Initial Environmental Examination

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Democratic Socialist Republic of Sri Lanka: Jaffna and Kilinochchi Water Supply and Sanitation Project

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EXECUTIVE SUMMARY

1. The Jaffna and Kilinochchi Water Supply and Sanitation Project is part of efforts to assist the Government of Sri Lanka in social and physical reconstruction in the north subjected to almost two decades of internal conflict. Supported by the Asian Development Bank (ADB) and Agence Française de Développement (AFD), with the Ministry of Water Supply and Drainage (MWSD) as the executing agency, and the National Water Supply and Drainage Board (NWSDB) as the main implementing agency, the project began with a feasibility study in 2005-2006. Security concerns then precluded further development until the end of the conflict in May 2009, after which ADB appointed new consultants to review and revise the feasibility study documents to reflect changes in the intervening period. This document is the revised Initial Environmental Examination (IEE), prepared according to ADB's Safeguards Policy Statement (2009).

2. There are no perennial rivers in Jaffna and groundwater, which is the main source of domestic and irrigation water, is in limited supply and is polluted because of inadequate sanitation and seawater intrusion. There is also no sewerage system and the widespread use of pit latrines and malfunctioning septic tanks causes public health problems and environmental damage. The project will deliver major sustainable improvements in these basic services for a significant proportion of the population, via components to (i) rehabilitate and expand water and sanitation infrastructure; (ii) strengthen water resources management; and (iii) build capacity of key institutions and support project management and implementation.

3. The new water supply system will serve the Jaffna Peninsula and parts of the adjacent mainland and will involve (i) repairing and raising the bund and head-works of Iranamadu Tank to store and abstract an additional 27,000 cubic meters per day (m^3/d) of water; (ii) a 32.5 kilometres (km) raw water main to a new 27,000 m^3/d water treatment plant (WTP) at Palai; (iii) high lift pumps and 44 km treated water main; (iv) 17 new overhead water tanks and 11 refurbished existing ones; and (v) a 520 km piped distribution network. The sanitation system will serve the highly populated Jaffna Municipal Council and University areas and will involve (i) house connections and 187 km of sewer pipes and pumping mains; (ii) pumping stations; (iii) a sewage treatment plant (STP) at Kallundai treating a total equivalent population of 91,000; and (iv) a sea outfall.

4. The natural environment in this part of Sri Lanka has been degraded by human use over the centuries (mainly farming and urbanization) and is therefore not especially sensitive, except for certain features like coastal areas which are of economic and ecological value as grounds where young fish and shellfish grow through early life stages. Social and economic factors are of greater importance, given the heavily populated nature of the Jaffna urban area, the hardship and neglect suffered by people, infrastructure and services during the conflict period, and the increasing number of displaced persons currently returning to reclaim and rebuild their lives, assets and livelihoods.

5. Both subprojects require action in the pre-construction stage to resolve issues that would otherwise constrain the proposals. Abstracting an additional 50,000 m^3/d from Iranamadu Tank requires farmers using irrigation water from the tank to cultivate only other field crops (OFC) in the dry season instead of the present mixture of rice and OFC. This was agreed in a memorandum of understanding (MOU) between NWSDB and the Provincial Irrigation Department (PID) in 2006, but discussions in 2010 indicated that a change in agricultural practice was no longer acceptable. The project, therefore, proposes to abstract 27,000 m^3/d in

Stage 1 (which will not affect farming) and to increase to 50,000 m^3/d only if the improved bund and head-works perform satisfactorily and if the changes in cultivation are successfully introduced. NWSDB will meet PID and farmers' representatives to negotiate the revised agreements and prepare a new MOU. The IEE requires NWSDB to also provide farmers with training and financial support to ensure they maintain and if possible improve their livelihoods as a result of these changes.

6. The proposed STP site is in a remote area with no inhabitants where, due to land constraints, a mechanical treatment system is preferred over waste stabilization ponds. There is a Hindu cremation site 200 meters (m) away, which would be affected by site views and potential odor. NWSDB should meet community leaders and custodians of the cremation site to determine whether the facility may be relocated and, if so, should acquire an agreed alternative plot and provide practical and financial support for the relocation as set out in the resettlement plan. Outfall length and location must also be designed to avoid sensitive habitats and dilute and disperse the effluent effectively, so design studies should include ecological surveys and computer-based dispersion modelling of alternative lengths and locations.

7. The two subprojects will be designed in 2011 and constructed in parallel in 2012-2016. Construction will be quite large in scale, involving (i) substantial earthworks at Iranamadu Tank, the WTP and STP; (ii) creation of large reinforced cement concrete (RCC) structures at the WTP, STP, and new tower sites; (iii) excavation of over 700 km of trenches, many in populated areas; and (iv) a major transportation exercise taking waste spoil for disposal and bringing construction materials from quarries on the mainland as there are no suitable sources on Jaffna Peninsula. Despite the scale and duration of the construction process it is not expected to result in major negative impacts. This is because:

(i) Many impacts have been avoided by careful site selection, such as locating pipelines in the government-owned Right of Way (ROW) beside roads and locating facilities on unoccupied government land to avoid acquiring private land and relocating people; and
(ii) Construction will involve certain basic techniques (excavation, creation of RCC structures) that are common to most large projects, so there are well developed mitigation measures with which experienced contractors should already be familiar with.

8. It is not possible to avoid all impacts, and as much of the work will occur in a heavily populated urban area, impacts upon people are the main concern, which include disturbance by noise, dust, vehicle emissions, visual intrusion, interrupted access, traffic disruption, etc. Most of these will be mitigated by requiring contractors to operate tidy and well managed sites and adopt responsible construction practices, such as covering loose materials when stored or carried on trucks; servicing vehicles regularly and ensuring they are fitted with noise and emissions reduction equipment; preparing and operating plans for traffic management, pollution prevention and abatement, health and safety, chance archaeological finds; etc.

9. Certain other impacts result from factors specific to this project and, therefore, require more custom-designed mitigation. These include transportation of waste and construction materials, which will disturb people along the routes and could contribute to global warming from the increased emission of greenhouse gases. Mitigation will involve reducing waste by re-use in this and other projects and using alternative construction materials, such as debris from war-damaged buildings, which may be suitable as aggregate substitute after crushing. The presence of the Sri Lankan army in the project area after the civil war will also require special precautions,

as there are now guard posts near some of the proposed facility sites. The army should be included in project consultations as an important stakeholder and all proposed work should be discussed with appropriate commanders to agree on measures that will allow construction to proceed without compromising army operations, security or safety.

10. When the schemes are operating, it will be essential for NWSDB to keep all elements in working order by conducting regular inspections and maintenance and effecting repairs promptly when necessary. The project will raise the capacity of NWSDB offices and staff by providing training, consultancy support and finance; and this will be extended to other government agencies with responsibility in these sectors, and to relevant nongovernment organizations (NGOs) and community-based organizations (CBOs).

11. Provided Iranamadu water-use agreements are adhered to, maintenance is regularly conducted and pipeline leaks are repaired promptly, the water supply scheme should operate without major negative impacts. The same should be true of the sanitation scheme as STP design will treat the effluent to national discharge standards and outfall location and design will dilute and disperse the effluent rapidly. During detailed design stages, options for sludge stabilization will be considered, and the most technically, financially and environmentally feasible option will be selected. Stabilized sludge can be put to beneficial use in agriculture, replacing organic matter and nutrients washed out of irrigated soil, so NWSDB should include a small composting plant in STP design and conduct programs to raise farmers' awareness of the benefits of using sludge fertilizer and to demonstrate its safety.

12. Stakeholder institutions and the general public were informed about the project and involved in planning and design during the feasibility study in 2005-2006 and in the project review period in 2009-2010. This involved informal discussions during household surveys and site visits; focus group sessions; structured meetings and presentations; and public meetings. Consultation and information dissemination will continue throughout design and construction. Relevant documents (including this summary) will be disclosed by making copies available in the Tamil language in local government offices in the project area. and the IEE will also be placed on NWSDB and ADB websites. NWSDB will also establish a Grievance Redress Mechanism through which people may bring any dissatisfaction to the attention of project authorities for appropriate action. This involves discussion and resolution on site if possible, or consideration by a Grievance Review Committee (comprising project officers and community representatives) if necessary.

13. The Northern Provincial Council Irrigation Department, through a project implementation unit (PIU) established in Kilinochchi, will be responsible for implementing the improvements to Iranamadu Tank, and NWSDB will be the implementing agency for all other aspects of both subprojects. Central management and administration will be by a project management, coordination, and implementation unit (PMCIU) in Jaffna and a smaller project implementation unit comprising three staff in Kilinochchi. The Project Director, two engineers, procurement officer, land acquisition and resettlement officer, environmental officer, plus consultants and support staff will be based in the Jaffna PMCIU. The staff in the PMCIU in Jaffna and the PIU in Kilinochchi, will administer contracts and oversee construction in their area, supported by design and supervision consultants who will design each scheme and supervise construction contractors. Project oversight will be by a National Project Coordination Committee (NPCC) comprising secretaries of relevant ministries, representatives from other agencies and senior PMCIU and PIU staff.

14. The IEE contains an Environmental Management Plan which lists all impacts identified in pre-construction, construction and operational phases of each subproject and describes the recommended mitigation, and allocates responsibility for each action. There are also Environmental Monitoring Plans setting out monitoring to be conducted to ensure that all parties provide the mitigation that is their responsibility, that the action protects the environment as intended, and to determine the long-term impacts of each scheme.

15. If all mitigation is delivered as recommended in the IEE, all potential negative impacts of construction and operation of the subprojects should be avoided or reduced to acceptable levels, and the long term impacts of the schemes should be very positive. Over 50% of the Jaffna population will be provided with a safe, efficient and convenient water supply and over 30% will have sanitary toilet and sewage disposal facilities. This will greatly improve personal hygiene, public health, environmental conditions and quality of life of the beneficiary community. Given that a safe water supply and sanitary wastewater disposal are basic human needs, the impact of the two systems together will be highly beneficial.

I. INTRODUCTION

A. Background

1. As part of efforts to support the Government of Sri Lanka in social and physical reconstruction in the north subjected to almost two decades of conflict, in 2003 Asian Development Bank (ADB) developed The Conflict Affected Areas Rehabilitation Project (CAARP). The resulting Report and Recommendation of the President (ADB 2003) included a comprehensive study of water resources in the Jaffna Peninsula and adjacent mainland, which led to the preparation of another project, aimed at providing the peninsula with safe and reliable water supply and sanitation services. This is the Jaffna Water Supply and Sanitation Project, for which a team of consultants conducted a feasibility study in 2005-2006.

2. An ADB loan fact-finding mission and a management review meeting were conducted in 2006, but the deteriorating security situation in Sri Lanka precluded further development of the project until the government announced the end of the civil war in May 2009. Donor and government meetings were held soon after wherein the importance of expediting the project was confirmed. As part of Sri Lanka's Country Programming Mission in June 2009 the government earmarked the project for immediate priority in 2010. Independent consultants were then engaged to review and revise the feasibility studies and update the related documents in light of any significant changes in circumstances.

3. This document is the Initial Environmental Examination (IEE) Report. It was prepared and submitted by the feasibility study consultant in 2006 and revised by ADB-appointed consultants from December 2009 to April 2010 to reflect changes in (i) the project; (ii) proposed institutional arrangements; (iii) social and environmental conditions in the project area; and (iv) ADB Safeguards Policy.[1]

B. Purpose of the Report

1. Project and the Project Proponent

4. CAARP was ADB's first response to the 2003 needs assessment of conflict-affected areas in the north of Sri Lanka, which constitute about 24% of the land area of the country and contain about 10% of its population. The Jaffna and Kilinochchi Water Supply and Sanitation Project will extend ADB's support for government reconstruction efforts by focusing on the provision of urgently-needed basic infrastructure and services.

5. The objective of the proposed project is to provide safe and reliable water supply and sanitation systems to the population in the Jaffna Peninsula and parts of the adjacent mainland. This IEE study was carried out as an ADB requirement before implementation of the project, in compliance with the Environment Policy (2002) and the Safeguards Policy Statement (2009). The project was identified in order to fulfil the priority needs of the communities in the north to be provided with effective water and sanitation facilities.

6. The Ministry of Water Supply and Drainage (MWSD) and the Ministry of Local Government and Provincial Council are the executing agencies responsible for successful project execution.

[1] In particular the *Safeguards Policy Statement* of ADB (2009).

2. Nature, Size and Location of the Project

7. **Water Supply.** The project area for water supply covers the whole of Jaffna District and Pachchilaipallai and Poonakary Divisions in Kilinochchi District. Jaffna District is the northern end of the Northern Province of Sri Lanka and consists of the peninsula and seven inhabited islands. Pachchilaipallai, Pooneryn and Poonakary Divisions are in the northern part of Kilinochchi district on the adjacent mainland.

8. The project is planned in three phases. The first and second phases have a design horizon of the year 2028. In Phase I Stage 1, it is planned to provide 27,000 cubic metre per day (m^3/day) of treated water to a beneficiary population of 300,000 or about 50% of the total population of the Jaffna Peninsula. In Phase I Stage 2, an additional 23,000 m^3/day will be supplied, bringing the serviced population to 366,000.

9. In Phase II an additional supply of 38,500 m^3/day of treated water will bring the total population served to 689,000 in 2028, which is the projected total population of Jaffna Peninsula at that time. Phase III will meet the 2058 design horizon by providing an additional 89,200 m^3/day to serve the total population of 1,023,000 projected for 2058.

10. The feasibility study and this IEE report considers Phase I Stage 1 which aims to provide 27,000 m^3/day of treated water to around 50% of the population of Jaffna Peninsula, in the following areas:

(i) Greater Jaffna, including Jaffna Municipality and surrounding densely populated Nallur Gramaseva Nildari Divisions (GND)[2]−by abstracting additional water from Iranamadu Tank (see below);
(ii) Chavakachcheri Urban Council area and part of the surrounding towns and rural settlements−also via the Iranamadu scheme;
(iii) Islands of Kayts, Karainagar, Velanai and Pungudutivu–existing water supply schemes integrated with the new system to provide additional bulk supply;
(iv) Araly North, Araly South, Vaddukkoddai and Ponnalai in Valikamam West *Pradeshiya Sabha*; and Sandilipay in Valikamam South West *Pradeshiya Sabha*–existing schemes integrated with the new system to provide additional bulk supply;
(v) Vatharawathai–augmenting the existing scheme and extending supply to Kopay and Atchuvely areas in Valikamam East *Pradeshiya Sabha*; and
(vi) Pachchilaipallai Town and Poonakary Town areas in Kilinochchi district–via the Iranamadu scheme.

11. The feasibility study also identified certain groundwater aquifers for abstraction of suitable quality water for domestic use during prolonged dry periods, and estimated that an additional 13,100 m^3/d could be provided from (i) Manatkadu and Maruthankarny sand dune aquifers in Vadamaradchchi East; (ii) Chunnakam limestone aquifer in Valikamam South; (iii) Chavakachcheri sand aquifer in Thenmaradchi; and (iv) the sand aquifer of Kayts in Island North. The study also considered rainwater harvesting and desalination by reverse osmosis as

[2] GND is the lowest level of central government administration, in which the administration is headed by a *Gramaseva Nildari*. A GND normally consists of a town and/or several villages, although rarely a GND can comprise a single village or town. Each divisional secretary area comprises a number of GNDs (typically around a hundred), and the divisional secretary is normally the main decision-maker, implementing central government policy.

options for specific uses, such as on the islands where severe water quality and quantity constraints restrict the use of groundwater. These proposals will be re-evaluated during a later stage of the project and are therefore not considered further in this document.

12. **Sewerage System.** The introduction of sewerage facilities and a treatment plant to the densely populated Jaffna Municipality and Nallur *Pradeshiya Sabha* areas is considered a priority because inappropriate human waste disposal methods are causing poor sanitary conditions for residents, resulting in health problems. Direct pit latrines and septic tanks are very common and local authorities are unable to impose regulations regarding the minimum distance between a dug well and a latrine (15-30 m to avoid contamination) as most premises are too small to allow sufficient separation. Groundwater is currently the only source of water on the peninsula and contamination of this source by improper sewage disposal is a major issue.

13. Jaffna has no conventional sewage collection and disposal system at present and post-conflict urbanization and development in the region and enhanced water supply will certainly generate higher wastewater volumes. It is inevitable, therefore, that the densely populated urban centers will need sewerage systems. The project proposes to provide a sewerage system for the Jaffna Municipal Council (JMC) and University of Jaffna areas with treatment facilities and effluent discharge into the sea.

3. Importance of the Project

14. Only 44% of households in Jaffna have access to a supply of safe water and availability of sanitation is less than the national average of 72%. If the entire population of the peninsula is considered, only 0.42% is provided with house connections and 14.6% are supplied by stand posts and the supply is limited to 1-3 hours per day (feasibility study data). Thus even where water is provided the piped system hardly satisfies the drinking and cooking water demands and people depend on wells for all other needs.

15. Except for the JMC water supply that has 250 domestic connections, all other systems on the peninsula supply only to stand posts. People, therefore, spend a significant amount of each day collecting water, which has a knock-on effect on their socio-economic status. It is common in Jaffna District to see women waiting at stand posts to collect water during the hours of water distribution.

16. The tsunami disaster of 26 December 2004 caused damage to a large part of the coastal area in Sri Lanka, particularly in the east, with widespread loss of life and damage and destruction of houses, property and public infrastructure. Less obvious but no less severe damage occurred behind the immediate impact zone where wells became silted and contaminated with sewage and seawater and were rendered unusable. In the sandy soil found along the coastline, infiltration of salt water occurred rapidly (e.g., Valvettithurai and Point Pedro) and the entire upper aquifer was polluted in these areas. Salt water is still present in the wells today and the tsunami has changed the balance between salt and fresh water along the entire coastline. In many such areas, water is now supplied by tanker (“bowsers”; e.g., Valvettithurai, Manalkaadu, etc.).

17. The district of Jaffna has a very thin sandy soil layer, in many places approximately one metre deep, and the groundwater is easily contaminated with surface source pollutants. Waterborne diseases such as diarrhea, dysentery, typhoid and hepatitis are now common in Jaffna (see Section 4.4), mainly as a result of groundwater contamination. Today all areas in the peninsula suffer from preventable intestinal diseases, with typhoid and diarrhoea emerging as

major public health challenges. As such, safe methods of sewerage and wastewater disposal have become imperative. A requirement for sewerage facilities and a treatment plant for the densely populated Jaffna Municipality area were also identified by the post-conflict needs assessment study of 2003.

C. Extent of the IEE Study

18. The IEE study covered the area that could be affected directly or indirectly by construction or operation of the proposed water supply, sewerage and wastewater disposal systems as identified during initial scoping studies. For physical and biological environments this comprised the immediate surroundings of the proposed project facilities and their environs, which included certain sensitive areas such as coastal lagoons. Socio-economic and socio-cultural conditions were investigated over a somewhat wider area (primarily the Jaffna Peninsula and/or its administrative divisions) as these are the units within which government data are normally collected and presented. Impacts associated with source areas for water abstraction and locations of facilities were also considered.

19. Potential adverse impacts during the construction and operational phases of the project were studied, considering direct and indirect as well as long- and short-term effects. Possible magnitudes of the impacts were judged, and for negative impacts that were considered likely to be significant, appropriate mitigation measures were identified. These were categorized according to whether the impact would occur during the periods of design, construction and/or operation, and the implementation of the mitigation measures was set out in detail in an Environmental Management Plan (EMP).

20. The original study was conducted in 2005-2006 by an environmental specialist with the support of the feasibility study consultants and field staff. The environmental specialist made reconnaissance field visits to collect information. He and other specialists also consulted various line agency personnel, local communities and environmental groups. Available reports and literature relevant to the project were reviewed and socio-economic and environmental data available from local authorities were collected. The feasibility study team was made aware of the potential impacts associated with different options and recommended mitigation measures; and all field data and information collected by the feasibility study team were reviewed.

21. The following agencies are acknowledged for the cooperation extended in completing the study and their suggestions and recommendations for the proposed projects:

(i) Department of Wildlife Conservation, Deputy Acting Director − Development and Management at Head Office for providing a map of the protected areas and details of the environmental clearance procedure for activities inside such areas;
(ii) Department of Forest, Conservation − Operations at Head Office, district Forest Officer at Vavuniya and Range Officer at Jaffna for providing information on forest reserves and environmental clearance procedure for activities inside such areas;
(iii) Central Environmental Authority (CEA) Head Office for providing relevant standards of effluents and sludge for various uses and maps of sensitive areas;
(iv) Jaffna and Kilinochchi district Secretariats for socio-economic and other data;
(v) CEA Sub-regional Office at Jaffna for information on local environmental conditions and the Environmental Protection License (EPL) procedure;
(vi) JMC, Chief Engineer Water Supply for information related to water supply and demand;

(vii) JMC, Divisional Environmental Officer for information on industrial pollution, sanitation, waste management, etc.;
(viii) Urban Development Authority, Northern Province Office at Jaffna for information on zoning;
(ix) Department of Fisheries, district office at Jaffna for information on fisheries;
(x) Provincial Director Health Services and District Director of Health Services at Jaffna for data on health and sanitation; and
(xi) Thinnaweli Agricultural Research Station, Officer-in-Charge for information on agricultural practices by farmers and groundwater pollution.

