detailed		4. Complete detailed designs of: <b>1)</b> raw water intake and pipeline from Song Bac hydro reservoir along Cu De river to Hoa Lien WTP; <b>2)</b> new Hoa Lien WTP; and <b>3)</b> treated distribution network that incorporate the following:  <b>a)</b> updated plan and schedule from GERUCO for completion & operation of Song Bac reservoir , and ensure a <u>sufficient and sustainable supply of treatable</u> raw water will be available when WS system is	(a-g), Entire subproject area: 1) raw					

<sup>13</sup> Project Management Unit under DAWACO; identified as Project Management Board (PMB) in IEE

<sup>14</sup> No marginal cost indicates that costs to implement mitigation are to be built into cost estimates of bids of contractors

<sup>15</sup> Detailed Design & Supervision Consultant

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
designs	Minimize negative environmental impacts	<p>commissioned.</p> <p><b>b)</b> results of updated assessment of potential impacts of section of raw water pipeline running through Ba Na-Nui Nature Reserve on affected critical habitat and/or rare or endangered fauna &amp; flora (see Update EMP section below);</p> <p><b>c)</b> high sensitivity of raw water pipeline corridor to soil erosion, traffic safety &amp; congestion, noise &amp; dust (see Update EMP section below);</p> <p><b>d)</b> no disturbance or damage to culture property and values from all three subproject components defined above;</p> <p><b>e)</b> minimal acquisition of agriculture and forested lands especially along raw water pipeline &amp; at new Hoa Lien WTP;</p> <p><b>f)</b> no or minimal disruption to water supply, utilities, and electricity with contingency plans for unavoidable disruptions;</p> <p><b>g)</b> for raw water pipeline special plan to notify &amp; provide local residents &amp; merchants with schedule of construction activities to minimize disruption to normal commercial and residential activities (see Update EMP section below); and</p> <p><b>h)</b> final review of ability of URENCO &amp; wastewater infrastructure to manage the increased wastewater that will be produced.</p>	<p>water intake at reservoir &amp; pipeline corridor; 2) Hoa Lien WTP; and Treated water distribution network</p> <p>h), WWTPs, &amp; collection areas (e.g., canals</p>	Before construction initiated	Once with detailed designs documents	No marginal cost	DAWACO / DDSC	PMU
Update EMP	Minimize negative environmental impacts	5. In direct consultation Ba Na-Nui Nature reserve management board identify & locate critical habitat, rare & endangered species cited in Viet Nam Red Book, and other valued ecological resources that could be affected by construction & operation of the raw water	Raw water	In parallel with completion of detailed designs completed	Once, as part of detailed	<p>No marginal cost</p> <p>Original wildlife</p>	DAWACO /	PMU

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
		<p>pipeline.</p> <p>6. Commission original ecological surveys if available data are insufficient for assessment.</p> <p>7. If Song Bac hydro reservoir completed then the water quality parameters sampled in Bac river for the IEE must be re-sampled at raw water intake to determine effects of flooded basin on raw water quality. Of particular interest is mercury concentration.</p>	pipeline		designs	<p>survey if needed (See Monitoring Plan below)</p> <p>WQ survey if needed (See Monitoring Plan below)</p>	DDSC	PMU / EPRC <sup>16</sup>
Update EMP	Minimize negative environmental impacts	<p>8. Update all mitigation measures and monitoring requirements of EMP where necessary to meet detailed designs.</p> <p>9. Identify any new potential impacts of project and include in EMP.</p> <p>10. Submit updated EMP with new potential impacts to ADB to review.</p> <p>11. For the three components of subproject develop individual environmental management sub-plans for: <b>a)</b> Securing GoV approvals; <b>b)</b> UXO survey &amp; removal; <b>c)</b> Forest clearing, tree/ vegetation removal, &amp; site restoration; <b>d)</b> Civil works; <b>e)</b> Cultural chance finds; <b>f)</b> Contaminated spoil identification &amp; disposal; <b>g)</b> Construction materials acquisition, transport, &amp; storage including borrow pit management; <b>h)</b> Erosion &amp; river sedimentation control; <b>i)</b> Construction site drainage; <b>j)</b> Noise, dust &amp; NOx, SOx, CO, CO<sub>2</sub> emissions; <b>k)</b> Worker camp operation; <b>l)</b> Solid and liquid waste disposal; <b>m)</b> Hazardous chemical &amp; waste management; <b>n)</b> Construction &amp; urban traffic (especially along raw water pipeline); <b>o)</b> Utility and Power Disruption; <b>p)</b> Worker and public</p>	Entire subproject	In parallel with completion of detailed designs	Once, as part of detailed design phase	No marginal cost	DAWACO / DDSC	PMU

<sup>16</sup> Environmental Protection & Research Centre, University of Da Nang.

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
		Safety (especially along raw water pipeline); q) Raw water quantity & quality sustainability; r) Training & capacity development plan; s) WTP chemicals & sludge management; and t) Treated water quality management.						
Update EMP	Minimal negative environmental impacts	12. Special attention to be given the raw water pipeline corridor through Ba Na-Nui Nature Reserve including the Nam river crossing with pipeline in sub-plans a-q in item #10 above.	Pipeline through Ba Na-Nui Nature Reserve	In parallel with completion of detailed designs	Once, as part of detailed design phase	No marginal cost	DAWACO / DDSC	PMU
Develop bid documents	No negative environmental impact	13. Ensure updated EMP is included in contractor tender documents to enable contractors to develop their CEMP <sup>17</sup> , and that tender documents specify that implementation of CEMP must be included in cost estimates. 14. The environmental management sub-plans identified in 11) above should be identified in the appropriate contractor tender documents, for the contractor to detail into CEMPs for their bidding documents. 15. Specify in bid documents that contractor must have experience with implementing EMPs, and/or provide staff with EMP experience.	All project areas	Before construction begins	Once for all tenders	No marginal cost	DAWACO / DDSC	PMU / DDSC
UXO survey	Injured worker or public	16. Ensure military is consulted and clears areas where necessary.	All construction sites.	Before any clearing or excavation	Once	See Monitoring Plan below	PPC & military	military
Training & capacity development	No negative environmental impact	17. Develop and schedule training plan for DAWACO / PMU staff to be able to fully implement EMP, and manage implementation of mitigation measures by contractors. 18. Create awareness and training plan for later	For all project areas	Before construction begins	After each training session	No marginal cost	DDSC	DDSC / DAWACO