22. Nongovernment organizations (NGOs), environmental and other groups consulted during the study include GTZ, International Federation of Red Cross and Red Crescent Societies (IFRC), International Committee of the Red Cross (ICRC), Swiss Development Corporation, Oxfam, United Nations Children's Fund (UNICEF), Cooperative for American Remittances to Europe (CARE), NSGD Association with SVISL, Action Contre la Faim and farmers' organisations.

23. The IEE was reviewed and updated from December 2009 to April 2010 by an international and a domestic environmental specialist appointed by ADB. Additional work conducted in this period included:

(i) Detailed review of IEE, resettlement plan, the final report of the feasibility study (ADB/SMEC 2006) and the new ADB Safeguards Policy Statement (ADB 2009);
(ii) Discussions with ADB and their project review consultants on potential changes in the project and the approach to construction and operation of each scheme;
(iii) Site visits to inspect the locations of proposed facilities to ascertain whether they are now used and/or occupied and to assess the environmental and social context of each site and its surroundings;
(iv) Collection and review of data on physical, biological, socio-economic and socio-cultural conditions in the study area, in particular covering the period 2006 to 2010; and
(v) Updating this IEE report to reflect changes in the project, environmental or social conditions in the study area, and ADB safeguards policy.

24. Public consultation was not possible during the initial review period because the return of displaced persons and other residents was still at an early stage at that time. Nevertheless preliminary contacts were made with certain stakeholders in April 2010, and further meetings are planned over the succeeding months.

25. Changes were made throughout the IEE where necessary, and several new sections of text were added, together with new data, illustrations and interpretations. The assessment of impacts and proposed mitigation were reviewed in detail and revised as appropriate. An EMP was added setting out in detail how each mitigation, compensation, or enhancement measure should be implemented, and its effects monitored.

26. Many of the organizations listed above were re-visited during the updating period to seek new baseline data and to inform them of the recommencement of the project and the likely program for implementation. This opportunity is taken to thank these and other agencies and the many stakeholders in the local community and elsewhere for their continued cooperation, support and interest in the project.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

27. ADB's Environment Policy requires the consideration of environmental issues in all aspects of the ADB's operations. The requirements are defined in the Safeguards Policy Statement (2009), which covers issues of environment, involuntary resettlement, and indigenous peoples and supersedes former policies in these areas. The new safeguard policy affirms that ADB considers environmental and social sustainability as a cornerstone of economic growth and poverty reduction in Asia and the Pacific and is committed to ensuring the social and environmental sustainability of the projects it supports.

28. Safeguards in this context are operational policies that seek to avoid or reduce to acceptable levels adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process. The objectives of ADB's safeguards are to:

(i) avoid adverse impacts of projects on the environment and affected people, where possible;
(ii) minimize, mitigate and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
(iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

29. In the field of environment the principal tool for achieving these aims is environmental assessment, which is a generic term for the process of environmental analysis and planning to avoid or reduce the environmental impacts and risks associated with a project. The nature of the assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project, the sensitivity, scale, nature and magnitude of its potential impacts, and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts and are assigned to one of the following categories:

Category A: Projects likely to have significant adverse environmental impacts, which are irreversible, diverse or unprecedented and may affect an area larger than the location subject to physical works. An Environmental Impact Assessment (EIA) is required.
Category B: Projects with adverse environmental impacts that are less significant than those of category A projects, are site-specific, generally not irreversible, and in most cases can be mitigated more readily than for category A projects. IEE is required.
Category C: Projects likely to have minimal or no adverse environmental impacts. No environmental assessment is required, although environmental implications are reviewed.

30. ADB has classified this project as Category B, mainly because, once completed, its environmental and social impacts will be largely beneficial; any negative impacts of location, design, construction, or operation are expected to be minor; and avoidance, mitigation, or compensation for negative impacts should to be relatively straightforward. An IEE was therefore conducted and the results are presented in this document.

31. The exact locations of certain project facilities (including sewage pumping stations and the treatment plant outfall) are to be decided during the detailed design. It may therefore be necessary to review the IEE at that stage to determine whether any further mitigation is required to address unforeseen impacts at or resulting from the location of these facilities. The need or otherwise for such action will be reported and consulted with ADB at that time. It may also be necessary to revise the IEE to comply with national law, and this will be determined by the government CEA in liaison with NWSDB as explained below.

B. National Law

32. The requirement for Environmental Assessment in Sri Lanka is established by the National Environment Act (1980), and the procedures are defined in the EIA Regulations (1993). The regulations specify activities for which environmental assessment is mandatory, and those that could occur within this project are as follows:

(i) A Water Treatment Plant with a capacity of over 500,000 m^3/day;[4]
(ii) Laying more than 1 km of pipes for transporting liquid (excluding water); and
(iii) Projects that fall within sensitive area(s).

33. Sensitive areas are defined in the EIA Regulations as:

(i) Any erodible area declared under the Soil Conservation Act (1951, 1953);
(ii) Any Flood Area declared under the Flood Protection Ordinance (1924, 1955) and any Flood Protection Area declared under the Sri Lanka Land Reclamation and Development Corporation Act (1968, 1982);
(iii) Any reservation beyond the Full Supply Level of a reservoir;
(iv) Any archaeological reserve, ancient or protected monument as defined or declared under the Antiquities Ordinance (1965);
(v) Any area declared under the Botanic Gardens Ordinance (1928, 1973);
(vi) Areas within, or less than 100 m from the boundaries of, any area declared under the National Heritage and Wilderness Act (1988): the Forest Ordinance;
(vii) Areas within, or less than 100 m from the boundaries of, any area declared as a Sanctuary under the Fauna and Flora Protection Ordinance (1937);
(viii) Areas within, or less than 100 m from the high flood level contour of, a public lake as defined by the Crown Lands Ordinance (1947, 1949, 1956) including those declared under Section 71 of the Ordinance; and
(ix) Areas 60 m or less from the bank of a public stream as defined in the Crown Lands Ordinance, with a width of more than 25 m at any point.

34. The requirement for EIA and the level of study required are determined by the CEA after submission by the proponent of a Project Information Document (PID), plus supporting information if relevant. There are two possible outcomes:

(i) Categorical Exclusion: the activity is not on the list of prescribed projects in the EIA regulations, is not in or near a sensitive area, has not been the subject of public protest, and it is clear from the PID and supporting information that the project will have no significant environmental impacts. Environmental Clearance is granted (with or without conditions) and the project may proceed; and
(ii) All other projects require Environmental Assessment and the CEA establishes a Scoping Committee to decide on the level of study (IEE or EIA) and prepare

[4] The Central Environment Authority is considering a proposal to lower this limit to 500 m^3/day.

Terms of Reference (TOR). Alternatively, if the project lies wholly within the jurisdiction of a single government agency (e.g. UDA) CEA may refer the project to this authority (as the Project Approving Agency) to administer the EIA process. A Technical Review Committee reviews the completed IEE or EIA report and recommends whether Environmental Clearance should be granted; the final decision is made by CEA.

35. Phase I Stage 1 of this project involves provision of 27,000 m^3/day of treated water to a population of 300,000 people and installation of an urban sewerage system in the densely populated Jaffna Municipality and Nallur *Pradeshiya Sabha* areas. It is, therefore, a relatively large project that will be implemented in a densely populated area and it involves certain activities (provision of sewerage pipelines and construction of an intake in Iranamadu Tank) that are prescribed by the EIA regulations and, therefore, require environmental clearance from CEA. The project also involves certain other activities that might be considered as sensitive by local communities, including abstraction of water from a reservoir that is distant from the main supply area where the water is already used for both irrigation and domestic purposes; and discharge of treated sewage effluent to a coastal area with an important fishery.

36. It is likely, therefore, that CEA will require an environmental assessment study, and as previous IEE reports prepared according to ADB procedure have been accepted by CEA as fulfilling the requirements of national law, it is anticipated that that will also be the case for this document. In preliminary discussions, CEA have advised that NWSDB should submit the PID accompanied by the IEE and other supporting material so that CEA may determine whether further studies are needed.

37. In addition to environmental clearance, NWSDB will also need to obtain approval from the local authorities and CEA for site clearance and they should inform and obtain consent from all relevant *Pradeshiya Sabhas*, Municipal Councils and Divisional Secretaries before construction begins. They will also need to obtain EPL from CEA for the operation of the completed facilities, in particular the treatment plants and sewerage networks.

38. There are further compliance requirements prescribed by certain other legislation, in particular the Coast Conservation Act which requires clearance by the Coast Conservation Department (CCD) for any development activity or structure in the Coastal Zone (defined as the area from 2 km seawards of the Mean Low Water Line to 300 m landwards of the Mean High Water Line). If the CEA or CCD requires any additional environmental studies, NWSDB will be responsible for conducting these, and complying with any conditions set by these agencies or the local authorities in granting approval.

39. Table 1 summarizes the application procedures for the four main environmental permits, and Figures 1 and 2 illustrate the process of obtaining Environmental Clearance and a CCD Permit.

Table 1: Summary of Procedure for Obtaining Main Environmental Permits Required by the Government of Sri Lanka

Legislation	Regulatory Authority	Summary of the Procedure	Timescale
1. CEA EIA/IEE Clearance (See Figure 1)			
National Environmental Act No. 47 of 1980 and amended Act No. 56 of 1988; Government Gazette No. 772/22 of 24th June 1993 and No. 859/14 of 23rd February 1995	CEA of Sri Lanka	1. Submit Preliminary Information to CEA	During feasibility stage
		2. Designate PAA by to CEA	
		3. Scoping; Issue of Terms of Reference for EIA/IEE by PAA	36 days
		4. Conduct the IEE/EIA study and submit the report to PAA	About 60 to 90 days
		5. Check for adequacy by PAA	14 days
		6. Open for public comments (only for EIA)	30 days
		7. Review by TEC appointed by to CEA	
		8. Issuance of approval by PAA/ to CEA	36 days
2. Coast Conservation Department Permit (See Figure 2)			
Under Section 5, 14, 15 and 16 of Coast Conservation Act No. 57 of 1981	Coast Conservation Authority of Sri Lanka	1. Submit application to CCD	During feasibility stage
		2. Issue of TOR for - EIA / IEE by CCD	About 14 days
		3. Conduct the IEE / - EIA study and submit the report to CCD	About 60 to 90 days
		4. (i) Invite Coast Conservation Advisory Council for comments (Only for - EIA); and (ii) Open for public comments (Only for EIA)	120 days (maximum)
		5. Review of comments	
		6. Issuance of permit by CCD	
3. Archeological Impact Assessment Survey			
Under Section 47 read with Section 43(b) of Antiquities (Amendment) Act No. 24 of 1998; Gazette Notification No. 1152/14 dated 4 October 2010	Department of Archaeology Sri Lanka	1. Submit application to the Department	During feasibility stage
		2. Conduct a Preliminary Observation by Regional Office and submit the report to the Department	
		3. (i) If there are no antiquities according to the recommendation and observation report, land will be released for the project.	About 30 days
		(ii) If the preliminary observation report has proposed to carry out an AIA survey, steps will be taken to conduct the survey.	
		4. Call for quotations for AIA from registered agencies by the Department and award the survey	About 30 days
		5. Conduct the AIA survey by the selected agency and submit the report to the Department	42 days

		6. Submit AIA report to Minister in charge for approval	About 30 days
		7. Issuance of permit by the Department	
4. Environmental Protection Licence			

AIA = archaeological impact assessment, CCD = Coast Conservation Department, CEA = Central Environment Authority, EIA = Environment Impact Assessment, EPL = Environmental Protection License, IEE = Initial Environmental Examination, PAA = Project Approving Agency, TEC = technical evaluation committee, TOR = terms of reference.

Figure 1: Procedure for Obtaining Environmental Clearance

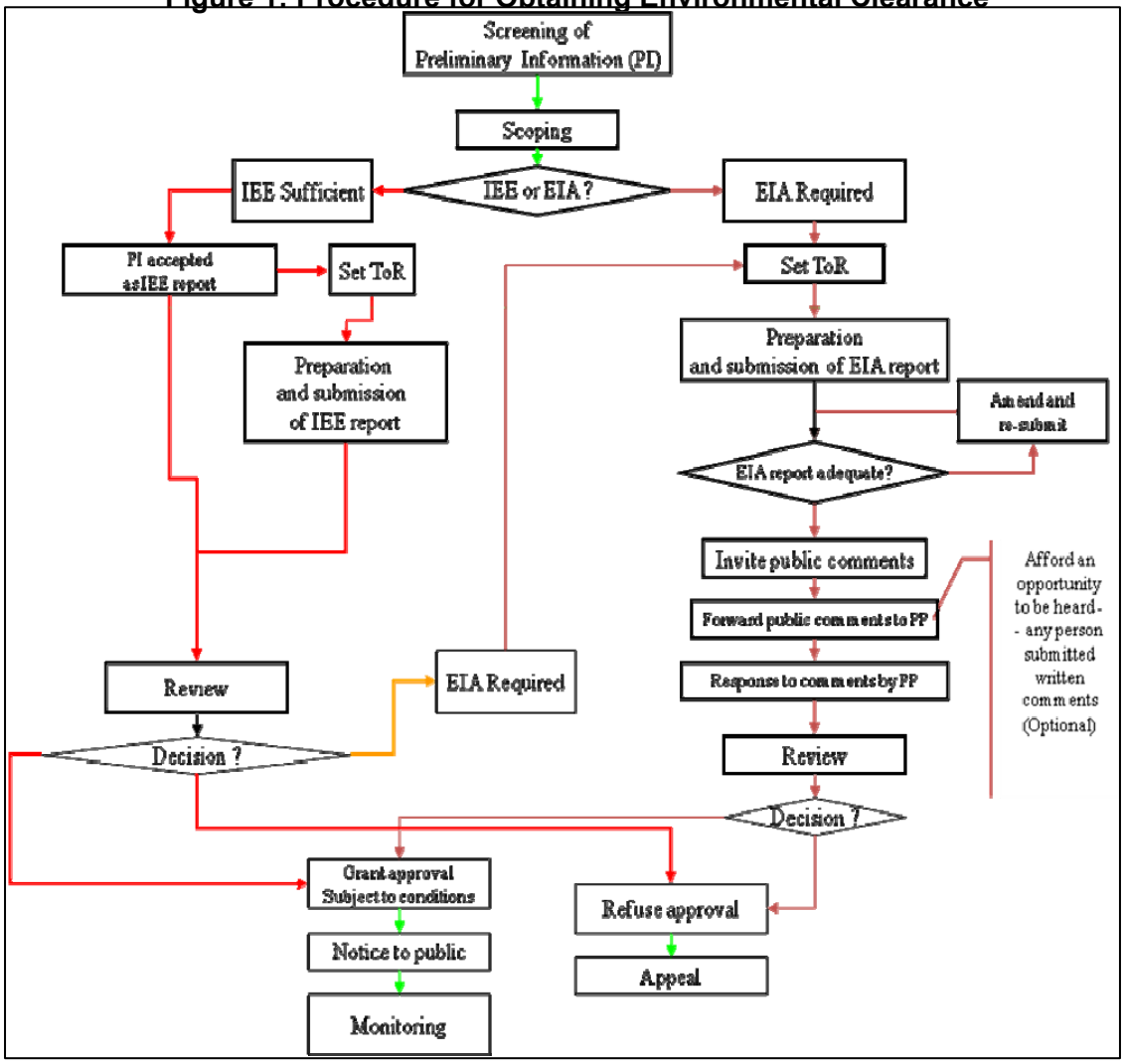
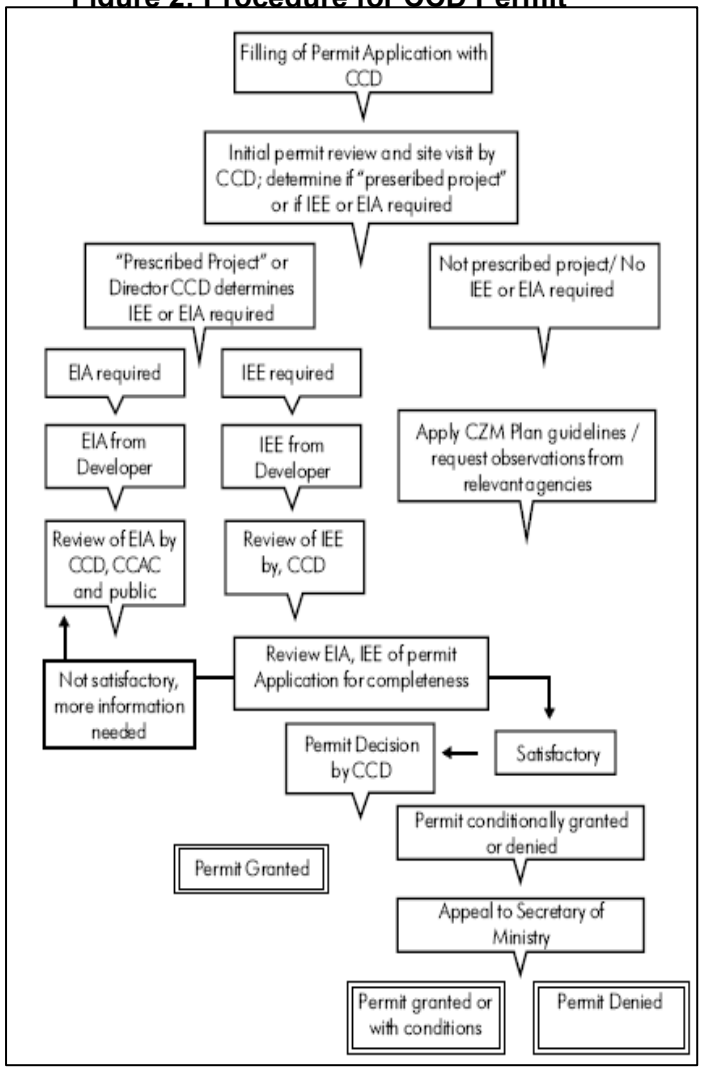


Figure 2: Procedure for CCD Permit



CCD = Coast Conservation Department, EIA = Environmental Impact Assessment, IEE = Initial Environmental Examination, TOR = terms of reference.

III. DESCRIPTION OF THE PROJECT

A. Type of Project

40. The revised project consists of two main infrastructure components, providing (i) domestic water for the District of Jaffna and Pachchilaipallai, Pooneryn, and Poonakary divisions in Kilinochchi District; and (ii) sewerage facilities and a sewage treatment plant (STP) for Jaffna Municipal Area and Nallur *Pradeshiya Sabha*. The project aims to enhance the domestic water supply and sanitation service in these areas to improve the quality of life of the inhabitants by ameliorating the adverse impacts on human health caused by present services, and improving environmental quality and living standards.

41. This will be complemented by proposed capacity building and institutional strengthening elements of the project which will include a comprehensive training program to be implemented during project construction and into the early part of the operational stage. The main objective of this program is to guide and prepare the concerned staff of the regional office (NWSDB) and other stakeholders to enable them to manage and operate the new water and sewerage schemes effectively.

42. Capacity building will involve institutional strengthening by providing administrative infrastructure and equipment-related facilities to improve performance and efficiency of services. Intensive instruction will also be provided through a series of workshops as well as on-the-job training to enhance the capability of the staff involved. Apart from the NWSDB and JMC, training will also be given to other institutional stakeholders, such as *Pradeshiya Sabhas*, NGOs (involved in water supply and sanitation) and community-based organizations (CBOs).

B. Need and Justification for the Project

1. Water Supply

43. The only fresh water resource in the Jaffna Peninsula is groundwater. Its vulnerability to saline intrusion from below, and contaminant leachate from above is such that without an integrated approach for protection of water resources, sustainable use from this source cannot be guaranteed. Open wells are the common source of domestic water but these are generally contaminated with faecal pollution from septic tanks and soakage pits located close to wells. In Jaffna District there are about 53,600 protected wells, around 8,800 unprotected wells and some 5,100 tube wells. However, the quality of water is generally not satisfactory due to the widespread presence of chlorides and pathogenic organisms.

44. In addition to the problem of water quality, the available quantity of groundwater is also inadequate. The demand of water for domestic, institutional, commercial, and industrial purposes in the Jaffna Peninsula is estimated by this study as increasing; 88,514 m^3/day (including 4,425 m^3 of treatment plant loss) in the year 2028 for a population of 925,000. There is also an additional demand of 400,000 m^3/day for agriculture. Modelling studies showed that available groundwater sources can supply only 13,100 m^3/day over a prolonged (10 years) dry period so additional supply must be sought from outside sources.

45. Where the Jaffna City water supply is concerned, the Mahadeva report of 1936, Gunasegaram report of 1979 and the report of Harrald Kraft of GTZ in 2002 have all clearly confirmed the unavailability of adequate and satisfactory potable water within the city limits and suggested exploration of resources outside. The nearest identified source is the Iranamadu

Tank on the mainland within the adjacent district of Kilinochchi, and the feasibility study suggests abstracting water from that source to supplement the present groundwater use.

2. Sewerage and Sewage Treatment

46. In the highly populated Jaffna Municipal Council Area and the Nallur *Pradeshiya Sabha* area it is common for every household to have a well due to limited supply or non-availability of pipe-borne water. Due to very small land parcels, the septic tanks or latrines and the wells exist in close proximity to one another (3-6 m separation in most cases). At present, wastewater from each property is either infiltrated through soak pits or discharged into the storm water drain. As a result, well water used by the occupants is polluted both biologically and chemically. With improvements in water supply, the generation of increased quantities of wastewater would almost certainly aggravate the existing problem. Considering all the factors that cause groundwater pollution and concomitant health hazards, the introduction of a comprehensive sewerage system is clearly a priority for the high density population areas of Jaffna Municipal Council and the University of Jaffna.

C. Description and Context of the Project

47. The IEE was prepared during the initial stage of project development, when only limited engineering and planning studies were conducted, involving consideration of options and outline designs, to the extent necessary to confirm the technical and financial feasibility of the proposals. The project will be developed further in the design stage (currently scheduled for mid-2011) when all facilities will be designed in detail, and during the subsequent tendering process, when contractors bidding for the construction contracts will be required to develop and present their working methods. The project will then be constructed during 2012 and 2013.

48. The following description of the project and the approach to construction is therefore presented on the basis of information available at the feasibility study stage, supplemented by knowledge of standard approaches to projects of this nature where appropriate.

1. Water Supply

49. Figure 3 is a schematic diagram of the water supply subproject. The scheme proposed by the feasibility study involves developing a new surface water source at the Iranamadu Reservoir, to provide 50,000 m^3 of water per day in two stages: Stage 1, 27,000 m^3/d; Stage 2, a further 23,000 m^3/d. Supply, treatment and distribution will require the following components:

(i) Refurbished and raised reservoir bund and refurbished spillway head-works;
(ii) New intake structure and raw water gravity main;
(iii) Water Treatment Plant (WTP) with raw- and treated-water sumps, treatment tanks, etc.;
(iv) High lift pumps and treated water pumping main; and
(v) Elevated water towers and water distribution network.

50. Hydrological modelling and irrigation-use studies reported in the feasibility study documents suggested that an additional 1,250 acre feet of water per month (51,000 m^3/day) could be abstracted from the reservoir if the earth and clay retention bund was rehabilitated and raised by an additional 2 feet (0.61 m), to a full supply level (FSL) of 103 feet (31.39 m) above sea level (ASL). This would however require a change in agricultural practice in the area served by the Iranamadu irrigation scheme, involving farmers planting rice only in the wet season and

changing to other crops in the dry season. Although this was agreed in 2006, such a change was considered unacceptable by the PID and District Secretaries when discussed during the project review period in 2010.

51. The water resources review study[5] therefore recommended abstracting the 27,000 m^3/d required for Phase I Stage 1 in the first instance (involving the same infrastructure improvements as proposed in the feasibility study); and to increase abstraction to 50,000 m^3/d subsequently (by changes in the operation of spillways), if crop diversification is successfully introduced, and if a review of tank performance after FSL raising suggests that an increase in capacity could be safely accommodated.

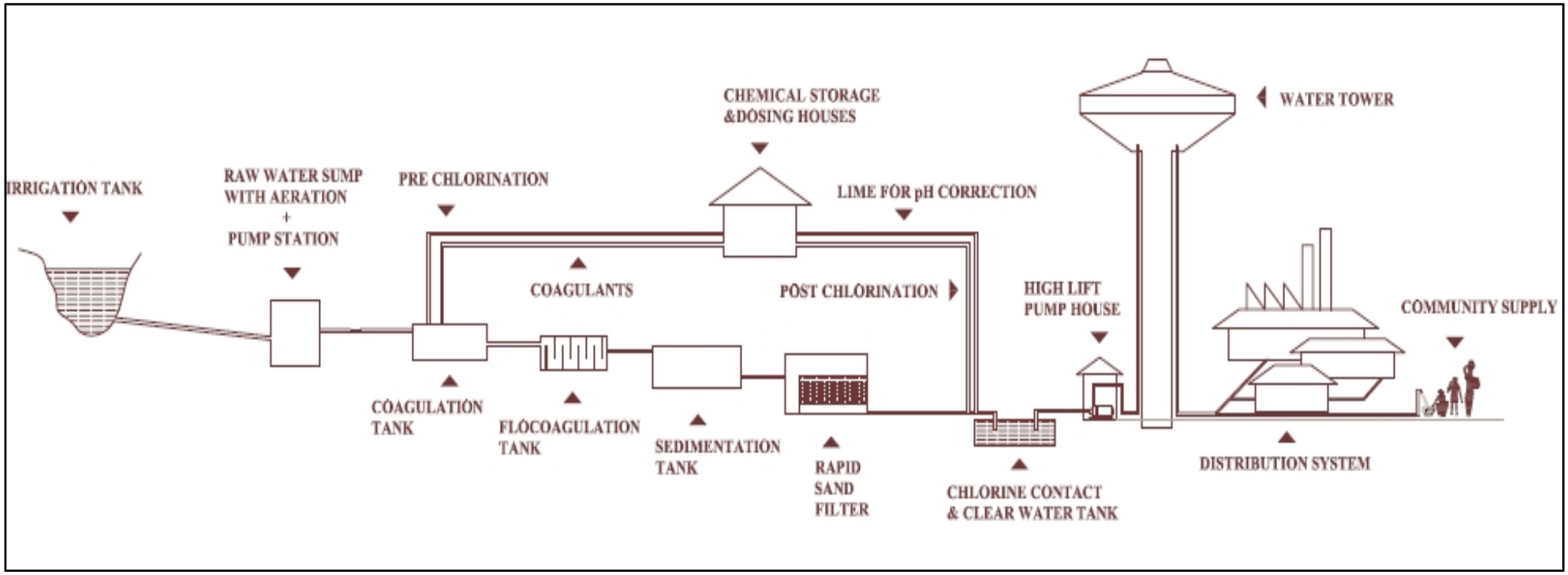
52. Increasing the storage and abstraction of water at Iranamadu Tank will require improvements in the existing bund[6] and head-works, and construction of a new intake. The proposed bund improvements are shown in Figure 4 and will involve application and compaction of earth fill on the crest to repair and raise the surface; and application of sand and earth at the toe of the downstream side to strengthen the structure and incorporate drains to allow safe discharge of seepage. Gabions[7] will also be placed at intervals along the upstream side of the embankment to form horizontal walls, with rip-rap stone/rubble between the walls to protect the surface from wave erosion.

53. Discharge of water from the tank currently occurs across a 183 m wide concrete spillway, onto a badly eroded concrete-slab stilling basin (Figure 5). Flow is controlled by 11 concrete and steel radial gates, five on the left bank and six on the right, separated by a 103 m un-gated spillway. There are also sluices through which water is diverted into irrigation canals (Photo 1). All head-works are dilapidated and will be repaired by the project to restore stability and safety; and three new radial gates will be provided to enhance functioning under the new operating regime (Figure 5). The un-gated section will also be raised by 0.61 m. Work will involve demolition, and replacement of parts of the existing head-works, creation of new reinforced cement-concrete (RCC) structures, and addition of pre-fabricated steel gates, plus switchgear and other components for electrical operation.

54. A new raw water intake will also be constructed at a suitable location near the existing left bank main channel sluice of the tank. This will be mainly of RCC box-type construction and will have inlets at several vertical heights to allow continued functioning as water level falls during the dry season. From here it is proposed to transfer the raw water by gravity through a 32.5 km main pipeline to a raw water sump at the WTP to be built at Palai. The first 12 km of the pipe (Iranamadu to Paranthan) will be of 800 mm diameter ductile iron, and will be located alongside the existing left bank irrigation channel. The remaining 20.5 km (Paranthan to Palai) will be of 600 mm High Density Poly-Ethylene (HDPE) pipe and will be in the government-owned right-of-way (ROW) alongside the A9 highway (Vavuniya-Jaffna road) north of Karadipoku junction.

[5] ADB 2010: Jaffna Water Supply Scheme – Review of Irrigation Component by PWC Dayaratne, 18 pp.
[6] Earth embankment
[7] Wire mesh baskets filled with stone.

Figure 3: Schedule of the proposed Water Supply Sub-project



55. The proposed treatment process for the 27,000 m^3/day capacity treatment works is summarized in Figure 3. Treatment will involve coagulation, flocculation, sedimentation and filtration, plus pre-and post- treatment chlorination. Each process will be conducted in a separate tank of RCC to be constructed at the WTP site, along with necessary pumps, pipe-work and other facilities. The site will cover approximately 4 ha and the layout is shown in Figure 6.

56. When the WTP is operating, sludge will be produced from coagulation-sedimentation basins and from backwashing of the filters and this will be pumped into purpose-built earth-sided lagoons, also at the WTP site, and allowed to dry out. The settled sludge from the filter backwash equalizing reservoir will also be pumped to the sludge lagoon, whereas the coagulation-sedimentation sludge will discharge by gravity.

57. After treatment, the water will be pumped to various elevated towers on the peninsula (see Appendix 1) and to ground sumps at Kaddudai west of Jaffna and Araliturai on Kayts island. The 44 km treated water pumping main (of 600 mm diameter Ductile Iron) will run parallel to existing roads, buried within the ROW. From Kaddudai, water will be pumped though transmission mains to the islands of Karainagar and Kayts, and thence to Pungudutivu, Mandaitivu, Nainativu, Analaitivu and Eluvaitivu Islands. The distribution system from other elevated towers (both existing and new) will supply Jaffna, Palai, Kodikamam, Chavakachcheri, Navatkuli, and Kopay. In total there will be 17 new towers and 11 refurbished existing towers; and the new distribution system will involve 520 km of 63-300 mm diameter unplasticized (rigid) Poly Vinyl Chloride (uPVC)/Medium Density Polyethylene (MDPE) pipes, including 275 km in Jaffna and Nallur.

2. Sewerage and Sewage Treatment

58. The sewerage systems for the high density neighbourhoods of the Jaffna Municipal Council and University of Jaffna areas will transport wastewater from domestic, commercial and institutional establishments to a central STP through a sewerage system and pumping stations. For domestic and non-domestic sewage the system will serve a total equivalent population of 91,576 in 2028, which is expected to generate an average dry weather flow of 211 l/s, a peak dry weather flow of 844 l/s and a design wet weather flow of 971 l/s.

59. Sewer pipes and pumping mains will be 150-525 mm diameter uPVC, and a total of 187 km will be laid below ground in the ROW alongside roads in the served areas. The STP will be located on the coast at Kallundai on a 4.5 ha plot of government-owned land under the control of the Valikamam South-East Divisional Secretariat (see Appendix 2). Pumping stations will be positioned at various points around the sewer network and specific locations will be determined during the detailed design stage. Wherever possible these will also be located on government land, controlled either by Jaffna Municipal Council or *Pradeshiya Sabhas*. Each pump station will be relatively small (around 50 x 50 m) and will contain a wet well and dry well, plus pumps, pipes, electrical switchgear, and other equipment and components.

Figure 4: Proposed Improvements to the Bund of Iranamadu Tank

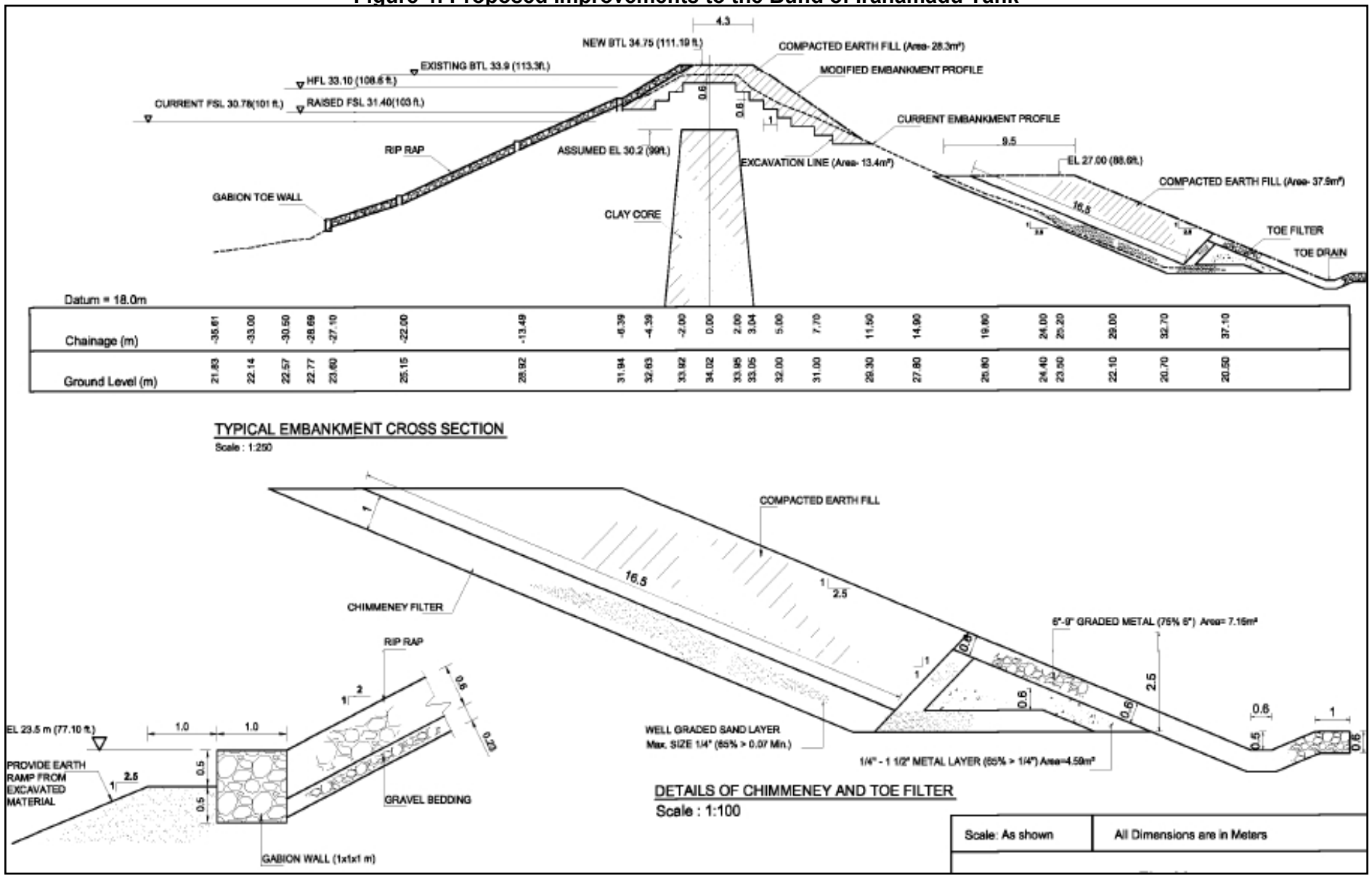


Figure 5: Plan View of Existing Spillway from Iranamadu Tank, Showing Location of Proposed New Radial Gates

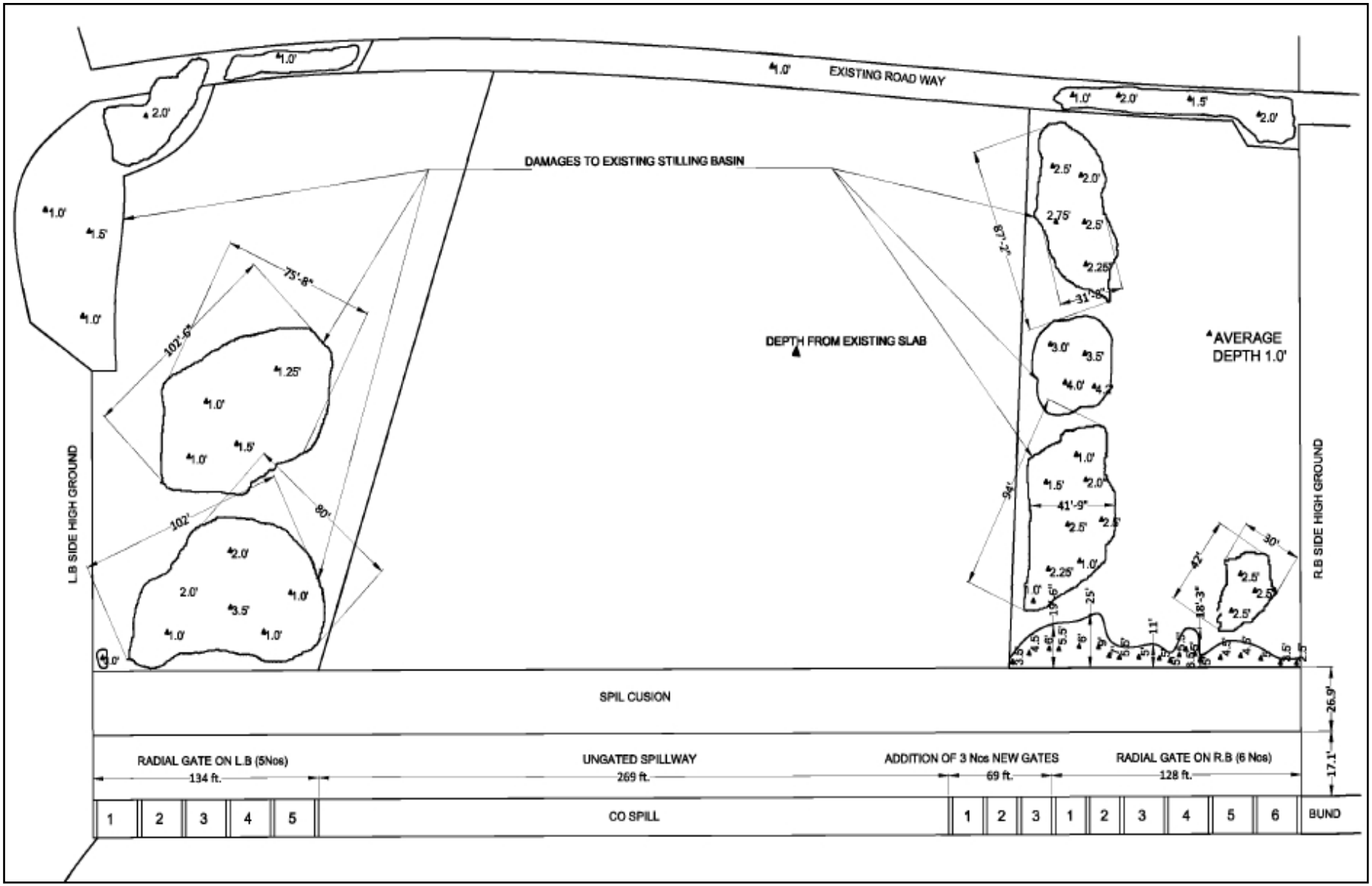
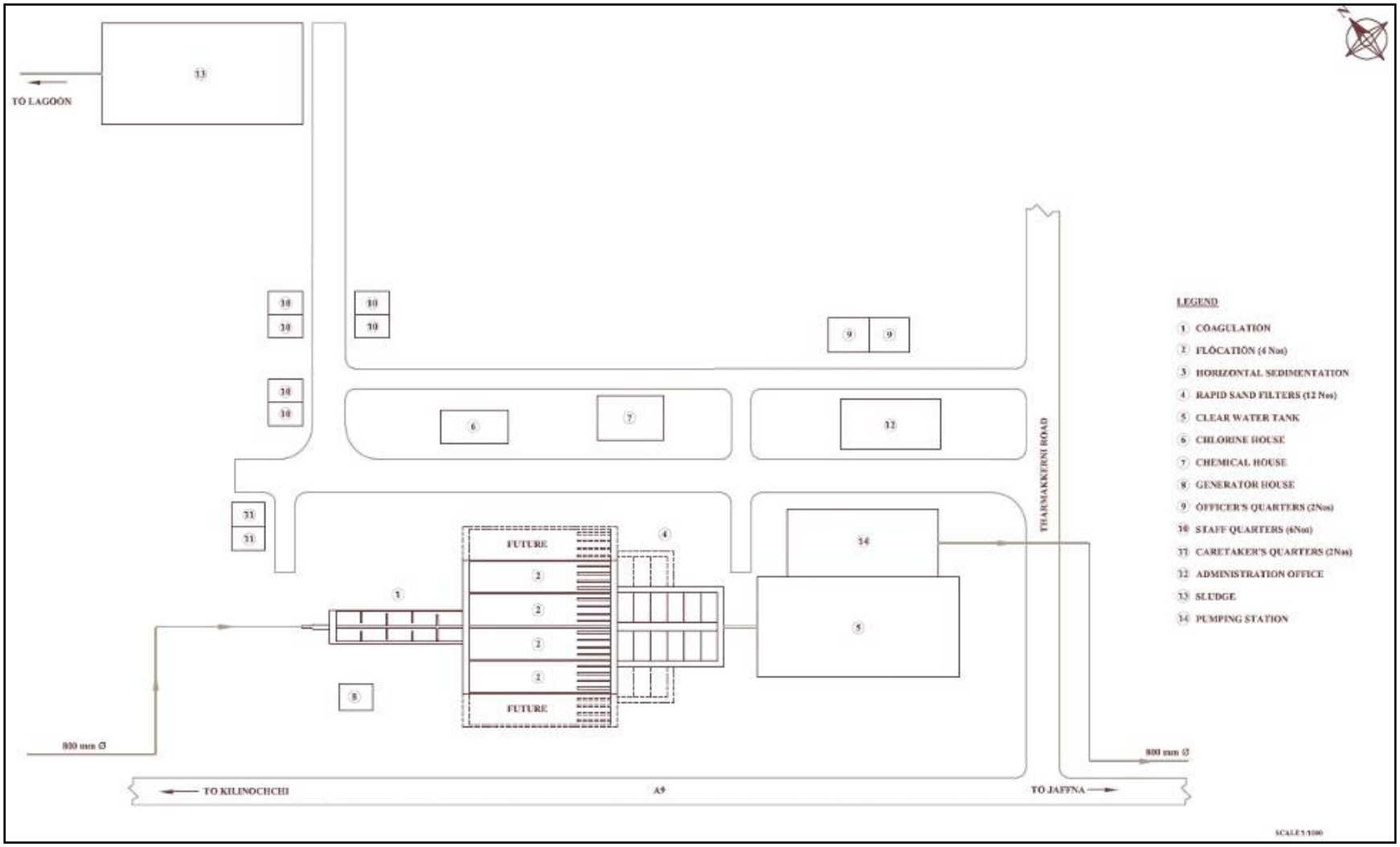


Photo 1: Iranamadu Tank Spillway, Radial Gates and Spill Cushion

Photo 2: Existing Water Tower in Jaffna

Figure 6: Layout of Proposed Water Treatment Plant



60. The method of sewage treatment must produce an effluent that meets the legal effluent discharge standards for sea disposal shown in Appendix 3. Two treatment methods were considered in the feasibility study (activated sludge or waste stabilization ponds), which are dependent on the land area available. The activated sludge method requires less space, but is more complex and costly as it would involve aeration to produce an effluent of the requisite quality for sea disposal.