<sup>17</sup> Contractors Environmental Management Plan

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
		delivery to contractors whom will implement mitigation measures.						
Procurement of Contractor(s)	No negative environmental impact	19. Ensure winning contractor bid(s) include a CEMP that addresses items 8 – 11 in "Update EMP" section above.	All project areas	Before contracts signed	Once	No marginal cost	DAWACO / DDSC	DAWACO / DDSC
Recruitment of workers	Community mischief, & sexually transmitted disease	20. Use local workers as much as possible, reducing #s of migrant worker	For all work locations	Throughout construction phase	After worker hiring stages	No marginal cost	DAWACO / DDSC	Contractor's bid documents
<b>Construction Phase –</b> <b>General Mitigations for all Components of Subproject</b>								
Initiate EMP & sub-plans,	Prevent or minimize impacts	21. Initiate updated EMP including individual management sub-plans for the different types of potential impacts identified in pre-construction phase. See sub-plan implementation guidance below.	For all construction sites	Beginning of construction	Once	No marginal cost	DAWACO / DDSC	PMU & contractors
Obtain & activate construction permits and licenses	Prevent or minimize impacts	22. Contractors to comply with all statutory requirements set out by DoNRE for use of construction equipment, hazardous waste & chemicals management, and operation of construction plants, e.g., concrete batching.	For all construction sites	Beginning of construction	Once	No marginal cost	DAWACO / DDSC	PMU & contractors
Worker camp operation	Pollution and social problems	23. Locate worker camps away from human settlements. 24. Ensure adequate housing and waste disposal facilities including pit latrines and garbage cans. 25. A solid waste collection program must be established and implemented that maintains a clean worker camps	All worker camps	Throughout construction phase	Monthly	No marginal cost	DDSC & PMU	contractor

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
		<p>26. Locate separate pit latrines for male and female workers away from worker living and eating areas.</p> <p>27. A clean-out or infill schedule for pit latrines must be established and implemented to ensure working latrines are available at all times.</p> <p>28. Worker camps must have adequate drainage.</p> <p>29. Local food should be provided to worker camps. Guns and weapons not allowed in camps.</p> <p>30. Transient workers should not be allowed to interact with the local community. HIV Aids education should be given to workers.</p> <p>31. Camp areas must be restored to original condition after construction completed.</p>						
Training & capacity	Prevention of impacts through education	32. Implement training and awareness plan for DAWACO / PMU (Environmental staff) and contractors.	PMU offices, construction sites	Beginning of construction	After each event	No marginal cost	DDSC	DDSC & PMU
Tree and vegetation removal, and site restoration sub-plan	Damage or loss of trees, vegetation, and erosion of landscape	<p>33. Contact local forestry department for advice on how to minimize damage to trees and vegetation especially in Ba Na-Nui NR.</p> <p>34. Restrict tree and vegetation removal to within designated RoWs.</p> <p>35. Within RoWs minimize removals, and install protective physical barriers around trees that do not need to be removed.</p> <p>36. All RoWs to be re-vegetated and landscaped after construction completed. Consult forestry department to determine the most successful restoration strategy and techniques.</p>	All construction sites.	Beginning and end of project	Monthly	No marginal cost	DDSC / PMU	contractor
		37. All construction sites should be located away						



Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
Civil works	Degradation of terrestrial resources	forested, plantation, & agricultural areas as much as possible. 38. No unnecessary cutting of trees. 39. All construction fluids such as oils, and fuels should be stored and handled well away from forested and plantation areas. 40. No waste of any kind is to be discarded on land or in forests/plantations.	All construction sites	Throughout construction phase	Monthly	No marginal cost	DDSC & PMU	contractor
Civil works	Degradation of water quality & aquatic resources	41. Protective coffer dams, berms, plastic sheet fencing, or silt curtains should be placed between all earthworks and surface waters including Nam and Cu De rivers. 42. Minimize earthworks & final area of foundation for intake in Song Bac reservoir. 43. Nam river pipeline placement works should be done during dry season. 44. Erosion channels must be built around aggregate stockpile areas to contain rain-induced erosion. 45. Earthworks should be conducted during dry periods. 46. All construction fluids such as oils, and fuels should be stored and handled well away from surface waters. 47. No waste of any kind is to be thrown in surface waters. 48. No washing or repair of machinery near surface waters. 49. Pit latrines to be located well away from all surface waters. 50. No unnecessary earthworks in or adjacent to all water courses.	All construction sites	Throughout construction phase	Monthly	No marginal cost	DDSC & PMU	contractor

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
		51. No aggregate mining from Nam and Cu De rivers, or from nearby lakes.  52. All existing irrigation canals and channels to be protected the same way as rivers and lakes.						
Cultural chance finds	Damage to cultural property or values & chance finds	53. As per detailed designs all civil works should be located away from all cultural property and values including cemeteries and pagodas.  54. Chance finds of valued relics and cultural values should be anticipated by contractors. Site supervisors should be on the watch for finds.  55. Upon a chance find all work stops immediately, find left untouched, and PMU and CPC notified. If find deemed valuable, provincial cultural authorities must be notified.  56. Work at find site will remain stopped until authorities allow work to continue.	All construction sites	At the start , and throughout construction phase	Monthly	No marginal cost	DDSC & PMU	contractor
Construction materials acquisition, transport, and storage sub-plan	Pollution, injury, increased traffic, disrupted access	57. All borrow pits and quarries should be approved by DoNRE.  58. Select pits and quarries in areas with low gradient and as close as possible to construction sites.  59. Required aggregate volumes must be carefully calculated prior to extraction to prevent wastage.  60. Pits and quarries should not be located near surface waters, forested areas, critical habitat for wildlife, or cultural property or values.  61. If aggregate mining from fluvial environments is required small streams and rivers should be used, and dry alluvial plains preferred.  62. All topsoil and overburden removed should	For all construction areas.	Throughout construction phase	Monthly	No marginal cost	DDSC / PMU	Contractor(s)