61. Kallundai was chosen as the STP site in preference to alternative sites, however, given the land limitations, it is likely that activated sludge treatment option will be adopted. This will involve construction of primary sedimentation tanks, aeration tank, secondary sedimentation tank, with facilities for recirculation and appropriate treatment for sludge thickening and stabilization, of which details will be determined during detailed design. Both treatment methods considered in the feasibility study require the pumped disposal of treated effluent to the sea through an outfall. Two possible outfall locations were considered during the feasibility study.

Photo 3: Sewage Treatment Ponds

IV. DESCRIPTION OF THE ENVIRONMENT

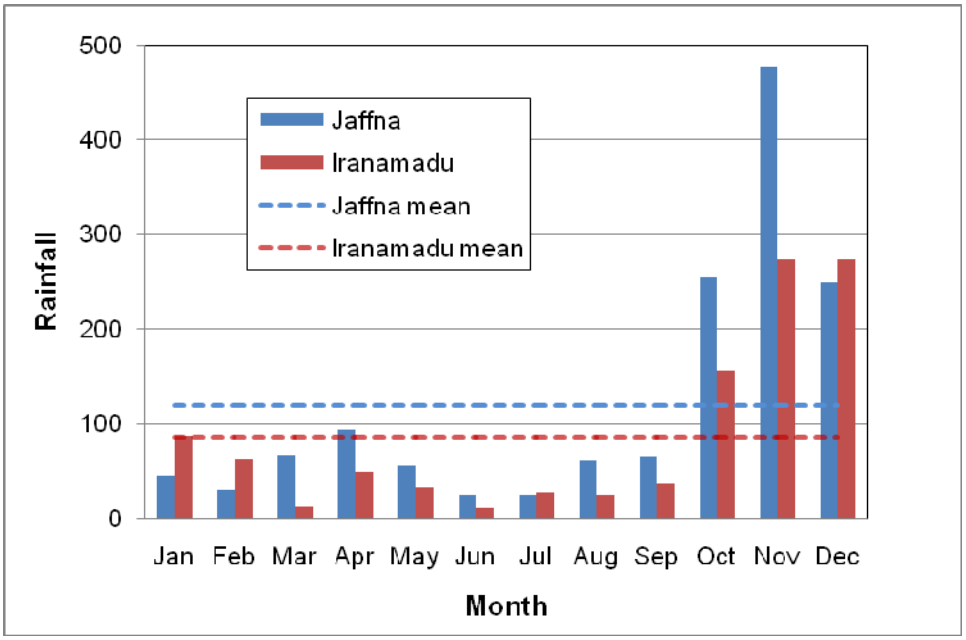
A. Physical Resources

1. Climate

62. Jaffna District is in Sri Lanka's dry zone. The average temperature is 28.2 ºC, and maximum and minimum averages are 33.3 and 21.4 °C, respectively. The mean annual rainfall over the past decade is 1,357 millimetre (mm). Peak rainfall occurs during the months of October to January with the Northeast Monsoon producing about 75% of total annual rains. Scattered rains are experienced during April to May when the inter-monsoon rain is uncertain. The dry season in the region extends from June to September. Monthly average wind speed varies from 12.1 to 4.4 km/h and the highest level is recorded in May and lowest in November.

63. Kilinochchi District is also in the dry zone. The average annual rainfall here is 1,017 mm and again nearly 75% falls during the Northeast monsoon from October to January. The remaining period of the year is dry with the driest period being June to August. According to Vavuniya meteorological data, the average monthly temperature is 28.4 ºC while maximum and minimum averages are 35.0 and 21.3 ºC. The average monthly temperature ranges from 25.6 to 30.0 ºC. Monthly average wind speed varies from 5.9 to 1.7 km/h and the highest level is recorded in June, and lowest in November. Figure 7 shows the rainfall pattern in the project area.

Figure 7: Average Rainfall in Jaffna and Iranamadu



64. According to government zoning data the project area lies mainly in the agro-ecological regions of DL3 and DL4 of the Dry Zone Low Country. The major characteristics of these agro-ecological regions and the surrounding regions are shown in Table 2.

Table 2: Characteristics of the Agro-ecological Regions of Sri Lanka

Agro-Ecological Region	75% Expectancy of Rainfall (mm)	Terrain	Major Soil Groups	Land Use
$DL_{1(d)}$	> 900	Undulating and flat	Reddish Brown Earth; Rogosols; Low Humic Gley	Rain-fed upland crops; scrub, paddy
$DL_{1(e)}$	> 900	Undulating	Reddish Brown Earth; Low Humic Gley	Rain-fed upland crops; paddy, scrub
DL_3	> 800	Flat and slightly undulating	Red Yellow Latosol; Rogosols	Cashew, coconut, condiments, scrub, natural forest
DL_4	> 750	Flat	Solodized Slonetz; Solonchaks; Grumusol	Scrub, paddy, rainfed upland crops

2. Air Quality

65. No air quality measurements have been conducted in the study area. However the CEA has carried out monitoring in other towns, the closest being Anuradhapura, 100 km south of Kilinochchi. Table 3 shows the most recent results, taken in 1999, when the one hour average for all parameters measured was well below the National Ambient Air Quality Standards, including Carbon Monoxide (CO), Sulphur Dioxide (SO_2), Oxides of Nitrogen (NO_X), Nitrogen Dioxide (NO_2) and Nitric Oxide (NO).

Table 3: Ambient Air Quality Measurements in Anuradhapura, 1999

Parameter	Averaging Time	Maximum Permissible Level (ppm)	Recorded Level (ppm)
Particulate Matter	1 hr	-	32.4
Carbon Monoxide (CO)	1 hr	26.00	0.35
Sulphur Dioxide (SO_2)	1 hr	0.08	0.002
Nitrogen Dioxide (NO_2)	1 hr	0.13	0.003

ppm = parts per million
Source: Environmental Atlas of Sri Lanka, Central Environmental Authority, Ministry of Environment and Natural Resources, 2005

66. Considering the project area, where no highly polluting industries exist and the number of vehicles is much less than in other areas, except in Jaffna town, the ambient air quality is expected to be within the National Ambient Air Quality Standards. Moreover, most of the project area being coastal, the potential to attenuate any air pollutants is very high due to wind movement between land and the sea.

3. Topography and Soils

67. The area of the Peninsula land mass is 1,129.9 square kilometres (km^2) of which lagoons occupy 45.7 km^2. The project area lies in the lowest peneplain, which is a gently undulating to rolling, mantled plain stretching down to the coast. The highest ground level is 11 m above mean sea level (AMSL). The land forms include floodplains, coastal plains, sand dunes, and beaches.

68. The soil is sandy along the coast but sandy clay or clayey sand in the interior with high infiltration rates. The peninsula overburden mantle is covered with three different types of soils classified according to agricultural suitability. They are:

(i) Calcic Red Yellow Latosols;
(ii) Solodized Solonetz and Solonchaks; and
(iii) Regosols on recent beach sands.

69. There is an obvious and expected correlation between land use and soil characteristics. The Red Yellow Latosol soils (RYL) are agricultural soils, highly suitable for crops. They are found extensively in Valikamam (Chunnakam aquifer, see below) and Vadamaradchi areas. These soils are deep and well drained. Regosols support horticulture, mainly coconut; and sandy soils sustain palm trees such as coconut and Palmyra and in some areas paddy rice is grown during the wet season under rain-fed conditions. There are pockets of loam earth (mixture of sand, clay, silt, and humus) suitable for some crops scattered throughout the peninsula.

70. Alluvial soils are found in a strip along the Kanakarayan Aru spreading towards Paranthan area. In general the richest dry zone vegetation occurs on these soils and tall trees with other mesophytic species of the dry zone are found. The catchment area of Iranamadu Tank mainly consists of Reddish Brown Earth and Low Humic Gley soils in which the natural vegetation is mainly dry mixed evergreen forest that may consist of thorny scrub jungle with stunted emergents. The RYL soils are common in undulating areas around Kilinochchi. Solodized Solonetz and Solonchaks can be found in flat terrains, especially from Elephant Pass to Poonakay. Vegetation around the tidal flats and estuaries is predominantly grassland with thorny scrub and a few scattered trees.

4. Surface Water

71. Throughout Jaffna District there are several seasonal streams, natural ponds and man-made storage “tanks” (normally created by building earth bunds across streams), but no permanent rivers. The drainage originating in Tellipalai and terminating at Araly channel drains a considerable part of Valikamam area and winds its way from Tellipalai through Kantharodai and Sandilipay and flows out through a salt water exclusion structure at Araly. The Valukai Aru is about 25 km long and has several regulators across the stream to facilitate flood irrigation of adjoining land, intermittent flood detention in the rainy season, and groundwater recharge. The Vadamaradchi, Uppu Aru, and Valukkai Aru lagoons have been converted to hold freshwater, and are also major devices for rain water harvesting and rain water detention.

72. Jaffna Peninsula has a characteristic and peculiar surface drainage system, comprising a cascade system of ditches (drainage canals) and ponds. This system is credited to the Dutch who colonised Sri Lanka in the 17th and 18th centuries. Geologists believe that ponds are limestone caves with collapsed roofs. The canals and ponds have been de-silted and maintained as drainage and detention devices and more importantly as sources of groundwater recharge.

73. During intense rainfall the drainage channels first fill the paddy fields and village ponds (usually sited in the middle of paddy fields) in sequence. Water then spills over and flows down to fill the next lower pond down the cascade and so on, ultimately draining into the sea or lagoons. The Provincial Irrigation Department has constructed ring spill structures at road crossings to impede this drainage and promote groundwater recharge.

74. In Jaffna, traditionally, surface water has been regarded as “dirty” and ground water as “purified”, and surface water is collected and conserved only as a means of infiltrating as much water as possible into the ground. Surface water in ponds is not considered acceptable to the Jaffna population as a source of drinking water because it is used for bathing and washing clothes, watering livestock, etc., and is frequently polluted from catchment areas. Dug wells in close proximity to the ponds are however accepted as sources for drinking water. Ponds hold in storage part of the water that would have escaped to the sea. Occasionally the ponds are used for lift irrigation.

75. There are about 630 large ponds in the Jaffna system, along with about 2,400 minor ditches with interconnecting drainage channels. However, many more ponds that existed in urban areas have been obliterated as they have been used as dumping areas for solid waste. A large proportion of the surface water of Jaffna (45.7 km^2) consists of coastal lagoons, containing seawater, or brackish water where there are inputs of excess irrigation water.

76. The drains in the city are open channels. Usually they have retaining walls with concrete dished inverts. The bed gradient is too gentle and self cleansing velocities are not developed even in heavy rain. Stagnation of water and siltation in the invert are therefore inevitable. There are 36 city ponds that function as temporary detention facilities. Unlike the rural area, city ponds do not serve the functions of irrigation. When designed and maintained properly, they help to prevent flooding and enhance the scenic beauty of the city. However the water in both the drains and ponds is contaminated with wastewater and solid waste leachate from the city commercial areas and residences. They are breeding areas for mosquitoes, encourage vermin and are a health hazard in their present condition.

5. Groundwater

77. There are two types of aquifer: karstic limestone and sand aquifers. The geology, geomorphology, climatic conditions, and proximity to the ocean combine to create a balanced dynamic groundwater system that is vulnerable to a variety of factors. In the limestone aquifer, the infiltrating rainwater forms fresh water lenses floating on the denser sea water. After infiltration into the ground, there is subterranean flow through solution channels in the limestone aquifer, draining part of the infiltrated water into the sea. However, the cavernous nature of the limestone provides a large storage reservoir, but its extremely high permeability causes a rapid dissipation of any recharge with rapid movement of fresh water to discharge points around the coastal fringe. Any occurrence of a large body of fresh water is therefore exceptional and its retention depends on maintenance of stringent conditions.

78. The soil cover and sand deposits originating from ocean and wind activity in turn become sand aquifers providing a limited amount of storage for monsoonal rainfall. These formations are useful and widely exploited for small water supply facilities. The sand aquifers are also underlain by Jaffna Limestone, into which the water in the sand will drain over a longer period of time.

79. The people of the Jaffna Peninsula have developed water supply facilities that are well-suited to the conditions. The numerous shallow, low-yielding wells distributed over large areas did not have the capacity to cause an imbalance of the dynamic conditions maintaining the fresh water lens. In more recent years however, the increased demand for water has led to pumping rates that have, in places, caused problems. These problems can often be attributed to high pumping rates concentrated in small areas. An additional problem with the widely distributed

shallow well system is that the groundwater is vulnerable to pollution in the absence of appropriate waste disposal arrangements.

6. Geology

80. Geological units exposed in the Jaffna area are part of a sequence of tertiary aged rocks which rests on a basement of Precambrian crystalline rocks. The total thickness is approximately 250 m, made up of three main units: Mannar Sandstone at the base, Jaffna Limestone, and a thin discontinuous surficial cover. The basal Mannar Sandstone comprises about half this total but is not exposed in the project area. Jaffna Limestone, which is 50-90 m thick, overlies the Mannar Sandstone and is extensively exposed in the western part of the peninsula in the Chunnakam area and in a small area to the west of Point Pedro. The limestone is also extensively exposed on the islands off the west coast.

81. Jaffna Limestone is of Miocene age coral reef formation and the easily soluble limestone also gives rise to a number of underground solution caverns. The upper surface of the limestone slopes gently to the south-east from the relatively high areas in the north-west where it forms the land surface in the general vicinity of Chunnakam. To the east of the Uppu Aru Lagoon, the limestone is generally obscured by younger formations.

82. The youngest geological unit is a thin discontinuous cover of unconsolidated deposits. In the Chavakachcheri-Palai area to the south-west of the Vadamaradchi Lagoon these deposits are yellow and brown sand, which is fine to medium grained and sub-rounded, with a maximum reported thickness of about 15 mm. Similar sand deposits occur in limited areas on the islands off the western end of the Peninsula, and in the western part of the Chunnakam area north of Jaffna City.

83. On the north east side of Vadamaradchi Lagoon there is a long almost linear belt of coastal sand dunes increasing from less than 2 km wide at the southern extremity to about 3 km at the northern end near Point Pedro. The sand beds appear to range from about 8 m to about 17 m thick with a maximum elevation of about 10 m above sea level. They are clearly a recent coastal feature and in places are currently mobile.

84. A third main type of surficial deposit is present in the central part of the Chunnakam area. The unit is very thin, with a reported maximum depth of about 3 m. There is an upper sandy part and a lower gravely part, and the characteristic reddish brown color is imparted by a coating of haematite on many of the constituent grains. The unit is not important as a potential aquifer, but may have an influence on recharge processes in the areas where it is present.

B. Ecological Resources

1. Fisheries

85. The fisheries sector in Sri Lanka is considered one of the major potential fields for expansion of the economy. Previously nearly 89% of the country's fish production was obtained from coastal fisheries, but this dropped to around 65% after 1990 because of the conflict in the north. Formerly the Northern and Eastern Province produced around 54% of the island's total fish catch but this dropped to 21% during the conflict. The tsunami of December 2004 then destroyed most of the fishing craft and the production of coastal fish dropped even further.

86. Until the mid 1980s the fisheries sector grew at a higher rate in Jaffna District than in other parts of the country. For example in 1983 Jaffna District contributed 26% (49,740 metric tons [MT]) of the total fish production and 57% (5,484 MT) of total dry fish production and provided employment for 24,840 people and indirectly to another 500 people. Fishing was then severely restricted due to security risks and has been almost totally prohibited since October 1995. A large number of craft and fishing gear were damaged by shelling and bombing; and many fishers left the area, resulting in further damage to craft from a lack of maintenance. Service infrastructure such as boatyards, ice plants, net factories, processing plants, jetties, co-operative buildings, trucks, etc., was also damaged or destroyed. As a result, in 2003 total fish production in Jaffna District was 5,311 MT and only 14,862 people were employed. Although the catch increased to almost 34,000 MT in 2004, the tsunami destroyed much of the operable infrastructure at that time so catches subsequently declined again (Table 4).

Table 4: Marine Fish Catch in Jaffna and Kilinochchi (MT)

District	1983	1990	1995	2000	2004	2005	2006	2007	2008
Jaffna	49,740	14,450	3,400	6,400	33,980	12,790	11,220	5,130	5,830
Kilinochchi	-	-	-	-	3,130	1,460	830	550	360

87. Despite the many setbacks, rehabilitation of the fisheries sector is now underway, even though fishing is prohibited in the High Security Zones operated by armed forces. It has been estimated that the Northern Province now accounts for 21% of the total fishers in the country while the fish production was 12% and 5% in 2006 and 2008 respectively. Tables 4 and 5 show the marine and inland fish production from Jaffna and Kilinochchi districts in the recent past. Table 6 shows the fish production by major commercial groups in Jaffna and Kilinochchi Districts. Carangids, blood fishes, sharks, skates, mullets, shore seine fish and prawns are the most abundant fish types in the area.

Table 5: Inland and Aquaculture Fish Production in Jaffna and Kilinochchi (MT)

District	1998	2000	2004	2005	2006	2007	2008
Jaffna	100	248	250	180	-	30	360
Kilinochchi	120	268	-	-	-	10	290

Source: Statistics Unit Ministry of Fisheries and Aquatic Resources

Table 6: Fish Production by Major Commercial Groups (MT)

Fish Group	Jaffna			Kilinochchi		
	2006	2007	2008	2006	2007	2008
Thora (Seer)	420	-	20	-	-	-
Paraw (Carangids)	1,080	120	270	30	10	10
Balaya (Skipjack)	10	-	-	-	-	20
Kelawalla (Yellowfin)	30	-	-	-	-	10
Tuna-like (Blood fishes)	1,480	470	940	50	-	30
Mora/Maduwa (Sharks/Skates)	890	230	160	20	10	20
Rock fish (mullet)	1,100	880	1,050	60	30	30
Shore seine (small fish)	3,970	2,530	1,870	220	360	160
Prawns	930	410	910	80	10	30
Crabs	-	-	70	-	-	10
Lobsters	-	-	10	-	-	-
Others	1,310	490	530	370	130	40
Total	11,220	5,130	5,830	830	550	360

Source: Statistics Unit Ministry of Fisheries and Aquatic Resources

2. Aquatic Ecology

88. Most of the lagoons are important for fisheries because the young stages of many shrimp and fish spend much of their early life history in protected shallow waters such as these. They also attract considerable numbers of birds, particularly flamingos, ducks, and some shore birds. The lagoons are as follows:

(i) Delft Island, with several shallow lagoons and a few fresh water ponds;
(ii) Pungudutivu Lagoon is a 390 ha shallow brackish to saline tidal lagoon with extensive mud flats;
(iii) Wetlands of Jaffna Peninsula, occupy 20,000 ha of shallow sea bays, intertidal mud flats, mangrove swamps, saline marshes, and a large shallow lagoon;
(iv) Uppu Aru Lagoon is a 3,000 ha brackish water lagoon with fringing mangroves, extensive mud flats and salt marshes. This is located interior of the peninsula and is surrounded by human settlements;
(v) Thondamannar Lagoon is a 7,787 ha shallow brackish to saline tidal lagoon with extensive mangrove swamps, sea-grass beds and mud flats. This is located interior of the peninsula and is important for fisheries and as a source of fuel-wood from mangroves;
(vi) Jaffna Lagoon is 40,000 ha of shallow tidal lagoon with extensive intertidal mud flats and fringing mangroves. This is important for fishing and is the most important site in Sri Lanka for greater flamingos (Phoenicopterus roseus). There are also salt-pans in the east of the lagoon; and
(vii) Chundikkulam Lagoon is a 13,500 ha large brackish lagoon with sea-grass beds and fringing mangroves. Pawn fishing, salt production and cultivation of palmyrah palms in the adjacent areas were common before the conflict and the lagoon supports a wide variety of waterfowl, notably migratory ducks, shore-birds, gulls, and terns.

89. The lagoons are also used as harbors and for ferry services and provide anchorage for fishing vessels. Compared to other lagoons in the country, those around Jaffna are somewhat less disturbed by anthropogenic activities. However, the wetlands of Jaffna Peninsula are threatened by destruction of mangroves, severe pollution and in-filling; and Thondamannar lagoon is threatened by reclamation of land for agriculture and aquaculture, and pollution by pesticides. Thondamannar and Uppu Aru lagoons have been converted into freshwater lakes for rainwater retention and harvesting by concrete salt water exclusion barrages built across the mouths. At present the barrages are not operating because of lack of maintenance and protests by fishers who recognise the importance of salt water lagoons to coastal fisheries.

3. Wildlife

90. Jaffna Peninsula and islands, with extensive lagoons, mudflats, sand-flats, sea-grass beds and shallow shores, is the most important area for migrating water birds in Sri Lanka, and regularly records the greatest numbers of birds, compared with the Hambantota-Bundala area in the south-east, which records the greatest number of species. There are three flying routes across India and the Bay of Bengal through which migrating birds come to Sri Lanka.

91. Birds of note found in the project area include the following:

(i) Indian Reef Heron (Egretta gularis schistacea) with two morphs (grey and white) occurs in very small numbers along the coast, particularly in Jaffna Peninsula;
(ii) Greater Flamingo (Phoenicopterus roseus) is the only member of the Flamingo family found in Sri Lanka and inhabits lagoons on the peninsula and islands;

(iii) The most common migrating ducks are Pintail (Anas acuta) and Garganey (Anas querquedula); and Widgeon (Anas penelope) is also found;
(iv) Common waders include Oystercatcher (Haematopus ostralegus), Black-winged Stilt (Himantopus himantopus), Avocet (Recurvirostra avosetta);
(v) Common gulls include Great Black-headed Gull (Ichthyaetus ichthyaetus) and Lesser Black-headed Gull (Larus fuscus);
(vi) Caspian Tern (Hydroprogne caspia) is most common along the north-west coast of the island, between Puttalam and Jaffna.

92. Tables 7 and 8 show the main species of waterbirds in Sri Lanka and the numbers found in Jaffna and the country as a whole, as recorded in annual censuses conducted by the Ceylon Birds Club.

Table 7: Numbers of Waterbirds Recorded in Jaffna and Sri Lanka, 2006

Group	No of Species	Sri Lanka Total	Jaffna Region
Grebes	1	120	2
Pelicans	1	161	-
Cormorants, Darters	4	3,978	873
Herons	11	6,046	783
Storks	5	879	317
Ibises, Spoonbills	2	454	158
Flamingos	1	650	100
Ducks	8	15,031	9,715
Rails, Coots	5	1,015	2
Jacanas	1	344	-
Shorebirds	33	17,014	1,998
Gulls, Terns	10	5,460	291
Raptors	7	60	10
Total	**89**	**53,342**	**14,249**

Source: Ceylon Birds Club, Annual Waterbird Census in Sri Lanka, 2006

Table 8: Total Numbers of Waterbirds in Jaffna and Sri Lanka, 1999-2006

Year	Sri Lanka Total	Jaffna Region
2006	53,342	14,249
2005	216,250	17,078
2004	234,648	81,214
2003	265,069	35,516
2002	219,872	25,978
2001	51,166	18,061
2000	103,976	25,032
1999	72,088	26,620

Source: Ceylon Birds Club, Annual Waterbird Census in Sri Lanka, 2006

93. Despite their importance, there is little formal protection of the wetlands of the Jaffna Peninsula, apart from the Chundikulam Lagoon sanctuary, which includes adjoining land areas and retains its major importance and value despite inadequate physical protection and policing of activities. Elsewhere the ongoing destruction of wetlands emphasizes the need to provide greater protection, for example in the extensive Uppuaru lagoon between the Peninsula and Kayts Island, the Poonalai mud and sand flats, Punkuditivu lagoon and the wetlands on Delfts.

4. Forests

94. In the Jaffna Peninsula there are no forests in and around the populated areas, except for Palmyra (Borassus flabellifer) plantations found as scattered patches and Casuarina plantations established by the Department of Forest Conservation along the sand dunes in Vadamarachchi area. However, the north-eastern part of the mainland, including parts of the Kilinochchi District, has large areas of forests and contains a large percentage of the forest cover of the country. Forests in the seasonally dry northern and eastern plains (transition between the wet and dry zones) consist of tropical semi-evergreen forests with their own characteristic species as well as some common to the adjacent zones. The major part of the dry zone has tropical dry mixed evergreen forests, where the dominant species seldom exceed 20 m in height and do not form a closed canopy.

95. There are two forests reserves in Kilinochchi District: the recently declared Thirumurukkandiya Forest Reserve and the 1,417 ha Panikkankulam Forest Reserve. These are along the western side of the A9 road in the Paranthan area.

96. In the Northern and Eastern Provinces, management of the forest reserves faced major difficulties during the conflict period. Forests, forest reserves and Palmyra plantations suffered heavy damage due to their use by combatants and the resulting effects of land mines and shelling, and from unregulated felling for timber. A skeleton staff of the Department of Forests Conservation continued to operate at Vavuniya but enforcement of the legal forestry regulations was prohibited in areas not controlled by the Government. As a result, some parts of the forest reserves were deforested and used for settlements or for other activities by combatants.

5. Rare or Endangered Species

97. The major legislation relating to wildlife in Sri Lanka is the Fauna and Flora Protection Ordinance (FFPO 1993), administered by the Department of Wildlife Conservation (DWC). This was created primarily for the purpose of protecting terrestrial biodiversity and has provision for the declaration of protected areas. However for more than three decades the conflict has prevented any detailed ecological assessments in the project area, and the only recent data collected on rare and endangered species is from some individual studies carried out by the universities.

98. A herpetological survey in 2002-2004 revealed 18 species of terrestrial snakes belonging to five families, with seven of the species being recorded for the first time on the Jaffna Peninsula. Four species were highly venomous, two were mildly venomous and the rest were non-poisonous. Two species were endemic to Sri Lanka: the variegated kukri snake (Oligodon taeniolata ceylonicus) and the Sri Lankan Rat Snake (Ptyas mucosa maximus), both of the family Colubridae.

99. Another recent survey in and around the Thondamanaru lagoon confirmed the presence of crocodiles. Two species are found in Sri Lanka: the marsh or freshwater crocodile

(Crocodylus palustris) and the salty or estuarine crocodile (C. porosus), which is the largest living reptile. Both are listed on Appendix I of CITES,[13] so their international trade is prohibited. In Sri Lanka, the two species would meet the IUCN criteria for being "endangered" and "critically endangered" respectively. Both species are recorded from northern extension of the Chandikulam Sanctuary, while freshwater crocodiles were known to be present in Palai. In the past crocodiles were known in a variety of places, including Nagarkovil, Varani, Ampan, Maruthankerni, Maanviluntha, Kooru, Mulliyan and from the extensive mangroves along the Thondamanaru lagoon. Today, the lagoon and its mangroves represent the last stronghold of the crocodiles in the Jaffna Peninsula. Reclamation of swamps, draining of coastal wetlands, conversion of mangroves to prawn farms, and the removal of riverine forests are some of the reasons for the decline.

100. Amongst the Peninsula's flora, Wild yam (Dioscorea), a large climber, with slender, cylindrical, twining stems, is a globally endangered species according to the Red Data Book of Sri Lanka. There are two species on the Island: Dioscorea koyamae and Dioscorea trimenii, both of which are endemic and highly threatened. Both were recorded at Maruthankerni (Vadamaradchy East) from the 1960's to the 1980's, but were destroyed by firewood seekers. Recently some specimens were found at Sanguvely, close to Manipay.

6. Protected Areas

101. Protected areas are managed by the Department of Wildlife Conservation, but in the Northern and Eastern Provinces such areas have been largely unmanaged during the war period, and as a result there is currently no information on their present status.

102. There are two protected areas in the project region and both of them are sanctuaries. These are areas where habitat protection is conducted in parallel with human activities, and they may include both government and privately-owned land. However, sanctuaries ensure the protection of wildlife which is outside the state land. It is not necessary to obtain a permit for entering into such areas. However, human activities within sanctuaries are regulated by the FFPO. Enforcement of the regulations was halted in the areas previously not controlled by the Government. As a result, some parts of the protected areas are being used for other purposes.

103. The protected area located in the area identified for the transmission route include the Chundikkulam Sanctuary, which is a terrestrial cum aquatic (include parts of the Chundikkulam Lagoon) bird sanctuary covering 11,140 ha. Available information for the period before the conflict showed that it is used for aquaculture in some parts and for cultivation of palmyrah trees around the lagoon. This sanctuary is located at a distance from the A9 road passage considered for transmission mains and also from other works related to water supply schemes. The Pariativu Island sanctuary is of 18 ha size and occupies the uninhabited Island, where no activities related to the project are planned.

104. Further, Important Bird Areas (IBA) – potential Ramsar Sites – have been identified by Bird Life International, many of which are important breeding and feeding areas for threatened bird species. In which, there are 3 of 24 such sites in Sri Lanka located in Jaffna Peninsula: Jaffna Lagoon (14,912 ha); Araly South, Ponnalai (550 ha); and Kayts Island, Mandativu (900 ha).

[13] Convention on International Trade in Endangered Species of Wild Fauna and Flora (1975).

7. Coastal Resources

105. The coastal resources in the project area include near-shore and lagoon fisheries, minerals resources such as Miocene limestone, cement raw material, silica sands, etc.

106. The places of scenic beauty constitute places that provide aesthetically appealing views of the beach with uninterrupted vistas of seascape and landscape. Manatkadu Sand Dunes are such a place. Recreational sites are the natural coasts with potential for activities such as swimming, diving, surfing, boating, sport fishing, relaxation and leisure walks. In the project area such sites also have scenic beauty. Senthakulam Beach, Casuarinas Beach, Castle Beach, and Kalmunai Point have such potential. In addition to the above, bird watching is also possible in Pariathivu and Chundikkulam sanctuaries. At present, these places of scenic beauty and recreational value are not utilized by people for such purposes, except Casuarinas Beach, due to security. Compared to other recreational sites in the coastal belt of Sri Lanka, such places in the project area are still not polluted by unplanned- and over- development.

C. Economic Development

107. The conflict which lasted for 25 years, the economic embargo, and other restrictions due to the conflict have impacted badly on the economic situation of the Northern Province. During the conflict period the environment was not conducive to the initiation of any economic and social infrastructure development activities. As a result, the regional economy has been tremendously weakened.

108. For rapid economic recovery, reviving industrial sector is of paramount importance as it would increase production and cash flow to the area. The government is making arrangements and financial assistance to the business community in Jaffna to rejuvenate their business and uplift the socio economic conditions in the Peninsula. Immense efforts have been made by the government in the reconstruction and development of the north in the recent past where the focus has been on key infrastructure development such as roads, electricity and water systems which will make the economic development process fast.

109. The Northern Province's contribution to the total production of the country and its composition by main sectors are shown on Table 9. The figures show that the contribution to the National GDP is minimal and there were no increment in growth of industry during the period.

Table 9: Northern Province's Contribution to GDP and the Composition by Sector

Year	Contribution to the National GDP			GDP Share by Sector – Northern Province		
	National	Northern Province	%	Agriculture %	Industry %	Service %
2001	1,245,598	29,490	2.37	21.02	6.99	71.98
2002	1,403,286	37,400	2.67	26.49	6.45	67.05
2003	1,562,739	43,126	2.76	28.39	6.93	64.69
2004	1,800,751	52,988	2.94	27.53	6.60	65.87
2005	2,098,004	64,004	3.05	24.77	7.79	67.45
2006	2,484,191	72,722	2.93	26.39	6.99	66.62

GDP = gross domestic product.
Source: Northern Province Council, Sri Lanka, 2009

1. Industries

110. Jaffna, in the pre conflict period was self-sufficient in every way with the industrial sector booming and residents maintaining a high per capita income. It was estimated that there were 750 industries in Jaffna prior to the conflict.

111. At present, there are limited number of industries operating in Jaffna Peninsula which includes lime stone crushers, toddy bottling industries, vehicle service stations etc. There were only 3 industries in Jaffna registered under the Ministry of Industrial Development and the Board of Investment of Sri Lanka and non in Kilinochchi, as of end of 2008.

112. The major irrigation schemes and other minor irrigation schemes spread out in the Northern Province will facilitate the agricultural and livestock development. Even under the conflict situation, the Northern Province produced 10 % of the total annual paddy production of the country. Production of Other Field Crops (OFCs) such as Red Onions were 40% of country total; Chilies, 10%; Green Gram, 14%; Ground Nut, 25%, etc. Main agro industries operated in Jaffna and Killinochchi are rice and flour mills, and oil extraction mills.

2. Infrastructure Facilities

a. Water Supply

113. All the water supply schemes excluding the micro scale schemes in the Jaffna Peninsula are in operation under the local authorities in the Peninsula and the NWSDB. Total numbers of structures installed under the water supply schemes are 81,722 open wells, 12,324 tube wells and 6,442 pipe lines.

114. There are 8 water supply schemes for the Jaffna Municipal area managed by the JMC with 2 main intakes located in Kondavil and Thirunelveli, and with 3 main water towers. The remaining other 6 water schemes are mini scale. At present, there are 12 water supply schemes in operation under the NWSDB in Jaffna Peninsula and Table 10 shows the details of them. The remaining schemes in operation in other District Secretary divisions are spread throughout Jaffna Peninsula. In these schemes, house connections are minimal compared to the Municipal and Urban schemes and stand post connections have been provided.

Table 10: Jaffna NWSDB Water Scheme Details for the Month of November, 2009

Scheme	Supplied (m^3)	Service connection									
		Domestic	Stand Post	School	Government Institution	Hospital	Commercial	Navy	Religious	Government Quantities	Total Connection
Araly South	681	24	16	3	0	2	1	0	4	0	**50**
Chunnakam	1,852	12	22	1	0	0	0	2	2	0	**39**
Vaddukoddai	588	10	11	3	0	0	1	0	0	0	**25**
Kayts	2,787	17	61	2	2	1	1	0	3	1	**88**
Velanai	1,661	1	37	3	4	1	2	0	5	0	**53**
Nainathivu	237	1	0	0	0	0	0	1	7	0	**9**

Scheme	Supplied (m^3)	Service connection									
		Domestic	Stand Post	School	Government Institution	Hospital	Commercial	Navy	Religious	Government Quantities	Total Connection
Analaithivu	180	1	1	1	0	1	0	0	2	0	**6**
Karaveddy	4,059	109	101	4	0	0	2	0	1	0	**217**
Valvettithurai	1,470	17	12	2	0	1	0	0	2	0	**34**
Watharawathai	2,381	8	45	4	0	0	2	2	3	0	**64**
Kanpolai	368	0	1	0	0	0	0	0	0	0	**1**
Karainagar	300	0	9	0	0	0	0	0	0	0	**9**
Bowser Supply	97,500	0	0	0	0	0	0	0	0	0	**0**
Total	**114,065**	**200**	**316**	**23**	**6**	**6**	**9**	**5**	**29**	**1**	**595**

115. In addition, there are 9 proposed water supply schemes estimated at a total cost of Rs 1,629 million included in the Action Plan, 2010, Ministry of Nation Building and Estate Infrastructure Development, and it will serve an additional 132,000 population.

116. The water supply system in Kilinochchi has been severely affected by the conflict and the main tower which was located in the town center was destroyed in the later stages of the conflict in 2008. (Photo 4) At present Killinochchi town and resettlement areas are dependent on bowser supplies of drinking water.

Photo 4: Destroyed Water Tower, Kilinochchi

117. Previously, the INGOs were actively involved in supplying drinking water in the Jaffna Peninsula but currently, UNICEF and ICRC are the only main agencies who provide funding for water supply projects. Especially after the announcement of the end of conflict, most of the other NGOs are mainly focusing on resettlements, poverty alleviation, enhancement of livelihoods through microfinance schemes, etc.

3. Drainage

118. In the Peninsula occasionally storms with intense rainfall of more than 100 mm per hour cause floods due to the gentle slopes and sluggish run- off. The surface run- off from rainfall in rural areas is only a minor percentage of the rainfall. The balance infiltrates into the ground or evaporates. There is seldom flooding in rural areas. However, the runoff in urban areas is considerably more, because of the low infiltration rate of built up and paved areas. The run–off from rainfall in urban areas sometimes cause overflowing from drains and ponds and cause temporary flooding of streets, buildings, and compounds. Flooding of streets and inundation occur frequently during rainy months. In some areas drain outfalls to the sea get blocked with sand or debris which also causes flooding and is a chronic problem. The invert levels of many drain outlets are below mean sea level, so that there is perpetual drowning of sea outlets.

4. Transportation

119. The road network in Jaffna District include, 279.68 km of A-class, 246.11 km of B- class, 482.23 km of C-class, and 89.56 km of D-class roads under the Road Development Authority and Road Development Department. There are also 3,175.13 km of other roads under the local authorities.

120. The islands Karainagar and Kayts are connected with the mainland through separate causeways. Mandativu and Pungudutivu islands are also connected with the Kayts through separate causeways. The main method of transportation between Karainagar, Kayts, Analaitivu, Nainativu, Eluvaitivu and Delft islands is by boat (or ferry between Karainagar and Kayts).

121. Bus service managed by the government and private owners is the common land transportation method in the Peninsula. Long distance bus services such as Colombo-Jaffna and Kandy-Jaffna has been reinstated after the reopening of the A9 highway. Particulars of the buses managed by the Northern Region Transport Board (Government) are given in Table 11.

Furthermore there were 70,173 private vehicles registered under the Department of Motor Traffic, Jaffna in 2008 (Table 12).

Table 11: Buses Managed by Northern Region Transport Board, Jaffna, 2008

Particulars	Numbers
Number of bus available	71
Number of buses in operation	71
Number of routes operated during the year	54
Average Number of buses operated per day	57
Scheduled km during the year	9,205,252
Operated km during the year	4,403,679
Number of passengers transported during the year	7,603,591

Note: The above numbers are for northern district Jaffna, Point Pedro and Karainagar depot
Source: Northern Region Transport Board, Kondavil

Table 12: Number of Registered Vehicles, Jaffna District

Vehicle kind	2003	2004	2005	2006	2007	2008
Motorcycle	23,065	31,308	40,234	46,963	51,566	54,457
Motor Car	1,665	2,167	2,403	2,789	3,045	3,067
Land Vehicle	1,156	1,695	2,465	2,795	3,047	3,122
Hand Tractor	571	910	1,267	1,646	1,747	1,802
Lorry	687	1,199	1,505	1,738	1,876	1,925
Motor Coach	434	656	819	920	1,030	1,118
Motor Tricycle	731	1,315	1,702	2,522	3,059	3,503
Dual Purpose	242	519	756	979	1,064	1,179
Total	**28,546**	**39,769**	**51,151**	**60,352**	**66,,434**	**70,173**

Source: Department of Motor Traffic, Secretariat, Jaffna

122. An airport at Palali is in operation for light aircraft - domestic flights and aircraft of the Air Force.

123. The road network in Kilinochchi district consists of 106.05 km of A−class, 51.19 km of B-class, 186.37 km of C-class and 94.17 km of D- class roads under the Road Development Authority and Road Development Department.

124. The road network in the project area is in dilapidated state due to conflict, lack of maintenance, impacts of floods, coastal erosion etc. However, at present a significant improvement is seen in Jaffna both in urban and rural roads. The Government with the assistance of international organizations has taken initiatives to rehabilitate the road network in Jaffna and Killinochchi districts. Some of the ongoing projects are Jaffna Kandy (A9) Road, Jaffna–Manipay–Karainagar Road and Jaffna–Point-Pedro Road and Mannar–Poonaryn (A32) Road. The Sangupitty Bridge in A32 Road will also be rehabilitated.