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
		<p>be stockpiled for later restoration.</p> <p>63. All borrow pits and quarries should have a fence perimeter with signage to keep public away.</p> <p>64. After use pits and quarries should be dewatered and permanent fences installed with signage to keep public out, and restored as much as possible using original overburden and topsoil.</p> <p>65. Unstable slope conditions in/adjacent to the quarry or pit caused by the extractions should be rectified with tree planting.</p> <p>66. Define &amp; schedule how materials are extracted from borrow pits and rock quarries, transported, and handled &amp; stored at sites.</p> <p>67. Define and schedule how fabricated materials such as steel, wood structures, and scaffolding will transported and handled.</p> <p>68. All aggregate loads on trucks should be covered.</p> <p>69. Piles of aggregates at sites should be used/or removed promptly, or covered and placed in non traffic areas.</p>						
Excavation spoil management sub-plan	Contamination of land and surface waters from excavated spoil	<p>70. Uncontaminated spoil to be disposed of in DoNRE-designated sites, which must never be in or adjacent surface waters. Designated sites must be clearly marked and identified.</p> <p>71. Spoil must not be disposed of on sloped land, near cultural property or values, ecologically important areas, or on/near any other culturally or ecologically sensitive feature.</p> <p>72. Where possible spoil should be used at other construction sites, or disposed in spent quarries or borrow pits.</p>	All excavation areas	Throughout construction phase	Monthly	No marginal cost	DDSC, PMU & DoNRE	Contractor

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
		<p>73. A record of type, estimated volume, and source of disposed spoil must be recorded.</p> <p>74. Contaminated spoil disposal must follow GoV regulations including handling, transport, treatment (if necessary), and disposal.</p> <p>75. Suspected contaminated soil must be tested, and disposed of in designated sites identified by DoNRE as per GoV regulations.</p> <p>76. Before treatment or disposal contaminated spoil must be covered with plastic and isolated from all human activity.</p>				Testing of contaminated soil (See Monitoring Plan below)		DoNRE
Construction Drainage sub-plan	Flooding from loss of drainage & flood storage	<p>77. Provide adequate short-term drainage away from construction sites to prevent ponding and flooding.</p> <p>78. Manage to not allow borrow pits and quarries to fill with water. Pump periodically to land infiltration or nearby water courses.</p> <p>79. Install temporary storm drains or ditches for construction sites.</p> <p>80. Ensure existing road &amp; street drains do not become plugged with construction waste .</p> <p>81. Protect surface waters from silt and eroded soil.</p>	All areas with surface waters	Design & construction phases	Monthly	No marginal cost	DDSC & PMU	contractor
Solid and liquid construction waste sub-plan	Contamination of land and surface waters from construction	<p>82. Management of general solid and liquid waste of construction will follow GoV regulations, and will cover, collection, handling, transport, recycling, and disposal of waste created from construction activities and worker force.</p> <p>83. Areas of disposal of solid and liquid waste to be determined by DoNRE.</p> <p>84. Disposed of waste should be catalogued for</p>	All construction sites and worker	Throughout construction phase	Monthly	No marginal cost	DDSC, PMU, & DoNRE	contractor

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
	waste	<p>type, estimated weigh, and source.</p> <p>85. Construction sites should have large garbage bins.</p> <p>86. A schedule of solid and liquid waste pickup and disposal must be established and followed that ensures construction sites are as clean as possible.</p> <p>87. Solid waste should be separated and recyclables sold to buyers in community.</p> <p><u>Hazardous Waste</u></p> <p>88. Collection, storage, transport, and disposal of hazardous waste such as used oils, gasoline, paint, and other toxics must follow GoV regulations.</p> <p>89. Wastes should be separated (e.g., hydrocarbons, batteries, paints, organic solvents)</p> <p>90. Wastes must be stored above ground in closed, well labeled, ventilated plastic bins in good condition well away from construction activity areas, all surface water, water supplies, and cultural and ecological sensitive receptors.</p> <p>91. All spills must be cleaned up completely with all contaminated soil removed and handled with by contaminated spoil sub-plan.</p>	camps					
Noise and dust sub-plan	Dust Noise	<p>92. Regularly apply wetting agents to exposed soil and construction roads especially in high density areas such as Nam Hai Van section of raw water pipeline just above WTP.</p> <p>93. Cover or keep moist all stockpiles of construction aggregates, and all truck loads of aggregates.</p> <p>94. Minimize time that excavations and exposed</p>	All construction sites.	Fulltime	Monthly	No marginal cost	DDSC & PMU	contractor

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
		soil are left open/exposed. Backfill asap. 95. As much as possible restrict working time between 07:00 and 17:00. In particular are activities such as pile driving. 96. Maintain equipment in proper working order 97. Replace unnecessarily noisy vehicles and machinery. 98. Vehicles and machinery to be turned off when not in use. 99. Construct temporary noise barriers around excessively noisy activity areas where possible.						
Utility and power disruption sub-plan	Loss or disruption of utilities and services such as water supply and electricity	100. Develop carefully a plan of days and locations where outages in utilities and services will occur, or are expected. 101. Contact local utilities and services with schedule, and identify possible contingency back-up plans for outages. 102. Contact affected community to inform them of planned outages. 103. Try to schedule all outages during low use time such between 24:00 and 06:00.	All construction sites.	Fulltime	Monthly	No marginal cost	DDSC, PMU & Utility company	contractor
Erosion sub-plan	Land erosion	104. Berms, and plastic sheet fencing should be placed around all excavations and earthwork areas. 105. Earthworks should be conducted during dry periods. 106. Maintain a stockpile of topsoil for immediate site restoration following backfilling. 107. Protect exposed or cut slopes with planted vegetation, and have a slope stabilization	All construction sites	Throughout construction phase	Monthly	No marginal cost	DDSC & PMU	contractor

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
		protocol ready. 108. Re-vegetate all soil exposure areas asap.						
Worker and public safety sub-plan	Public and worker injury, and health	109. Proper fencing, protective barriers, and buffer zones should be provided around all construction sites. 110. Sufficient signage and information disclosure, and site supervisors and night guards should be placed at all sites. 111. Worker and public safety guidelines published by MoLISA should be followed. 112. Population near blast areas should be notified 24 hrs ahead, and evacuated well before operation. Accepted GoV blast procedures and safety measures implemented. 113. Speed limits should be imposed on all roads used by construction vehicles. 114. Standing water suitable for disease vector breeding should be filled in. 115. Worker education and awareness seminars for construction hazards should be given. A construction site safety program should be developed and distributed to workers. 116. Appropriate safety clothing and footwear should be mandatory for all construction workers. 117. Adequate medical services must be on site or nearby all construction sites. 118. Drinking water must be provided at all construction sites. 119. Sufficient lighting be used during necessary night work. 120. All construction sites should be examined	All construction sites.	Fulltime	Monthly	No marginal cost	DDSC & PMU	contractor

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
		daily to ensure unsafe conditions are removed.						
Construction and local vehicle traffic sub-plan	Traffic disruption, accidents, public injury	121. Schedule construction vehicle activity during light traffic periods. Create adequate traffic detours, and sufficient signage & warning lights at all construction locations. 122. Post speed limits, and create dedicated construction vehicle roads or lanes. 123. Inform community of location of construction traffic areas, and provide them with directions on how to best co-exist with construction vehicles on their roads. 124. Increase the number of pedestrian crossings away from construction areas. 125. Increase road and walkway lighting.	All construction sites	Fulltime	Monthly	No marginal cost	DDSC & PMU	contractor
<b>Specific Mitigations for Construction of Raw Water Supply Pipeline</b>								
Construction of pipeline	Minimal negative environmental impacts	126. Special attention to be given to sub-plans identified item #11 above as they apply to the raw water pipeline corridor through Ba Na-Nui Nature Reserve including the Nam river crossing with pipeline. Specific attention to be given to the protection of the following values:  a) Fauna, flora, and critical habitat of Ba Na-Nui Nature reserve; b) aquatic habitat and biota of Nam river; c) erosion through Cu DE river gorge & water quality of Cu De and Nam rivers; d) public & worker safety; and e) traffic and community/commercial disruption along narrow gorge of pipeline corridor and 450m section from Nam Hai Van to WTP.	Pipeline corridor through Ba Na-Nui Nature Reserve	During construction	Monthly	No marginal cost	DDSC / PMU	contractor
<b>Specific Mitigations for Construction of Hoa Lien WTP &amp; Treated Water Distribution Network</b>								



Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
Construction of WTP	Minimal negative environmental impacts	127. Mitigation measures to address potential impacts of WTP are all addressed by the general subproject mitigations listed above.	Land around WTP site	During construction	Monthly	No marginal cost	DDSC / PMU	contractor
Construction of treated water distribution network	Minimal negative environmental impacts	128. Mitigation measures to address potential impacts of distribution network are addressed by the mitigations identified for the raw water pipeline above.	End user property, roads, and public area	During construction	Monthly	No marginal cost	DDSC / PMU	contractor
<b>Post-construction Operation of Water Supply System</b>								
Raw water supply from Song Bac reservoir	Unsustainable quantity or quality of raw water	129. Establish with GERUCO a committee of users of Song Bac reservoir to regularly review water demand forecasts, and Song Bac basin production, and reservoir levels especially during the dry season to ensure sustainable supply to all users.  130. Establish a water quality monitoring program funded by all users of Song Bac reservoir that meets the information needs of all users. Program especially important during the initial period after reservoir filling, and during dry seasons. (See Environmental Monitoring Plan below)	Song Bac reservoir intake	once	biannually	No marginal cost	GERUCO / DAWACO / DoNRE / other users  GERUCO / DAWACO / other users / DDSC	DAWACO  EPRC
Treated water supply	Unsustainable quantity or quality of treated water	131. Develop and implement O&M manual for all equipment and operations of WS system which includes regular maintenance of treatment system components, and materials supply to ensure treated water production (m <sup>3</sup> /day) always meets WTP design specifications. Incorporate contingency and back-up plans for planned and unplanned	Entire WS system	Quarterly, and as needed	As needed	No marginal cost	DAWACO / DDSC	DAWACO

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
		<p>system shutdowns.</p> <p>132. Establish a regular treated water quality monitoring program to ensure the quality of treated water meets original WTP design specifications. Incorporate contingency and response plans to address episodes of decreased treated water quality, including public notification. (See Environmental Monitoring Plan below).</p> <p>133. As part of #131 coordinate with Dept of Health for them to periodically monitor treated water quality to ensure it meets potable quality standards</p>	At WTP outlet and at select locations along distribution network					EPRC / DoH
Operation of raw & treated water pipelines	Local flooding from ruptures	134. As part of implementation of O&M manual for entire WS system instate a regular inspection program of all pipeline networks starting at intake at Song Bac reservoir to WTP and then entire distribution network with focus on junctions and end-user connections.	At all pipeline locations	Quarterly, and as needed	As needed	No marginal cost	DAWACO / DDSC	DAWACO
Operation of WTP	Chemical spills, and pollution from solid and domestic waste	<p>135. As part of O&amp;M manual provide clear methods and procedures for safe handling and storage of planned treatment chemicals defined by poly-aluminum chloride (PAC), soda, and chlorine in designated chemical house and chlorine house on WTP property, including spills action plan.</p> <p>136. With O&amp;M manual define and implement a formal solid and domestic waste collection and disposal protocol for all WTP activities.</p>	At WTP	Continuously	As needed	No marginal cost	DAWACO	DAWACO
Production of	Contamination	<p>137. Review and clarify with DN DoNRE the appropriate landfill location to dispose of the planned dried sludge produced at the WTP.</p> <p>138. Ensure planned plate pressing technology for dewatering sludge to be located in sludge press house at WTP is maintained in good</p>	At WTP	Continuously	As needed	No marginal	DAWACO /	DAWACO