125. The railway track beyond Vavuniya was totally damaged due to the conflict and has not been in operation for almost two decades, and needs to be reconstructed entirely. Sri Lanka Railway has re-commenced its operations to Thandikulam railway station from June 2009. Under the ‘Uthuru-Mithuru’ Programme, the Northern railway line from Vauniya to Omanthei is

under reconstruction and the tracks from Kankasanthurei to Pallai and from Vauniya to Pallai are expected to be rehabilitated before the end 2010.

5. Land Use

126. In the Jaffna Peninsula, land use is mainly for settlements and in red soil areas cash crops are grown intensively under lift irrigation from shallow dug wells. In sandy soils either coconut plantations or seasonal rainfed paddy cultivation is common. The extent of agricultural land uses has declined during the period of conflict but it has begun to increase. The land use change in Jaffna District is shown in Table 13.

Table 13: Land use of Jaffna District (ha)

Category	1986	%	2003	%
Paddy	12,760	12.9	7,598	7.4
Arable crops	12,000	12.2	11,183	10.9
Fruit crops	2,200	2.2	1,819	1.7
Coconut	4,400	4.4	2,918	2.8
Palmyra	13,000	13.2	12,775	12.4
Economic trees	1,000	1.0	870	0.8
Rocky lands	3,000	3.0	3000	2.9
Sandy and scrublands	12,000	12.2	12,000	11.7
Saline, alkaline, and barren lands	16,000	16.2	16,000	15.6
Built-up areas	22,000	21.3	22,000	21.5
Inland waters	4,180	4.1	4,160	4.0
Land deprived of cultivation due to security reasons			2,000	1.9
Damaged permanent crop lands			6,000	5.8
Total	102,530	100	102,323	100

Source: Jaffna District Secretariat

127. About 27.5% of the land in the Kilinochchi District is under forest cover while the cultivatable land extent is in the region of 50%. Nearly 45% of the cultivatable land is paddy land and 27% of the land is cultivable with subsidiary and other food crops. The balance 17% of the land is planted with perennial crops such as Coconut, Mangoes, Bananas, Palmyrah, and Limes, etc. The land use pattern in Kilinochchi District is shown in Table 14.

Table 14: Land use of Kilinochchi District (ha)

Types of land	Category	Sub-category	Area (ha)	%
Urban Land	Built-up land associated	-	70	0.1
	Non-agricultural land	-	580	0.5
Agricultural Land	Homesteads	-	13,200	10.3
	Tree and other	Coconut	3,080	2.4
	Perennial crops	Mixed tree & oher perennial crops	1,460	1.1
	Crop land	Paddy	27,910	21.8
		Sparsely used Crop land	16,300	12.7

Types of land	Category	Sub-category	Area (ha)	%
		Other crop land	700	0.5
Forest Land	Natural forest	Dense forest	24,850	19.4
		Open forest	10,250	8.1
	Forest plantations	-	10	0.8
Range Land	Shrub land	-	10,230	8.0
	Grass land	-	420	0.3
Wet Land	Forested	Mangrove	610	0.5
	Non-Forested	Marsh	5,070	4.0
Water Land	-	-	7,390	5.8
Barren Land	-	-	5,800	4.5
Total			**127,930**	**100**

Source: Statistical Handbook – 2008, District Secretariat, Kilinochchi

6. Power Sources and Transmission

128. Power supplies from the National Grid operated by Ceylon Electricity Board (CEB) were totally destroyed in 1989 and at present generators are used to provide electricity and supplied through a local grid in Jaffna Peninsula. The present peak requirement of the grid during the night time is 36.9 MW. There are 2 independent power producers and CEB is involved in generation of electricity. All 3 power plants are located at Chunnakam. CEB is planning to increase their generation capacity by adding another 7 MW plant to the grid to meet the anticipated future demand. The existing generation capacities of each power producer are shown in Table 15.

Table 15: Existing Electricity Generation Capacities

Power producer	Installed capacity	Fuel type
Northern Power	20	Heavy fuel
Aggreko	15	Diesel
CEB	7	Diesel

Source: CEB, Jaffna

129. The Jaffna grid consists of 33 kV transmission line throughout the Peninsula and has a total length of 773 km and distributed through 230V lines which have a total length of 3,000 km. There are 547 transformers to step down the voltage from 33 kV to 230 V which serve 49 bulk supplies and 498 retail supplies. There are 93,706 consumer accounts provided in the Jaffna District including 82,075 domestic, 1,490 industrial, and 8,216 commercial connections in 2008. In addition, there are 5,085 street lamps provided by CEB.

130. Presently the Kilinochchi town has the connection with the National Grid via Vavuniya by 33 kV transmission line. Vavuniya-Kilinochchi transmission line has the capacity to meet a demand of 4-5 MW while currently supplying only 1 MW. Kilinochchi area has 33kV line length of 9.5 km and low voltage lines of 60 km and 8 step-down transformers. There were 1,338 consumer accounts provided in the Kilinochchi District including 957 in the urban area and 381 in the rural area by end 2006. Annual electricity consumption of Northern Province is shown in Table 16.

Table 16: Annual Electricity Consumption by Area, 2008

Area	GWh
Jaffna	112
Vavuniya, Mannar, Kilinochchi, Mullaitivu	64
Northern Province Total	176

Source: CEB, Jaffna

131. Currently a 60- 70 % area of Jaffna Peninsula is electrified and the grid is extended only up to Mirusuvil of Thenmarachchi Divisional Secretariat. About 95% of the Jaffna Municipal area has been electrified with the existing system. CEB has a goal to electrify 80% of the Peninsula by mid-2010. To achieve this goal, there are 2 proposed transmission expansion projects which are funded by Japan Interantional Cooperation Agency (JICA). Those are (i) Vavunia–Kilinochchi Transmission expansion project, and (ii) Killinochchi–Jaffna transmission expansion line project.

7. Telecommunication

132. The telecommunication network in almost all the districts in Northern and Eastern Provinces were destroyed during the conflict period and a gradual improvement was observed in the recent past. The records from Sri Lanka telecom and other private telecommunication service provider's show an increase in the use of telephones both wireless and CDMA specially in last two years. The statistics showing the growth are given in Table 17.

Table 17: Growth of Usage of Telephones in Northern Province

Year	Land Phones*	Wireless Local Loop & CDMA**	Public payphones
2003	11,662	732	120
2004	13,099	2,477	119
2005	16,163	3,896	144
2006	18,906	5,906	150
2007	25,434	10,622	161
2008	31,930	14,844	

* Includes wireless and CDMA provided by SLT

** Provided by Suntel and Lanka Bell

8. Agriculture

133. Other than in urban areas and excluding beach sands, the land was covered with plantations or agricultural crops or paddy fields. Fringe belts of land on the perimeter of lagoons are grasslands (pasture) or wasteland.

134. The Red Yellow Latosol soils (RYL) are the agricultural soils highly suitable for crop agriculture. They are found extensively in Valikamam area (where Chunnakam aquifer is located) and in Vadamaradchi area. These soils are deep and well drained. Regosols and sandy soil sustain palm trees such as coconut and palmyrah. There are pockets of loam earth (mixture of sand clay silt and humus) suitable for some crops scattered throughout the Peninsula.

135. Cultivation of Other Food Crops (OFC i.e., crops other than paddy) under lift irrigation is the dependable agricultural pursuit in Jaffna. This includes crops such as onions, chillies, yams, tobacco and vegetables. Paddy is cultivated as a rain fed crop during the rainy season and is not dependable, subject to vagaries of rainfall and weather conditions. Farmers now use portable trolley mounted pumps for lift irrigating cash crops. Formerly the smaller pumps were kerosene driven but now diesel driven pumps of a higher capacity are preferred. Well sweeps and other manual or animal draught devices have been abandoned.

136. Jaffna has been an area with high potential in the agriculture field. Nearly 65,400 farm families and 30,000 laborers are involved in agriculture and livestock in the District. In addition, a large share of the population is involved in home gardens. Paddy is cultivated in 7,566 ha and is produced during the Maha season (March-April and September-October) under rain-fed conditions. Vegetables are being grown throughout the year with the help of lift irrigation from the wells. Low country vegetables such as brinjal, tomato, long bean, okra, snake gourd, bitter gourd, and other leafy vegetables are being cultivated and are available throughout the year. Exotic vegetables like cabbage, leeks, beet, beans, and carrots are also cultivated in large extent.

137. Among the other field crops, onion, potato, tobacco, chilli, and banana are cultivated as cash crops because farmers obtain considerable income from these crops. At present field crops and vegetables are cultivated in 4,000 ha approximately with the help of lift irrigation from the dug wells. About 19,261 agro wells and 2,433 ditches are being used for agriculture purposes. Farmers generate considerable income from perennial crops such as orchard crops like mango, jackfruit, grapes; and citrus and other crops like palmyrah and coconut. In 2002 the extent of which coconut was cultivated was 12,480 ha and due to war almost 50% was damaged and during the year 2008 only 6,355 ha was used for cultivation of coconut. Other perennial crops are grown in subsistence level. Further nearly 3.5 million palmarah palms are available in Jaffna.

138. Valukai Aru basin is one of the main agricultural areas in the Peninsula. This wet stream (seasonal river) in the western sector is 15 km in length and it is connected with 45 ponds and several channels. Around 1,300 ha of paddy land and 150 ha of high lands in Tellipalai, Uduvil, Sandilipay, and Chankanai areas are benefited by this seasonal river. Total population in this area is around 60,000 persons comprising of 15,000 families in which 4,950 are farm families. Around 5,000 farm laborers are involved in agriculture and the major crops cultivated in this area are onion, chilly, and vegetables.

139. Mainly ground water resources are being used for agricultural purpose where Department of Agrarian Development has listed 992 ponds in the Jaffna District in 2007. These irrigation schemes functioned satisfactory up to 1983 and thereafter most of it were damaged due to civil war. Such schemes need immediate reconstruction to safeguard the Peninsula from intrusion of sea water and for purposes of agriculture.

140. In Kilinochchi District, agricultural production was the major livelihood of the population. Among the annual crops paddy is the major crop cultivated in larger extent. It is cultivated in 14,650 ha in Maha season and 4,413 ha in Yala season producing a total of 41,057 MT in 2008. Both minor irrigation and rain-fed methods were used. Field crops were cultivated under lift irrigation from the dug wells and deep wells. The common field crops cultivated in the district were chilli, onion, cowpea, green gram, black gram, groundnut, gingili, potato, and vegetables where the major cash crop is chilli.

141. Perennial crops cultivated in the district include fruit crops like mango, lime, banana, orange, jackfruit and coconut. Fruit crops were cultivated in 1,042 ha. Total extent of coconut in Kilinochchi district was 11,541 ha. Most of this is under small holding and estates and a small amount in homestead.

142. There are 7 perennial rivers available are in the district with the total catchment area of 1,823 km^2. Further nine major irrigation tanks are available in the district with a total capacity of 1,575,55 acre feet of water. The total irrigable extent under major irrigation is 13,172 ha. A total of 283 minor tanks are also available in the district. Each of these tanks has the capacity of irrigating less than 80 ha. Among them, 106 minor tanks are abandoned. Among the major irrigation tanks Irranaimaduk kulam, Kalmaduk kulam and Akkarayan kulam are the largest tanks in the district. Iranaimadu kulam has the capacity to irrigate 8,897 ha while Kalmaduk kulam and Akkarayan kulam has the capacity of 1,396 and 1,382 ha respectively.

9. Tourism

143. Jaffna Peninsula which points towards the west to the tip of India is a flat dry land with shallow lagoons and a number of offshore islands. It is rich with attractive sandy beaches, heritage places, cultural activities, traditional food, beverages, and religious festivals.

144. Having many natural resources including forests, agricultural land, wetlands, lagoons, bays; and places of tourist attraction would provide a solid base for economic development in the Northern Province. Among the notable attractions, Jaffna may be mentioned for the Keerimalai hot water ponds, Chundikulam and Paraitivu Sanctuaries. Jaffna Peninsula is also a stronghold of migratory bird species especially in lagoons and island sides where this can be promoted for bird watching. Jaffna also has spectacular beaches which among them, Casuarina Beach and Chatty Beach are the most popular.

145. Jaffna has several important locations that are of religious, cultural and architectural significance. The Nallur Kandaswamy Kovil or Nallur Murugan Kovil built in 1749, Nagadeepa Island also known as Nainativu is a small but notable island 30 km off the coast of Jaffna Peninsula. The Jaffna Fort, built by the Dutch in 1680, is one of the best architecturally designed Dutch forts in all Asia. There are also many religious festivals. These locations and festivals are major crowd drawers from all parts of the country and overseas.

146. Jaffna is becoming a tourist destination in Sri Lanka after remaining unseen for years. Although there are various attractions, these tourist spots have not yet been developed on a large scale. The tourism industry in Jaffna needs more attention in becoming a good tourist destination. These locations have been damaged during the conflict and infrastructure has suffered greatly.

147. It is expected that the travel and tourism industry in Jaffna is to be fully operational by the end of 2010 as development work is improving rapidly. Entrepreneurs in the travel industry are getting ready to meet this potential demand by improving accommodation, building new hotels, improving transport and other services. The Tourism Development Authority of Sri Lanka has taken initiatives in large scale tourist resort development and they are in the process of identifying suitable land.

D. Social and Cultural Resources

1. Population, Communities, and Demographics

148. During the conflict period the country lost many lives, many people were disabled, and persons were forced to flee from their homes in Northern and Eastern Provinces. However the situation improved in 2002 .While some people started to return to their homes and some were still in camps, in 2005 December, the tsunami affected people living in the coastal area. The fighting resumed after a four-year ceasefire, and renewed hostilities began in July, 2006. Due to extensive fighting, severe damage was caused to lives, properties, houses, and public amenities. As a result entire population in Kilinochchi District was forced to evacuate. Government recaptured Kilinochchi in January, 2009 and announced the end of the conflict in May 2009.

149. Conflict-affected areas in the north east of the country, which constitutes about 24% of Sri Lanka's land area, contain about 10% of its population. The people of the Northern and Eastern Provinces have undergone displacement on several occasions and the population distribution has kept changing so frequently that it has been unable to keep a track of population in the various parts of the Northern and Eastern Provinces.

150. The census in 2001, which is the 13th in the series, was conducted after a hiatus of 20 years. However, in Jaffna District no enumeration was done. Since 1981 the only population records available in the project area are from the District Secretariat offices, in Jaffna and Kilinochchi. Therefore, the figures given in the Census 2001 for the project area are estimates as shown below in Table 18.

Table 18: Population, Annual Growth Rate and Population Density by District

District	Population		Average Annual Rate of Growth (%)	Population Density (per Sq Km)	
	1981	2001	1981-2001	1981	2001
Jaffna	738,788	490,621	-2.0	795	528
Kilinochchi	91,764	127,263	1.6	80	106
Sri Lanka	14,846,750	18,732,255	1.1	230	299

151. According to above estimates, the population has decreased since 1981 in the Jaffna District while it has increased in the Kilinochchi District.

152. In Jaffna District, the estimated present population (2009) is 627,664 based on figures available with the District Secretariat. The population density in 2009 was 3,263 persons per square kilometre in Jaffna division; 1500-2000 in Vadamaradchi North, Valikamam South and Nallur; 1000-1500 in Valikamam West and South West; 500-1000 in Vadamaradchi South West, Valikamam East and Islands North; and less than 500 in other divisions.

153. Regarding the ethnic composition, available data for the year 2008 shows that in the Jaffna District 99.91% of the population was Tamil, 0.005% Sinhalese, 0.08% Muslim, and 0.005% other. Religion-wise, 86.5% of the population was Hindu, 13.5% Christian, 0.1% Islam, 0.005% Buddhist, and 0.009% other. The present resident population is predominantly Tamils

and the Muslims accounts for some thousands. Sinhalese are only those employed in the area and attached to government services such as the armed forces.

154. In Kilinochchi District, the population in mid 2008 was 199,017 of which 99.9% of the population was Tamil and 0.06% Muslims. However, it is important to note that the entire population of Kilinochchi District was evacuated during the latter stage of the civil war in 2008-2009 and transferred to IDP camps in Jaffna and Vavuniya Districts. Under the Governments' resettlement schedule, a total population of 26,785 (2,416 families) were resettled in Karachchi (3,218 families), Poonakary (4,937 families) and Pachchilipalai (261 families) divisions as of February 2010.

155. Due to lack of any census in the Northern Province in the recent past, availability of any reliable socio-economic data is scarce. Consumer Finances and Socio-economic Survey (CFS) have been conducted by the Central Bank of Sri Lanka in 2003/2004 which is scheduled once in 5 years. Due to civil disturbances in the country and the unavailability of a proper sampling frame due to incomplete Census of Population and Housing till 2001, the survey could not cover the Northern and Eastern Provinces since 1981/1982. However the CFS 2003/2004 covered Jaffna and Vavuniya Districts in the Northern Province and is the latest available survey in the project area.

156. According to the CFS 2003/2004, in the Northern Province, the average monthly income per household, per spending unit and per income receiver were Rs15,204, Rs14,251 and Rs 9,228, respectively. However, 50% of households income was less than Rs10,430 per month while 50% of income receivers income were less than Rs6,500 per month. The poorest 20% of the income receivers in Northern Province received 1.9% of the total income and the richest 20% of the income receivers received 54.8% of the total income.

157. Labor force participation as a percentage of population for Jaffna and Vavuniya Districts are 31.7% and 37.7%, respectively. About 56.4% of Northern Province workforce is employed in the service sector, 25.9% in agriculture, forestry and fishery and 17.7% in the industrial sector. Unemployment rate in Jaffna District is 6.2%, while in Vavuniya Districts it is 4.7%.

158. Survey results reveal that the average monthly household expenditure was Rs15,425 for the Northern Province. Expenditure on food was Rs6,617 per household per month and it was 42.9% of the total household expenditure. Per capita consumption expenditure shares on liquor and tobacco, and education were 2.1% and 4.5%, respectively.

159. Except in the Jaffna municipal area where only 1% of land is under agriculture, cash crops in red soils with lift irrigation from dug wells is the major income source for the majority. Paddy is grown seasonally on sandy soils under rainfed conditions in the Maha season. Coconut plantations and fruit crops also bring substantial income. These agricultural practices have not been totally revived after about 20 years of conflict and land mines have denied access to some fields. Fisheries were the livelihood for a large number of people and expanding rapidly with the conclusion of the conflict which eased the fishing activities with comparatively less restrictions.

160. A socio-economic survey was conducted in 2005[14] for the proposed project. The total population covered in the survey of the Jaffna District was 3,637, which is approximately 0.6%

[14] At present Kilinochchi Districts total population consist of 26,785 recently resettled people and hence the survey does not reflect the present socio-economic condition in Kilinochchi District.

of the total population of the District. According to the survey, the primary, secondary, and tertiary activities have been more or less equally engaged by people in the Jaffna District. In Kilinochchi, employment in the primary sector is higher than other sectors. In the Jaffna District, primary activities, representing agriculture and fishing constitute 35% of employment, secondary activities such as services in the Government and private sector accounts for 35% and tertiary activities such as skilled employment and self-employment constitute 30% of the total economically active population. Within the Jaffna District, islands have the highest percent of the population in the primary sector and Kilinochchi also engages a comparatively high percentage. However, it is unusual to note that the peninsula-rural represented the lowest percentage of employment in the primary sector, though the rural area is characterized with agriculture and fishing activities. The reason for such reversal could be attributed to the lack of employment opportunities in these two sectors due to marketing limitations as well as the impact of the tsunami, which limited the fishers' access to sea. As a result, a shift in tertiary activities could be noticed. About 38% of the economically active population in the peninsula-rural area are engaged either in skilled employment or self-employment.

161. The households in the project areas get income from main sources such as income from employment, their own economic activities, and other sources such as assistance from government and NGOs mainly in the form of in-kind relief. Some get monetary assistance from relatives or friends especially from those living abroad.

162. The results of the survey carried out as part of this project revealed that a greater proportion of the household income comes from main income sources. About 86% of the household income of the peninsula-urban comes from main sources and 14% from other sources. The households in the peninsula-rural receive 80% from main sources and 20% from other sources; and the islands receive 92% from main sources and 8% from other sources. The experience of Kilinochchi is not different from this pattern. The households of the area receive 82% of their income from main sources and 12% from other sources.

2. Public Health and Health Facilities

163. The devastating results of the 25 year conflict became visible with its end in May 2009. The damaged halt infrastructure ranged from primary health care centers to tertiary hospitals. In post-conflict areas there is a scarcity of human resources for health, breakdown of preventive and promotive services, and lack of other supportive facilities such as medical supplies and equipment. There is also disorganization of health education, sanitation, etc.. These have created negative health impact among those living in those districts. Further, the massive displacement of more than 800,000 persons in the Northern and Eastern Provinces has created a range of physical and psycho-social problems, which need careful attention. However, the situation has improved after the conclusion of the conflict and various international agencies have mobilized their resources to re-establish the social infrastructure to arrest poverty and the spread of diseases.