Project Activity	Potential Impact	Proposed Mitigation Measure	Location	Timing	Reporting	Estimated Cost (USD)	Responsibility	
							Supervision	Implementation
WTP sludge	of environment	<p>working order, and can more than accommodate production capacity of WTP.</p> <p>139. Ensure sludge is covered when transported to designated landfill.</p> <p>140. Never dump or temporarily store sludge on lands outside landfill site, WTP property, or near water courses.</p> <p>141. Develop and implement regular sludge quality monitoring to document sludge quality (See Environmental Monitoring Plan)</p>				cost	DoNRE	
Production of treated water	Wastewater production too much for city wastewater management	142. Review and clarify wastewater loads generated from treated water from Hoa Lien WTP can be handled by current and planned future capacity URENCO's wastewater collection and treatment systems for Da Nang.	At WTP	Periodically	As needed	No marginal cost	DAWACO / URENCO	DAWACO
Operation of entire WS system,	Worker and public injury	<p>143. Educate workers in workplace safety of WS system operation according to MoLISA regulations. Prevent public access to WTP property, Song Bac reservoir intake area, and all pipeline areas with fencing and appropriate signage.</p> <p>144. Enforce WTP truck drivers to follow speed limits on roads and highways. Provide adequate signage informing public of WTP truck traffic routes, and pipelines service routes.</p> <p>145. Ensure all WS system vehicles in good working order.</p>	<p>WTP and all pipeline property</p> <p>WTP area &amp; road to landfill site</p> <p>All facilities</p>	Continuously	As needed	No marginal cost	DAWACO	DAWACO

## E. Monitoring Plan

27. The environmental monitoring requirements identified in the IEE were carried forward and expanded with more detail into a comprehensive monitoring plan (Table 4) that addresses both environmental effects and performance monitoring (Table 5). The monitoring plan focuses on all three phases (pre-construction, construction, post-construction operation) of the project and provides environmental indicators, the sampling locations & frequency, method of data collection, responsible parties, and the estimated costs.

28. The purpose of the monitoring plan is to determine the effectiveness of the impact mitigations, and to document any unexpected positive or negative environmental impacts of the subproject. The PMU will be required to oversee the implementation of environmental monitoring plan by the EPRC. Similar to the mitigation plan, the monitoring plan will need to be updated at the detailed design stage to ensure it meets the monitoring needs of the detailed designs of the subproject

29. The key environmental protection laws, policy, and environmental standards that need to be followed with the implementation of the EMP are listed in Table 3 including allowable pollutant concentrations of discharged liquid residue of sludge settling ponds (e.g., QCVN 24:2009/BTNMT).. Allowable ambient water and air quality levels are identified in QCVN 08:2008/BTNMT and QCVN 05:2009/BTNMT, respectively, as well as standards for domestic wastewater discharge for worker camps, and allowable contaminants in excavated soil for disposal are also provided.

30. Monitoring the success of the required resettlement of households and businesses, and the temporary relocation of secondary structures will be undertaken as part of the Resettlement Plan prepared under separate cover.

**Table 3. Applicable Laws, Policy and Environmental Quality Standards.**

<b>GoV Laws</b>
<ul style="list-style-type: none"><li>• Law on Environmental Protection (LEP) No. 52/2005/QH11</li><li>• Law on Water Resources No 08/1998/QH10</li><li>• Law on Construction (LoC) No. 16/2003/QH11</li><li>• Cultural Heritage Law 28/2001/QH10 dated 29th June 2001</li><li>• Biodiversity Law 20/2008/QH12 dated 13th November 2008</li><li>• Land law No.13/2003/QH11 dated 26<sup>th</sup> November 2003</li></ul>
<b>GoV Decrees &amp; Circulars</b>
<ul style="list-style-type: none"><li>• Decree No. 12/2009/ND-CP on managing construction and investment projects</li><li>• Decree No. 209/2004/ND-CP dated 16<sup>th</sup> December 2004 on managing the quality of construction projects.</li><li>• Decree 110/2002/ND-CP, supplementing some articles of Decree 06/1995 on labour code of occupational safety and health</li><li>• Decree 06/1995, elaborating provisions of labour code on occupational safety and health.</li></ul>

<ul style="list-style-type: none"> <li>Decree No. 149/2004/NĐ-CP dated 27/07/2004 on regulation of licensing to invest, exploit, use water resource, discharge wastewater in water source.</li> <li>Decree No. 59/2007/NĐ-CP dated 09/04/2007 on solid waste management.</li> <li>Decree No. 88/2007/NĐ-CP dated 28/05/2007 of Government of Drainage in Industrial Park and Urban Area</li> <li>Decree No. 35/2003/NĐ-CP dated 4/4/2003 of Government on detail regulations for implementing some articles of the Law of Fire Prevention and Fighting.</li> <li>Circular No. 37/2005/TT-BLĐTBXH dated 29/12/2005 of Ministry of Labour, War Invalids and Social Welfare instructing training for work safety and labor sanitation.</li> <li>Circular No. 02/2005/TT-BTNMT dated 24/6/2005 of MONRE instructing the implementation of licensing for investigation, exploitation, using water resource, discharging wastewater into receiving source.</li> <li>Circular No. 12/2011/TT-BTNMT dated 14/04/2011 of MONRE on conditions to set up procedures, registration, licensing, giving code for hazardous solid waste management.</li> <li>Decision No.3/2009/QĐ-UB. Decision on the environmental protection regulation in Da Nang city.</li> </ul>
<b>International Guidelines</b>
<ul style="list-style-type: none"> <li>World Bank Group, 2007. Environmental Health and Safety Guidelines, Wash. DC.</li> <li>AWWA Standard Methods for Measurement &amp; Analysis Environmental Quality</li> </ul>
<b>GoV Environmental Protection Standards &amp; Methods</b>
<ul style="list-style-type: none"> <li>QCVN 08:2008/BTNMT: national regulation on surface water quality</li> <li>QCVN 10:2008/BTNMT: national technical regulation on coastal water quality</li> <li>QCVN 05:2009/BTNMT: national technical regulation on ambient air quality</li> <li>QCVN 09:2008/BTNMT: national regulation on groundwater quality</li> <li>QCVN 14:2008/BTNMT: national technical regulation on domestic wastewater</li> <li>QCVN 24:2009/BTNMT: national regulation on industrial wastewater quality</li> <li>QCVN 15:2008/BTNMT: national regulation on allowable pesticide residues in soil</li> <li>QCVN 03:2008/BTNMT: national regulation heavy metals concentrations in soil</li> <li>QCVN 26:2010/BTNMT: national technical standard for noise</li> <li>TCVN 6962:2001: allowable vibration and shock from construction activities</li> <li>TCVN / QCVN standard methods for analyzing environmental quality</li> </ul>

## 1. Performance Monitoring

31. Indicators of the effectiveness of the EMP will be included in the Project Performance Monitoring System<sup>18</sup> that the EA will develop for the entire subproject. Select indicators of major components of the environment that will be affected primarily by the construction phase are drawn from the mitigation and monitoring plans and summarized in Table 5.

<sup>18</sup> Footnote 11



**Table 4. Environmental Monitoring Plan**

Environmental Indicators	Location	Means of Monitoring	Frequency	Reporting	Responsibility		Estimated <sup>19</sup> Cost (USD)
					Supervision	Responsibility	
Pre-construction Phase – Update Baseline Conditions							
In consultation with Management Board of Ba Na-Nui Nature Reserve update baseline on presence of rare & endangered fauna & flora, and critical habitat that will be affected by raw water pipeline construction and operation. Include aquatic resources of affected reaches of Nam river and Cu De river	Ba Na-Nui Nature Reserve, Nam River at pipeline crossing, and Cu De river near pipeline corridor	Review of existing data and information supplemented by original surveys as required.	Once	Once	DDSC & DAWACO & MB of BN-NR	EPRC	\$3,000. (for new survey)
Air quality (dust, CO, NOx, SOx, noise, wind, and vibration levels) to supplement baseline air quality data collected during PPTA and reported in IEE  Water quality parameters sampled at Bac river station during PPTA & reported in IEE.  Water quality data collected in Nam, and Cu De rivers during PPTA & reported in IEE are sufficient.	Representative sites of heavy civil & earthwork including along truck routes  At raw water intake at completed Bac reservoir, and at pipeline crossing in Nam river	Using field and analytical methods described in QCVN and TCVN standards for ambient air and surface water quality sampling & analysis.	One day and one night measurement	One baseline supplement report before construction phase starts	DDSC & PMU	EPRC	\$2,000.  \$3,000.
Inventory of present and past land uses that could cause contaminated	At all excavation sites, including borrow pits	Survey methods described in QCVN and TCVN standards	Once	Once			\$500.

<sup>19</sup> Estimated costs to be updated at detailed design stage

Environmental Indicators	Location	Means of Monitoring	Frequency	Reporting	Responsibility		Estimated <sup>19</sup> Cost (USD)
					Supervision	Responsibility	
soil.		for land use.			DDSC & PMU	EPRC	
Analysis of soil quality if required from above (heavy metals (As, Cd, Pb, oil & grease, hydrocarbons).	Possible contaminated lands all sites	Use field and analytical methods described in QCVN and TCVN standards for soil quality sampling & analysis.	D): Once if needed	Once	DDSC & PMU	EPRC	\$3,600.
Presence of UXO	Potentially located throughout project area	Military to survey and sweep affected areas of UXO	Once	Once	DAWACO	military	tbd.
Updated community stakeholder comments & concerns of subproject	Public consultation sites with same stakeholders consulted during IEE	Same format used in IEE for obtaining stakeholder input to subproject	At least once & in conjunction with Grievance Redress Mechanism	For each event	PPC / DAWACO	PMU	\$5,000.
<b>Construction of Raw Water Pipeline, Hoa Lien WTP, and Treated Water Distribution Network</b>							
<b>A)</b> Air quality: dust, CO, NOx, SOx, noise, wind, and vibration levels <b>B)</b> Surface water quality: TSS, heavy metals (As, Cd, Pb,) oil and grease, total & faecal coliform, pH, DO, COD, BOD <sub>5</sub> , temperature, NH <sub>3</sub> , and other nutrient forms of N & P. <b>C)</b> Analysis of soil quality (heavy metals (As, Cd, Pb, Hg, Mn), hydrocarbons. <b>D)</b> Domestic and construction solid waste inside & outside construction sites including worker camps. <b>E)</b> Public comments and complaints <b>F)</b> Incidence of worker or public accident or injury	A – B): At water quality sites #1 - #4 sampled during PPTA and reported in IEE (Bac river, Nam river, middle & lower Cu De river)  C): At sites where contaminated soil is suspected at excavation areas at all project areas  D): All construction sites and worker camps  E): Using hotline number placed at construction areas  F): At all construction areas	A – C : Using field and analytical methods described in QCVN and TCVN standards for ambient air and surface water quality monitoring.  Include visual observations of dust and noise from contractor & public reports .  D) Visual observation  E) Information transferred by telephone hotline number  F) regular reporting by contractors/PMU	(A – B): Quarterly during construction periods  C) Once before start of excavation  D) Monthly  E) Continuous public input  F) Continuous	Quarterly	(A - D):		A) \$9,600. /yr
					DDSC / PMU	EPRC	B) \$13,000. /yr
					E & F) & daily observations:		C) \$3,600. /yr
					PPC / DAWACO	PMU / contractor	D) With A-C (no marginal cost)  E) \$2,000. / yr  F) No marginal cost



Environmental Indicators	Location	Means of Monitoring	Frequency	Reporting	Responsibility		Estimated <sup>19</sup> Cost (USD)
					Supervision Responsibility		
Operation of WTP & Pipeline Network							
Air quality: dust, noise and vibration levels	At WTP	Using field and analytical methods described in QCVN & TCVN standards for ambient air quality monitoring.	Quarterly for 5 years	Biannual	DAWACO		\$1,200.00 / yr
Worker & public injury associated with WTP & pipeline network	On property of WTP, pipelines, and pump stations	Regular record keeping	Continuously	For each event	DAWACO		No marginal cost
Treated water quality: total & faecal coliform, pH, DO, NH <sub>3</sub> , NO <sub>3</sub> , NO, chlorine, PAC, NaCl, and heavy metals (As, Cd, Pb.).	At WTP & random user locations along distribution network	Using field and analytical methods described in QCVN & TCVN standards for water quality monitoring, and parameters of QCVN 14:2008/BTNMT	Biannually, or when public complaint arises	For each event	DAWACO / DoNRE / MoH		\$3,500.00 / yr
WTP sludge quality: ToC, heavy metals (As, Cd, Pb.), coliforms, pH, BOD, nutrients (N&P), PAC, chlorine,	After removal from sludge drying building and before disposal at designated landfill.	Using field and analytical methods described in QCVN & TCVN standards for water quality monitoring	Quarterly for 5 years	Biannually	DAWACO		\$4,500. / yr
Public complaints of operation of WTP, drinking water availability & quality, and malfunctions with pipelines (e.g., leaks).	At all sites	Regular record keeping	Continuously	Biannually	DAWACO		\$1,000. / yr