164. Jaffna Teaching Hospital is the main public health care and medical institution for the people of Northern Province and for teaching of medical students from the University of Jaffna, and nursing and midwife students. Most of the very sick patients are referred to Jaffna Teaching Hospital from other areas in Jaffna Peninsula, Palai, and Poonakary. This hospital handles about 308,438 in-patients and 239,302 out-patients during 2008 through 23 specialists, 172 doctors and 9 dental surgeons with the help of 310 nurses and 14 pharmacists.

165. Four base hospitals, 22 divisional hospitals, 16 primary medical care units and 34 public health clinic centers (PHC) are functioning under the Deputy Provincial Director of Health Services (DPDHS) while 41 ayurvedic dispensaries are under the control of local bodies. One ayurvedic teaching hospital is also available at Kaithady. The District is divided into seven Medical Officer of Health Divisions (MOH) for preventive care services under public clinics centers which are functioning in the Jaffna District. In addition 8 private hospitals and 78 pharmacies are functioning in the Jaffna District.

166. Records at the District Health Plan indicate that water-borne diseases such as diarrhoea, infectious hepatitis and typhoid are common in the Jaffna Peninsula. Deaths are also recorded due to water borne diseases. Statistics available at the Jaffna Provincial Health Department are shown in Table 19.

Table 19: Incidences of Notifiable Diseases in Jaffna District

Disease	2006		2007		2008	
	No of cases	No of deaths	No of cases	No of deaths	No of cases	No of deaths
Cholera	-	-	-	-	-	-
Diarrhoea and Dysentery	1,369	04	1,524	05	2,125	03
Acute flaccid paralysis	-	-	-	-	-	-
Diptheria	-	-	-	-	-	-
Infectious hepatitis	114	-	44	-	53	-
Tuberculosis	312	10	350	11	350	15
Whooping Couch	02	-	4	-	09	-
Neo - natal tetanus	-	-	-	-	-	-
Chicken pox	14	-	34	-	70	01
Measles	06	-	-	-	01	-
Mumps	53	-	-	-	24	-
Enteric fever	450	-	937	-	483	-
Tetanus	03	02	-	-	03	01
Human rabies	08	08	01	01	-	-
Leprospirosis	17	03	09	-	06	02
Dengue fever/dengue haemorragic fever	51	01	267	03	44	-
Rubella	01	-	-	-	-	-
Encephalitis	14	07	02	-	-	-
Food poisoning	85	-	9		69	01
Meningitis	05	01	04	-	03	-
Malaria	318	-	165	-	36	-
Clinical malaria	02	-	-	-	04	-

Sources: Regional Director of Health Services, Jaffna

3. Education and Education Facilities

167. In 2008 there were 700 registered pre-schools with a student population of 18,016. There were 126,688 students in grade 1-13 with 3,141 graduate teachers and 3,682 trained teachers, with a pupil-teacher ratio of 18.2. A total of 413 schools are functioning in Jaffna District consisting of 45 Type 1AB, 49 Type 1C, 139 Type 2, 36 Type 3-I, and 145 Type 3-II.[15]

168. Due to the conflict and consequent displacements, the education sector suffered set back in teaching, learning process, and infrastructure. Many schools are still in high security zones. Major constraints in implementing the rehabilitation and development programme are lack of adequate financial resources; presence of land mines; inadequate infrastructure; and acute shortage of skilled manpower resources, teaching aids, and equipment.

4. Socio-economics

169. In Northern and Eastern Provinces during the conflict period many lives were lost and many persons were forced to flee their homes. Displaced people do not have stable shelter. There is a need for adequate housing and other amenities through a comprehensive social development program.

170. The conflict resulted in large number of widows and women-headed families. The economic embargo and other restrictions imposed during the conflict have not only damaged economic and social infrastructure in the Northern Province, it has also badly affected the strength of the Government and NGOs to address social issues effectively.

171. Destruction of the economic structure has led to a lack of employment and self-employment opportunities. The disintegration of family and extended family network support has created war traumas and affected productivity. The destruction of health infrastructure has especially made the mothers and children more vulnerable.

172. Poverty is major area in concern with respect to the project area. The official poverty line is defined as the minimum expenditure per person per month to fulfill basic needs, and the Department of Census and Statistics of Sri Lanka publishes the figure for each month (district-wise). However, the Census and Statistics Department of Sri Lanka has not provided the figures for Jaffna and Killinochchi Districts. Therefore, the national figure is used for those two districts. Table 20 below illustrates the living status of the total population in Jaffna District and it is important to note that 79.5% of population is below the national poverty line (announced figure for month of October is Rs. 2,980 per person).

[15] 1AB - School with Advanced Level Science stream classes
1C - School having Advanced Level Arts and/or Commerce streams but no Science stream
Type 2 - School having classes only up to grade 11
Type 3I - School having classes from 1-8
Type 3II – School having classes from 1-5

Table 20: Member-wise Population Summary as of 31 October 2009, Jaffna District

Category	No of members in family						Total family	Total population
	1	2	3	4	5	6 ≤		
MR & DRS Relief								
Displaced before 11.08.2006	2,812	2,842	3,579	2,474	3,509	1,577	15,793	54,824
WFR Relief								
Displaced after 11.08.2006	265	310	236	241	265	113	1,430	4,595
Economically affected	10,062	10,549	7,600	5,686	4,252	1,318	39,467	106,418
IDP newly cleared areas	319	307	322	191	168	95	1,402	4,201
Resettled families	4,288	4,112	4,225	3,808	3,131	2,506	22,070	67,503
Total WFR relief	**14,934**	**15,278**	**12,383**	**9,926**	**7,816**	**4,032**	**64,369**	**182,717**
Samurdhi relief	8,239	5,577	7,562	8,843	11,863	11,014	53,098	205,293
Total Relief	**25,985**	**23,697**	**22,524**	**21,243**	**23,188**	**16,623**	**133,260**	**442,834**
Not provided Relief from Jan 2008								
Economically affected	3,888	3,630	2,964	2,500	2,612	2,040	17,634	53,072
Total Below Poverty Line	**29,873**	**27,327**	**25,488**	**23,743**	**25,800**	**18,663**	**150,894**	**495,906**
Above Poverty Line								
Government employees	4,790	5,232	4,589	4,251	3,975	1,232	24,069	75,189
Non-government employees	3,396	3,078	3,114	2,330	2,614	2,097	16,629	52,656
Total above poverty line	**8,186**	**8,310**	**7,703**	**6,581**	**6,589**	**3,329**	**40,698**	**127,845**
Total	**38,059**	**35,637**	**33,191**	**30,324**	**32,389**	**21,992**	**21,992**	**623,751**

Source: District Secretariat, Jaffna, 2009

5. History and Archaeology

173. The city of Jaffna has a written history of 2,000 years. After the rule of Chola Empire in the Jaffna Peninsula, the Arya Chakravathi dynasty reigned from 1240 to 1450. Jaffna was occupied by the Portuguese (1617 to 1658) and the Dutch (1658 to 1795) until the British conquest. In the project area, most of the high priority archaeological, historical, and cultural sites are located within the coastal zone. They are listed in Table 21.

Table 21: Important Archaeological, Historic and Cultural Sites in Coastal Parts of the Project Area

	Place	Gramasevaka Division	Importance
1	Pas Pyl Fort	Mulliyan (149)	A/H
2	Vallipuram Burial	Thunalai North (131)	A
3	Kankesanturai Fort	Kankasanturai (67)	A/H
4	Sambiturai Port	Keerimalai (64A)	A
5	Keerimalai –freshwater spring below sea level	Keerimalai (64A)	C/H
6	Naguleswaran Sivan Kovil	Keerimalai (6A)	H/C
7	Vishnu Kovil	Keerimalai (64A)	C/H
8	Monastic Site - Keerimalai	Keerimalai (64A)	A/H
9	Megalithic Site-Anaicottai	Anaikottai (40)	A
10	Jaffna Fort **	Columbuturai (8)	A/H

	Place	Gramasevaka Division	Importance
11	Hammenhiel Fort	Karainagar North (10A)	A/H
12	Portuguese Fort	Allapiddai (19)	A/H
13	Portuguese Fort (Eyrie)	Allapiddai (19)	A/H
14	Allapiddai	Allapiddai (19)	A
15	Portuguese Fort - Urindikottai	Allapiddai (19)	A
16	Nagar Pooshary Amman Kovil	Nainativu (04)	H/C
17	Portuguese Fort	Delft West (01)	A/H
18	Dutch Fort **	Delft Central (02)	A/H
19	Monastic site-vadiresankottai	Delft Central (02)	H
20	Nolans Bungalow	Delft Central (02)	H
21	Elephant Pass Fort	Nukavil 9153)	A/H

Source: Coast Conservation Department
** Protected Monument; A – Archaeological Value; H – Historical Value; C – Cultural Value

174. There are some other important sites in the interior of the Peninsula. A palace of the last king (Sangillion) of Jaffna is present in Nallur area. There are the historically and culturally important Temples: Nallur Hindu Temple (both historical and present), Vallipuram Hindu Temple and Nagadeepa Buddhist Temple. The Puttur bottomless well is also a legendary place. In the Kandarodai area, an archaeological site is present where a large number of tombs of Buddhist monks are found.

175. Artifactual distribution at Anaikotti–a complex archaeological sites ranging over several hundred years–covers an area of 2 km^2. A megalithic burial mound is found in this site. A large urn, several bones and number of early Carinated black and red ware shreds are indications of the megalithic potential of this site.

176. Sites that carry an archaeological value in the Jaffna region were abandoned due to the conflict. Maintenance was not done due to the access constraints which arose with the security concerns. Some of the sites were damaged, and the Archaeological Department of Sri Lanka has taken initiatives in restoration of the sites through its regional office in Jaffna. Currently a project on conservation and restoration of the ancient Fort in Jaffna is in progress with funds from the Government of Netherlands.

E. Natural Disasters

1. Cyclones and Flood

177. During the months of October to January with the North East Monsoon period, cyclonic activities and depressions in the Bay of Bengal bring heavy torrential rains to the project area in some years.

178. The most recent cyclone which caused severe flooding was the Cyclone Nisha which swept through the Jaffna Peninsula in November 2008 bringing with it very high rain fall. The cyclonic wind had a speed of 80-85km/h during its peak period. The condition lasted for six days and the Jaffna Metrological Station recorded 765.5 mm rainfall. The amount of rainfall that was received during the six days is the highest rain fall ever recorded in Jaffna. On 25 November

2010 the district recorded 389.8 mm. The previous highest figure for a single day rain fall was 211.8 mm and was recorded in 25 September 2001.

179. During floods, the groundwater level reached saturation level and the ponds and tanks start overflowing. Flood water spread to villages and towns making the flood water level rise to three to four feet during peak flooding time. Domestic dug wells become polluted by overflowing flood water. Extensive damage caused to highways, roads, causeways, telecommunication, and electricity networks. The entire paddy cultivation area is submerged under flood water and nearly half the total acreage paddy crop is totally lost. A large number of houses, school buildings, public institutions, and commercial places are partially or fully damaged.

2. Seismology

180. Although Sri Lanka has been considered as aseismic, the available records of seismic events that have occurred during the last four centuries suggest that the island is situated in a region where seismicity is quite high. Even though Sri Lanka is not situated close to any plate margin or any active faults, the plots of the epicenters of the earthquakes reported to have occurred during the last two centuries show that the island is located in a seismically active region of the Indian Ocean.

181. Some of the earthquakes that have occurred in Sri Lanka, or close to the coastal areas of the island, in the past have been recorded by international earthquake recording networks (e.g., US Geological Survey Earthquake Database). However, no proper records of these earthquakes are available in Sri Lanka.

182. Historical records reveal that over 60 tremors have been felt in Sri Lanka during the last two centuries. They are caused either by seismic activity occurring within the country, or by tectonics outside Sri Lanka in the Indian Ocean.

183. According to the available historical earthquake data, several earthquakes within their epicenters within the country occurred in the past. However, almost all the major earthquakes during the last century have occurred in the Indian Ocean, especially in the regions east, southeast, south, and southwest off Sri Lanka. Some of the historical earthquakes occurred in and around Sri Lanka are shown in Table 22.

184. In summary, two types of earthquakes have been felt in Sri Lanka: (i) earthquakes that occur outside Sri Lanka; (ii) earth tremors that have an origin within the country. The first type of earthquake is related to present-day plate tectonics taking place in the Indian Ocean, while those occurring in Sri Lanka seem to be the result of movements along the faults and fracture lineaments in the country caused by the nearly N-S compression acting on Sri Lanka landmass.

Table 22: Some of the Historical Earthquakes in and around Sri Lanka

Date	Longitude	Latitude	Magnitude	Description
14.04.1615			>6.5	Damaged Colombo Fort; 2,000 dead
09.02.1823	80.0	7.0	5.7	Epicenter east of Colombo
09.03.1823	80.0	7.0	5.0	Epicenter east of Colombo
03.07.1867	79.6	12.0	5.7	-
01.1882	81.2	8.6	6.3	Epicenter near Trincomalee
08.02.1900	76.7	10.7	6.0	Epicenter east of Colombo

Date	Longitude	Latitude	Magnitude	Description
30.02.1973	84.3	7.1	5.9	Epicenter east of eastern coast of Sri Lanka

Source: U.S. Geological Survey Data Base, Abeykoon 1996, Bansai and Gupta, 1998

3. Tsunami

185. The tsunami that hit Sri Lanka on December 26, 2004 caused the worst devastation from a natural disaster in the country's history. Northern and eastern coasts of Jaffna Peninsula were badly affected by the tsunami; this includes the villages in the coasts in Vadamarachchi East and Vadamarachchi North divisions. The damage to the eastern coast of peninsula was higher than that of northern coast. The division affected in Kilinochchi District were Pachchilapillai , Kandawali, and Poonakary.

Table 23: Damages Due to Tsunami

District	Affected Families	Displaced Families	Deaths	Injured	Missing	Damaged Houses	
						Completely	Partially
Jaffna	14,767	10,827	2,640	1,647	540	6,084	1,114
Killinochchi	2,297	407	560	670	0	246	-

Source: National Disaster Management Centrer

186. Damage on houses, health, education; infrastructure such as ground water, electricity, transportation; and livelihoods such as fishery, and agriculture were severe in the affected area. Reconstruction work commenced soon after the disaster with the assistance of international and local funds. In order to oversee and facilitate overall reconstruction efforts, the government has appointed the Task Force for Rebuilding the Nation (TAFREN) as a 3-5 year national secretariat responsible for setting priorities, policies, and guidelines. At the district level, Disaster Management Authorities have been appointed to coordinate local relief and reconstruction efforts.

187. It was noted that, at present, most rehabilitation works have been completed in the project area.

F. Post War Situation

1. Internally Displaced Person (IDP) and Resettlement

188. Resettlement of people who have been forced to flee or to leave their homes or place of habitual residence, as a result of the conflict is given a key importance in the country’s agenda. The government with the support from NGO’s and other local and foreign agencies/organizations are in the process of resettling IDPs with the objective of providing livelihood restoration.

189. In Jaffna District resettlement took place in all 15 Divisions. In 404 GN Divisions, 905 villages, 23,349 families (75,680) persons were resettled as of 31 January 2010. The total number resettled under the 5 categories of IDP is shown in Table 24.

Table 24: Details of Resettlement, Jaffna District (as of 31 January 2010)

Category	Resettled Population	
	Families	Persons
IDPs within Jaffna District resettled	495	1,755
Resettled families (HSZ) Buffer Zone 300 m	332	1,169
IDPs From newly cleared area in Jaffna	2,949	8,691
IDPs from newly cleared area Vavuniya, Trincomalee, Batticaloa	19,783	60,564
Independent arrival from Vavuniya	1,833	3,586
Total number resettled	25,392	75,765

190. Entire populations in Kilinochchi District fled from the area during the latter stage of the conflict and were displaced into IDP camps. Their houses and properties were totally damaged. The resettlement process in Killinochchi District is facing major challenges: providing shelters, clearing mines; and addressing insufficient basic services, transportation, supply of food and drinking water etc. The latest data related to resettled persons in the Kilinochchi District are given in Table 25.

Table 25: Details of Resettlement, Kilinochchi District (as of 24 February 2010)

Division	Resettled Population	
	Families	Members
Karachchi	3,218	9,215
Poonakary	4,937	16,715
Pachchilipalai	261	855
Total	8,416	26,785

191. Resettled farmers in Kilinochchi District were given seeds for 13 types of crops, land assistance and livestock support such as cattle, one-day old chicks, poultry, milk sales outlets, etc. Approximately 7,000 beneficiaries have received assistance for farming in both Karachchi and Poonakary.

2. Demining Process

192. The National Mine Action Programme operates under the leadership of the National Steering Committee on Mine Action (NSCMA), chaired by the Ministry of Nation Building and Estate Infrastructure Development (MNBEID) with District Mine Action Offices (DMAO) and District Steering Committees (DSCs) managing the operational coordination in the mine-affected districts. UNDP-supported DMAOs help government agents coordinate and manage mine and UXO clearance and mine risk education in conflict affected districts. There are offices set up in Colombo and two DMAOs in Jaffna (covering the Jaffna and Kilinochchi Districts) and in Vavuniya.

193. The DMAO staff support the government agents to prioritize and assign mine/UXO clearance tasks, conduct quality assurance/control operations, and organize District Mine Action Steering Committee meetings. Mine/UXO removal operations in Jaffna and Kilinochchi Districts are conducted by the Sri Lanka Army, Danish Demining Group (DDG) and the HALO Trust. UNICEF with its NGO partners and a network of community-based volunteers conduct mine risk education in the north and the east.

194. Based on the demining summary issued on 01 January 2009 by DMAO, Jaffna, land cleared of landmines and UXO in Jaffna and Kilinochchi Districts were 18.12 km^2 and 15.35 km^2 respectively. Summary of demining is shown in Table 26.

Table 26: Demining Summary (As of 31 December 2009)

District	Anti Personnel Land Mines	Anti Tank Land Mines	Unexploded Ordinance	Total
Jaffna	50,313	60	35,169	85,542
Kilinochchi	20,845	49	11,273	32,167

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: WATER SUPPLY

A. Environmental Impacts Related to Location and Design

1. Design Abstraction Rates

195. The Iranamadu Irrigation Scheme supports a potential cultivation of 8,500 ha of paddy rice and 465 ha of other field crops (OFC) in the maha (wet) season and 2,800 ha of paddy and 465 ha of OFC in the yala (dry) season.[16] It is therefore vitally important to farming, socio-economics, and quality of life in Kilinochchi District. Any scheme that proposed to abstract water from the source of that scheme, Iranamadu Tank, would therefore attract opposition from and risk conflict with the irrigation beneficiaries. In order to avoid any such conflicts, a hydrological modelling and water balance assessment of the tank were carried out at the beginning of the feasibility study in 2005 to ascertain the impacts of utilizing this source. This considered the irrigation water requirement in the context of cropping intensity and water use efficiency together with hydrological modelling of the Iranamadu Tank inflow and is reported in detail in the feasibility study reports. The analysis concluded that water amounting to an average of 51,000 m^3/day could potentially be abstracted from the tank by raising the FSL by 0.61 m (to 31.4 m).

196. The analysis did note however that abstraction at this increased level would require a change in agricultural practice, whereby in the dry season, farmers would be unable to cultivate paddy and would be required to cultivate only OFC instead (up to 4,700 ha). This was included in a water sharing agreement between the Provincial Irrigation Department (PID) and NWSDB in 2006, but in meetings during the project review of 2010 the PID and District Secretaries of Kilinochchi and Jaffna expressed the strong view that a change in agricultural practice was not acceptable. The water resources/irrigation review study therefore recommended a modified approach, of raising the tank bund by 0.61 m and improving the other infrastructure as proposed in the feasibility study, but abstracting the 27,000 m^3/d required for Phase I Stage 1 only, in the first instance. A subsequent increase in abstraction for Stage 2 (a further 23,000 m^3/d) would then be subject to successful introduction of the required changes in agricultural practice and a satisfactory review of the performance of the tank after raising the FSL. This amendment was incorporated into the project design.

197. The tank currently operates at 0.61 m below the present design FSL because of seepage of water through the bund, particularly in an area where a slippage and leak occurred in 1983, necessitae repair works. The crest of the bund has also been eroded and is lower than

[16] Feasibility Study Final Report Volume 4A Surface Water Resources, Table 5-1 (ADB/SMEC 2006).

the specified Bund Top Level (BTL) in many places. The proposed raising would therefore need to be accompanied by bund refurbishment, strengthening and erosion protection to restore safe and effective functioning. As explained in Section 3.3.1 this will involve addition and compaction of earth to the crest and downstream toe, incorporation of drainage into the toe and addition of gabions and rip-rap erosion protection on the upstream side. The existing head-works (spillway, gates, and stilling basin) have also deteriorated from a lack of maintenance and repair, so these will also be refurbished (involving demolition and re-concreting of parts of existing structures), and three new radial gates will be added to improve operation.