**Table 5. Performance Monitoring Indicators**

<b>Major Environmental Component</b>	<b>Key Indicator</b>	<b>Performance Objective</b>	<b>Data Source</b>
<b><i>Pre-construction Phase</i></b>			
Public Consultation & Disclosure	Affected public & stakeholders	Meeting with stakeholders contacted during IEE & new stakeholders convened for follow-up consultation & to introduce grievance mechanism	Minutes of meeting, and participants list
EMP	Updated EMP	All stakeholders contacted during IEE re-contacted for follow-up consultation	EMP
Bid Documents	Requirements of EMP (CEMP)	EMP appended to bidding documents with clear instructions to bidders	Bid documents
Training of DAWACO / PMU	Training course(s) & schedule	By end of P-C phase, required course(s) that will be delivered are designed and scheduled	Course(s) outline, participants, and schedule
<b><i>Construction Phase</i></b>			
Ba Na-Nui nature reserve	Critical habitat, rare or endangered species	All critical habitat and R & E species unchanged, and unharmed	Monitoring by EPRC & management board of reserve
Air quality	SOx, NOx, dust, VOC, CO, noise, vibration	Levels never exceed QCVN standards (Table 3), or normal ambient levels. Necessary exceedances are isolated, and short in duration as possible.	EPRC & contractor monitoring reports,
Surface water quality	DO, TSS, pH, discharge, heavy metals (Cd, Pb, As), oil, grease, coliform, nutrients (N & P)	Levels never exceed QCVN standards (Table 3), or normal ambient levels. Necessary exceedances are isolated, and short in duration as possible.	EPRC & contractor monitoring reports,
Soil quality	Solid & liquid waste	Rigorous program of procedures & rules to collect and store all waste from construction camps and sites practiced.	Contractor and EPRC monitoring reports
Hazardous materials & waste	Oil, gasoline, grease, PAC, chlorine, soda	Rigorous program of procedures to manage and store all waste from construction camps and sites practiced as well as adherence to specific policy (Table 3)	Contractor and EPRC monitoring reports
Public & worker safety	Frequency of injuries	Adherence to specific policy (Table 3), and site-specific procedures to prevent accidents	Contractor reports
Cultural property	Incidence of damage, or complaints	No valued cultural property, or unearthed valuable relic is harmed in any way	Public input, contractor reports, public

Major Environmental Component	Key Indicator	Performance Objective	Data Source
			input, EPRC reports
Traffic	Frequency of disruptions & blocked roadways	Disruptions, stoppages, or detours are managed to absolute minimum.	Public input, contractor reports, EPRC reports
<b>Operation Phase</b>			
Raw water quality	Degraded water quality of Song Bac reservoir	Raw water never degraded preventing WTP to produce potable water quality	DAWACO / DoNRE monitoring reports
Soil & surface water quality	Contamination from discharged sludge	Sludge is to be processed on WTP site then transported to DoNRE approved landfill.	Public input, DoNRE inspections, & DAWACO regular reporting
Worker health & safety	Exposure to treatment chemicals such as chlorine, and hazardous activities & equipment	No spills or unprotected exposure to chlorine, or other hazardous materials will occur following procedures of O&M manual for WTP.	MoLISA reports, & DAWACO regular reporting
Potable water supply	Sufficient potable water for users of distribution network	Safe drinking water quality produced as per design specifications of WTP	MoH inspections, & DAWACO regular reporting

## F. Reporting

32. Regular reporting on the implementation of mitigation measures, and on monitoring activities during construction phase of the project is required as indicated in Tables 3 - 5. Construction contractors are required to submit brief monthly reports on environmental issues and mitigation activities to the PMU. The PMU must prepare quarterly reports on the EMP to the EA which include input from regular meetings with public stakeholders. The EA must prepare biannual reports on activity and effectiveness of EMP to ADB<sup>20</sup>.

33. Environmental monitoring reports will be prepared in parallel quarterly for the PMU/EA by the EPRC. The reports will table all indicators measured from the monitoring plan of EMP, and will include relevant GoV environmental quality standards (i.e., QCVN & TCVN, Table 3).

## G. Estimated Cost of Mitigation and Monitoring Plans

34. No marginal costs are estimated for implementing impact mitigation measures during the pre-construction phase of the project (Table 2) because mitigation costs should be included in contractor bids. Estimated costs for field sampling and laboratory analyses for the monitoring plan during pre-construction phase to supplement the baseline including an estimated \$17,100.00 which does not include UXO survey & removal by military. Monitoring costs per year

<sup>20</sup> Footnote 5

during construction phase are estimated at \$28,200.00, and \$10,200. annually for the 2-3 year period from beginning of operation phase. All estimated costs are preliminary, and based on the national cost norms for environmental sampling and analyses (Circular 83/2002/TT-BTC). All cost estimates need to be updated with the EMP at detailed design stage.

## **H. Emergency Response Procedures**

35. Emergency response procedures must be in place during the construction and subsequent operation phases of the new raw water pipeline, WTP, and treated distribution network to protect the public and workers. Potential emergencies could arise from accidents resulting from the operation of heavy equipment, excavation activities including work at borrow pits, chemical spills, electrical shock, work in/or near rivers, and from worker & public vehicle traffic. Environmental incidents could occur from pipeline failures, spills at WTP sites, improper disposal of WTP sludge, and failures along distribution network.

36. The emergency procedures at the subproject (SERP) represent the first response which must align with the second and ultimate response by the existing external emergency response procedures (EERP) of the municipality and district for civil and environmental accidents. The SERP must complement workplace & public safety requirements prescribed by MoLISA (Table 3). The SERP essentially sounds the alarm and initiates emergency measures which are subsequently assumed and completed by the EERP.

### **Response Teams**

37. The SERP requires an emergency response team (SERT) which consists primarily of the contractor during construction phase, and DAWACO during the operation of the completed WS. Multiple contractors will have their own SERT. The SERT will have an emergency response coordinator (ERC) to oversee sub-teams assigned to each of the three subproject components (raw water pipeline, WTP, treated water distribution network). Representatives of the SERT will be present at construction sites at all times. The ERC will have a counterpart in the PMU which will assign 1-2 staffers as necessary as external officers of the SERT. The PMU will assist by providing a coordinating role amongst multiple contractors.

38. The EERP also has an emergency response team (EERT) which is comprised of local ambulance services, hospitals, clinics, police department, Department of Health, Department of Natural Resources & Environment, and the Department of Labour, Invalids, & Social Assistance. Before construction begins the SERT and PMU must meet with the different members of the EERT to ensure that the planned SERP and SERT are compatible and align with the procedures of the different components of the EERP.

39. Contractors will need to identify their draft SERP and SERT in the CEMP of their bid documents, and describe how they will coordinate with the EERT to finalize the SERP. Construction tender documents will need to specify the requirements for a SERP and roles of the SERT.

### **Example Emergencies**

40. Example emergencies, and emergency scenarios that the SERP must be able to provide the first response are summarized below. The list of possible emergencies will be finalized with the PMU.

### Human Injury

- all worker injuries requiring on-site first aid, or immediate hospital care
- all public injuries caused from construction-related activities requiring immediate first aid, or hospital care

### Environmental emergencies

- pipeline, coffer dam, or reservoir intake failures causing local flooding
- spills of hazardous substances (e.g., gasoline, oil, chlorine, soda, PAC, paint) on land into surface waters (rivers, lakes, reservoirs), or into drinking water source

### Emergency scenarios

- traffic accidents
- truck load or tanker spills, or ruptures
- excavation cave-ins
- landslides
- building collapse
- heavy equipment accident or malfunction
- near drownings
- gas or UXO explosions
- fire
- hazardous chemical or gas exposure

## **Emergency Response Procedures**

41. Described briefly below are general emergency response procedures that the SERT must be able to initiate ahead of the complete response of the EERT. The procedures will be finalized in coordination with the EERT and PMU, and will form part of the CEMP, and O&M manual for DAWACO.

### Alert & Communication & Initial Response

- Immediate recognition of emergency situation by sub teams of SERT;
- Immediate notification of ERC & PMU of nature of emergency
- ERC alerts required authorities & expertise of EERT (e.g., fire department, ambulance & hospitals, DoNRE, DoT, DoH, DoLISA, PPC);
- SERT under direction of ERC & PMU begin to stabilize situation where possible (e.g., first aid to injured worker/public, environmental clean-up, fire containment) while waiting for expertise of EERT to arrive

### Evacuation

- Move people out quickly as a group, and avoid panic
- Evacuate through pre-defined evacuation route
- Move people away until safely away from the emergency site and area of influence
- Report missing persons to EERT immediately
- Assist the injured & transfer to medical component of EERT
- Only move seriously injured persons under direction of EERT

### Medical

- Administer appropriate first aid immediately regardless of severity of injury
- Alert ERC & PMU
- Call the EERT (emergency medical services and/or nearest hospital)
- Direct EERT to the emergency site by escort if necessary
- If necessary vacate and close site immediately, or restrict access to site

### Fire

- Alert immediate area and ERC & PMU of fire situation
- Contact EERT if fire considered too large to extinguish
- Contact EERT if medical assistance is required
- Stop all activities or operations
- Begin to contain fire and keep from spreading
- Evacuate site if deemed necessary
- Direct EERT to site by escort if necessary

#### Explosion

- Expect further explosions & take shelter or leave area
- Alert ERC & PMU
- Call EERT (fire dept, ambulance, hospitals) if necessary
- Evacuate area
- Direct EERT to site by escort if necessary

#### Hazardous Material Spill

- Alert all persons in area, and ERC & PMU
- Stop all work in area
- Notify EERT (DoNRE, DoH, ambulance, hospitals)
- Begin to stop spill and contain contaminated area if it can be done safely
- Direct EERT to site by escort if necessary
- All exposed persons to be taken to hospital to assess exposure damage

#### Drinking Water Contamination

- Assess potential eventual exposure (# of affected people) to contaminated water
- Contact EERT (DoNRE & MoH)
- Initiate notification of affected community
- Stop source of contamination
- Begin identifying alternate clean water supply to affected persons

42. The SERT in conjunction with the EERT will conduct follow-up measures to ensure that the emergency is over or under remediation. The specific follow-up measures of the SERP for the different emergency types and scenarios will be finalized with the EERT and PMU.

### **I. Institutional Capacity Review and Needs**

43. The capacity of the DAWACO and assigned PMU for environmental management is expectedly weak, and likely will need to be strengthened. Full-time staff in water supply companies dedicated to environmental management normally does not exist other than engineers who monitor raw and treated water quality, and quality of WTP sludge.

44. The environmental subunit created for PMU will need to understand and be able to effectively oversee implementation of the EMP. Understanding of potential project environmental impacts and their management will be required by the PMU. The PMU will need to understand and be able to oversee compliance of subproject with ADB and GoV pursuant to environmental safeguards of the LEP (2005) and SPS (2009).

45. As part of the institutional capacity development plan for the entire sub-project, the environmental subunit of the PMU should receive training on the development and implementation of an EMP. Two approaches to training should be: 1) classroom coursework;

and 2) “learning by doing” from work on the implementation of the subproject EMP with coaching assistance provided by the environmental specialist of the DDSC. On the job training begins with updating of the EMP to meet the detailed subproject designs as assisted by the DDSC.

46. Classroom training should be given by the environmental specialist of the DDSC, and focus on two thematic areas defined by: 1) principles environmental assessment & management focused on the potential impacts of infrastructure development on the natural and social environments; and 2) environmental safeguard requirements of the ADB and GoV with specific focus on the Da Nang subproject.