198. NWSDB conducted extensive stakeholder consultation during the feasibility study in 2006, involving the Government Agent for Jaffna and Kilinochchi, Divisional Secretaries of the relevant District Secretary Divisions of Kilinochchi District, political leaders, and the farmers of the Iranamadu Irrigation Settlement Scheme and their representatives. The initially proposed extraction rates and likely impacts on the irrigation scheme were openly discussed to avoid any misconceptions and this was followed by an extensive public awareness campaign involving newspaper advertisements. This led to preparation of a Memorandum of Understanding (MOU) between NWSDB and PID (the owner and operator of the tank), which set out the various aspects of the water-use agreement, ensuring the availability of water for the project (50,000 m^3/d), but with due recognition and priority for irrigation needs. Amendments requested by the farmer representatives to vest more powers in the Management Committee regarding the control of water were accepted and included.

199. Corresponding agreements for the modified approach recommended by the water resources review, and incorporating provisos for a potential future increase to 50,000 m^3 (if agreed) can now be prepared. NWSDB is fully aware of the need to proceed only with stakeholder agreement, and they held meetings with PID and Iranamadu farmers starting April 2010 to undertake this process (See Appendix 4). Such contacts will be expanded in with the aim of preparing a new agreement for the revised proposals. There should be no adverse socio-economic impacts from the increased abstraction in Stage 1, as farming practices will continue as of the present. Future proposals to increase abstraction for Stage 2 must be accompanied by appropriate training and support to farmers (including financial support) to enable them to adapt their cultivation practices to retain (and improve where possible) their livelihoods.

200. In some instances elsewhere, proposals to supply water to an area from a distant source have generated protests in the source area as people feel ownership of the resource. However this should not occur in this case as the project proposes to supply treated water to areas of water shortage in the vicinity of the tank (2 District Secretary Divisions in the Kilinochchi District), thus ensuring that local people are direct beneficiaries of the project.

201. The abstraction for water supply should not create any additional problems in the aquatic ecosystem of the reservoir, because at present, water levels fall significantly during the dry season, and the proposals would not exacerbate these conditions. The abstractions for water supply will be drawn from the augmented storage by raising the FSL, and spillage of water downstream (through a natural stream) will continue as of the present, with any excess still flowing to the sea during peak flow periods.

2. Water Quality

202. The inflow into the Iranamadu Tank is from the Kanakarayan Aru, which has a very large catchment (581 km^2) in the districts of Vavuniya, Mullaitivu, and Kilinochchi. There are two medium-sized irrigation schemes (with a total capacity of 4 million cubic meter [MCM]) in the

catchment (Kanakarayan and Chemamadu schemes), where paddy rice is grown on 94 ha, and 243 ha respectively. There are also >100 minor tanks and 64 minor irrigation schemes currently operating (with a capacity of 8 MCM), plus many others that are dilapidated and disused. There are some 5,000 cattle in the catchment around the Kilinochchi area and others in Mullaitivu District. The catchment is however relatively uninhabited, except for a few small settlements near the irrigation schemes.

203. Irrigated paddy is a potential source of water pollution by carrying fertilizer (plant nutrients) and other agrochemical residues in drainage water into the reservoir. However, the natural morphology of the catchment, which is 60 km long and 9.7 km wide with a slope of 1%, means that pollutant loads are unlikely to be carried over long distances as such chemicals become adsorbed onto mud particles and settle out of the water column. The low density population in the irrigated areas means that there is also unlikely to be a significant pollution threat from human waste, although cattle may pose more of a risk if they inhabit areas close to the reservoir during rainfall.

204. Preliminary analyses of Iranamadu Tank water during the feasibility study (Table 27) suggest that the quality of raw water is good and that the conventional treatment as designed should be sufficient to meet the desired drinking water quality standards. It should also be noted that these data were collected during the dry season and that certain aspects of water quality are likely to be improved by dilution during the monsoon.

Table 27: General Water Quality of Iranamadu Tank, 2004-2005

Parameters		Units	Desirable Level	Results			Results	
				Date 11 July 2005			Date 17 Aug 2004	
				Near Shore Surface	10m from Shore at Bed	Left Bank Canal surface	Iranamadu Left Bank inlet	Iranamadu Surface
Physical Quality								
1	Turbidity	NTU	2	11.7	11.8	14.1	34.2	22.7
2	Color	Hazen unit	5	60	70	70	>90	>90
Chemical Quality								
1	Conductivity	S/cm	750	320	310	280	275	274
2	Chlorides (Cl)	mg/l	200	135	128	114	78	84
3	Total Hardness (as $CaCO_3$)	mg/l	250	95	100	90	84	82
4	Alkalinity	mg/l	200	105	105	95	-	-
5	Nitrates (as N)	mg/l	-	1.5	1.3	1.5	4.5	5.6
6	Nitrites (as N)	mg/l	-	0.013	0.013	0.015	0.014	0.013
7	Phosphate (PO_4)	mg/l	-	0.04	0.01	0.01	-	-
8	Total Iron	mg/l	0.1	0.18	0.21	0.21	1.13	1.02
9	pH	-	7 – 8.5	7.4	8.11	8.52	7.78	7.74

205. Tests were also conducted to determine the extent of microscopic algae in the water, by the Department of Zoology of the University of Jaffna, in both dry and rainy seasons. The results are shown in Table 28. Both analyses showed the presence of toxin-producing blue-green algae, which indicates that there is a risk of algal blooms in the tank in the presence of high levels of plant nutrients (nitrate and phosphate), which tend to occur as water levels fall during the dry season. It is important therefore that the design of the treatment facilities includes measures to remove algae and any poisonous constituents they may release.

206. A further potential threat to water quality is posed by future development in the catchment, particularly along the A9 highway between Omanthai and Kilinochchi, especially if this result in rehabilitation of the presently abandoned minor tanks in the area. Given the numbers of displaced people currently returning to the north, it would be prudent for NWSDB to establish via this project, systems of long-term water quality monitoring and catchment management, to ensure that the quality of the raw water source remains adequate for conversion into potable water by the designed conventional treatment.

Table 28: Microscopic Algae in Iranamadu Reservoir, 2005

Organisms	Density at sampling sites (No/ml)			
	2nd October 2005 Main outlet channel	14th November 2005 Main outlet channel	2nd October 2005 Near the outlet sluice	14th November 2005 Near the outlet sluice
Filamentous Algae				
Microspora sp.	25,600	60,800	19,200	17,760
Nostoc sp.	-	-	-	
Spirulina sp.	-	-	-	
Colony/Single-celled Algae				
Microcystic sp.	16,000	1,600	9,600	1,600
Volvox sp.	-	-	-	-
Gleocapsa sp.	3,200	-	-	-
Chlorococcum sp.	12,800	-	9,600	-
Chiamydomonas sp.	16,000	-	-	-
Sorastrum sp.	-	-	3,200	-
Sphaerocystic sp.	-	-	-	-
Scenedesmus sp.	3,200	-	-	-
Pediastrum sp.	6,400	400	-	1,600

3. Intake from Iranamadu Tank

207. In the feasibility study, three options were considered for the intake location (water abstraction point) from Iranamadu Tank:

(i) From Iranamadu Tank near the left bank sluice;
(ii) From Dri Aru, which is a small tank fed by the left bank main canal of Iranamadu Tank, for irrigation of the command area in the left bank
(iii) From the D5 distribution canal, which runs across the A9 road to paddy fields in the Iranamadu scheme.

208. Option (ii) was not selected because of the environmental risks from water pollution due to local runoff from areas with human activities and potential future development in this area. Option (iii) was not selected for similar reasons: because of the risk of pollution from the catchment of Dri Aru and nearby communities (particularly from current development around Kilinochchi Town center and the A9 road); and because of uses for irrigation and other local purposes that are further potential threats to both water quality and quantity. Furthermore, if options (ii) or (iii) were selected, the resulting availability of substantial quantities of water in Dri Aru throughout the year would almost certainly encourage farmers to expand the area of cultivation in the dry season, leading to water-use conflicts. It was therefore considered that option (i), i.e., an intake direct from the Iranamadu Tank was the most suitable, with the least potential impacts.

4. Transmission Mains

209. After abstraction from Iranamadu Tank via the intake structure, it is intended that raw water will flow by gravity through a transmission main to a sump to be built at the Water Treatment Plant at Palai, 32.5 km away. The pipes therefore have to be laid along a gradient. For the first few kilometers the land gradient is easily recognisable along both the left bank main channel and the Paranthan main canal (which is the continuation of left bank main canal after Dri Aru), so this route was selected to minimize excavation depths and thereby reduce the impact of the earthworks.

210. There were three options for pipe-laying along the canal route: (i) along the side of the canal; (ii) under the canal bed; and (iii) burying in the maintenance road below the canal bank. Options (i) and (ii) would require closure and drainage of at least part of the canal during the construction period, which would therefore deprive farmers of irrigation water in the left bank. Option (iii) could be constructed without such disturbance and was therefore selected for this reason.

211. Over the remaining length to the WTP (approximately 25 km), pipes can be laid along the A9 road reservation, where there is sufficient room. In this section, impacts of the construction process should thus be temporary and limited mainly to soil erosion during rainfall, which can be minimized with adequate construction planning and supervision, as described below.

212. The A9 road reservation has also been selected as the location for the treated water transmission main from the WTP. It would however be advisable to route the pipeline around the outside of the densely populated towns of Kodikamam and Chavakachcheri to eliminate impacts on public utilities and houses and reduce the disturbance of people. The railway line is another hazard that should be avoided because if water mains are laid very close to this facility, leakage could compromise railroad safety.

213. The location of transmission mains alongside canals and roadways will also serve to avoid impacts on biodiversity and sensitive ecosystems, except in the few places where it is necessary to cross lagoons to provide water to the islands. Inshore areas are of vital importance to coastal fisheries as they are the location where many species of fish and shellfish pass through the early stages of their life history. The design should therefore avoid unnecessary damage and disturbance to these areas by locating the pipelines alongside existing causeways, which have been built to establish road links to Karainagar and Kayts islands. There are no road connections to the other islands, so pipeline routes should be selected to avoid any sensitive

areas of seabed (for example coral, seagrass or mangrove habitats, or areas that are significant fish nurseries or breeding grounds). Ecological surveys should therefore be conducted in the detailed design stage to enable selection of least damaging route options.

214. A ROW is needed around transmission mains to protect the pipes from accidental damage from excavation, other types of construction or vandalism, and to allow access for maintenance and regular checking for leakage. The selection of road reservations for pipe laying (shoulders or the center of the road where reservations are inadequate) would invariably provide the required right of way within the boundaries of government-owned land.

5. Water Treatment Plant

215. Analysis of the water of Iranamadu reservoir has shown that the important water quality parameters are within the acceptable limits for conventional treatment, so the treatment plant as designed should remain suitable for the purpose, provided that the recommendations made above regarding catchment management and regular monitoring for toxic algae are followed. The WTP will be located at Palai, where there is a large expanse of barren land amongst coconut plantations (see Appendix 2). This site was also selected because there is enough land for a lagoon system for drying sludge from the water treatment process. Alternatively, sludge could be landfilled following the standards recommended by the CEA, and it could even be used at the future landfill site for covering material when individual waste disposal cells are closed.

6. Water Towers and Other Facilities

216. There are unlikely to be significant impacts at sites selected for water towers, pumping stations and other facilities, as inspections in 2006, 2009 and 2010 confirmed that most locations are on un-used and unoccupied government-owned land, and are not close to any sensitive areas (Appendix 1). One exception is at Kaddudai, where NWSDB is considering acquiring a 0.3 ha plot of privately owned land containing a house, as the location for a new ground sump and overhead tower (see Appendix 2). Acquisition would follow the procedures established by Sri Lankan Law,[17] and additional compensation required by ADB policy on Involuntary Resettlement would be provided for the loss of the house, trees, and any other income-generating assets as set out in the Resettlement Plan for the project.[18] This will not involve physical relocation as the family currently occupying the house is planning to move to alternative accommodation shortly; and because adequate compensation will be provided, the social and economic impacts of the land acquisition should not be significant. There is also an alternative (unoccupied) government-owned site nearby, which may be selected instead, thus avoiding land acquisition altogether.

217. The water distribution system should only cause negative impacts during construction, when people and their activities may be disturbed by the excavation to install the pipelines. This will however be temporary and is likely to be tolerated by residents as they will benefit directly from the system once it is functioning. Here again impacts can be reduced by careful construction planning and management as described below.

[17] Land Acquisition Act No 9 (1950) and National Involuntary Resettlement Policy (2001)
[18] ADB (2010): Jaffna Water Supply and Sanitation Project, Draft Resettlement Plan, 67pp

B. Environmental Impacts Related to Construction

1. The Construction Process

218. The construction process will be quite large in scale, involving significant earthworks at the reservoir site and at the 4-5 ha WTP, excavation of over 550 km of trenches for the transmission mains and distribution pipe network, creation of a number of large RCC structures (ground tanks at the WTP site, sumps at Kaddudai and Araliturai, and overhead tanks at various points in the distribution network), and installation of large pumps and the pipe network, plus other facilities and equipment. Construction will be both extensive in terms of the area covered and intensive in terms of manpower and the working schedule, and will continue for a period of two years or more.

219. Despite being a significant undertaking it is however not expected that the construction process will cause major negative impacts. This is for two main reasons: (i) because careful site selection and design, as described above, has been successful in avoiding highly sensitive locations and certain other negative impacts (e.g., conflicts with other water users, relocation of site occupants, etc.); and (ii) because most of the construction activities are common to many types of project (excavation, creation of structures from RCC), so there are well-developed methods of mitigating their impacts, with which experienced contractors should already be familiar.

220. Most of the work will involve excavation, which will be both localized (e.g., creation of foundations for pump-houses and other buildings, and larger voids for sumps and tanks for water storage and treatment) and conducted over much larger distances (trenches for the mains and the water distribution networks). Most excavation will be conducted by backhoe diggers (Photo 5), which will operate with small teams of laborers and other workers. Soil and stone will be removed and piled nearby if it is to be used for re-filling trenches, or loaded onto trucks for transportation to disposal sites. Pipes, pumps and other components will be brought to site on trucks and offloaded by crane and stored nearby, and then put into place by crane or small pipe-jack (Photo 6) and connected to by hand. If sand is used to surround and protect the pipes in the trenches this will be sourced from the nearest quarry, brought to site on dump-trucks, and shovelled into the trenches by hand or backhoe. Surfaces of voids and re-filled trenches will be compressed by hand-operated compactors.

221. Materials for the RCC structures (sand, cement, metal reinforcing, etc.) will also be brought to site on trucks and offloaded by crane and/or by hand. Once voids have been dug and compacted, reinforcing bars will be installed and connected to by hand to form the core of each structure above and below ground (Photo 7). The reinforcing is then encased in hand-installed wooden shuttering (Photo 8), into which concrete (manufactured on site) is poured. After drying, the reinforcing is removed to reveal the completed RCC structure, and any surface imperfections, joints between sections, etc., are finished off by masons by hand. Some of the structures are quite large (ground tanks may be 10 m tall, built with 50% above and below the surface, and overhead tanks may be 15-20 m tall), but all will be created gradually by forming part of the structure before moving on to adjacent sections. This work will therefore also be conducted by relatively small teams of approximately 30-40 persons.

222. The two sites where construction will be most intensive are the area of the bund and spillway improvements at Iranamadu Tank, and the new WTP site at Palai. At both these locations the work will involve a combination of the techniques employed elsewhere, mainly excavation, concreting, and installation of ready-made fitments.

223. At Iranamadu, work will be conducted in the dry season when access is not impeded by high water levels. On the upstream side of the bund, horizontal trenches will be dug by backhoe and pre-constructed gabions will be put into position by crane, after which rubble rip-rap will be tipped from trucks on the crest of the bund, and distributed between the gabion walls by backhoe. Soil for bund-raising will be dug from the dry tank bed if its characteristics are suitable, otherwise it will be brought by truck from the nearest available site. After offloading, soil will be positioned on the crest by backhoe and bulldozer and compacted by roller vehicle; and this process will be repeated in stages until the desired profile is achieved. Layers of graded sand and soil will be applied at the toe of the downstream side in the same way.

224. Repair of head-works will involve removal of damaged areas of concrete on the spillway and stilling basin (by backhoe and pneumatic drills), after which metal reinforcing will be attached to intact reinforcing in the original structure. Segments will then be encased in shuttering, and concrete will be poured in. The structure of the three new radial gates will be created in the same way, after which the pre-cast metal gates will be positioned by crane and connected by hand to metal frames, bolts and other fixings embedded into the concrete. Hinges and other components, including electrical fitments will also be added by hand.

225. Work at the WTP site will involve substantial excavation to create voids for the tanks and trenches for pipes, with waste soil and stone being transported for disposal at sites approved by the relevant local authorities and divisional secretariats. Tanks will then be created from RCC as described above, and pipe-work and other components will be installed by hand, assisted by a small crane as necessary.

226. Other work, such as installation of pumps and electrical switchgear, plastering of internal surfaces of tanks/sumps and pump-houses, installation of fixtures and fittings, etc., will be relatively small in scale in comparison with the excavation and other activities, and will be conducted by small numbers of tradespersons, mainly working by hand.

Photo 5: Backhoe digger excavating a trench alongside a minor road

Photo 6: Hand excavation and pipe installation using a simple pipe jack

Photo 7: Metal reinforcing

Photo 8: Wooden shuttering

2. Construction Impacts

227. Impacts of the construction process will mainly be those normally associated with the activities described above, which include the following:

(i) Soil erosion and sediment-laden runoff during rainfall at excavation sites;
(ii) Changes in hydrology if rainfall or groundwater collects in excavated areas;
(iii) Pollution of streams, ponds, lagoons, aquifers, etc., (depending on location) by sediments from soil erosion or spills of oil, grease, fuel, etc. used on site;
(iv) Pollution due to improper disposal of excess material, spoil and waste including materials from equipment yards and labor camps, if used;
(v) Impacts on the landscape from vegetation clearance, quarrying and the use of borrow pits as sources of material;
(vi) Health risks from increases in mosquitoes and other disease vectors if water accumulates in areas from which construction materials are dug;
(vii) Impacts of transportation of material and equipment (noise, dust, vehicle emissions along haulage routes);
(viii) Health hazards and nuisance due to dust and noise (affecting workers and people who live and work near the construction sites);
(ix) Inadequate site safety (for workers, visitors, and local residents);
(x) Encroachment into archaeologically, historically, or culturally important sites and places of recreational value or scenic beauty;
(xi) Accidental impacts on public/private utilities or damage due to vibration;
(xii) Conflicts with other ongoing or proposed projects in the area; and
(xiii) Environmental and social effects (on workers and local communities) if workers are brought from outside the project area and housed in accommodation camps.

228. The significance of such impacts depends to a large extent on the sensitivity of the specific location, and as explained above, many impacts have already been avoided by selecting sites and pipeline routes that are away from areas that are known to be important for ecology/biodiversity, culture/heritage, and other key features; and through design measures, such as locating pipes alongside causeways to prevent damage to lagoon habitats. It is not possible however to avoid all sensitive locations, particularly those relating to the human and built environment, because the distribution network will be located in densely populated areas in order to supply water to maximum numbers of people.

229. The main impacts of construction in urban areas tend to be those caused by the physical presence of the workers, machinery, and vehicles and the emissions caused by the work itself. People living and working in the proximity of construction sites can thus be disturbed by noise and dust, and by the visual presence of construction activities, and these impacts can extend along transportation routes if heavy trucks are used to carry large amounts of materials. The normal activities of residents can be disrupted by the presence of the sites, particularly if traffic has to be rerouted and if access to shops, temples, places of work, etc., is restricted by the works. Businesses can also be affected if access limitations cause them to lose customers. There are however many well-known methods for reducing the extent and significance of such impacts, and these are discussed in Section 5.4.2 below. Amongst the most effective are the simple expedients of informing communities in advance when work is likely to be conducted in their neighborhood and the nature of the activities involved, and of completing the work in the minimum practicable time.

230. Impacts from the transportation of construction materials are more of an issue for projects in Jaffna as the Peninsula is composed mainly of coralline limestone and there is very little hard stone and gravel and no sources that are suitable for construction use. Such materials therefore have to be brought from the mainland, which increases the financial and environmental cost of the operation. Impacts include increased noise, dust, and vehicle emissions along transportation routes; disturbance of residents and transport; and reduced road safety from the increased presence of heavy vehicles. There are also wider concerns regarding the contribution of vehicle emissions to greenhouse gas effects and global warming, which is of particular concern in low-lying coastal regions, of which there are many in Sri Lanka. Impacts are exacerbated in a project like this, which involves major excavation, as there are further large volumes of heavy traffic carrying waste material for disposal. Clearly the project should take action to reduce these impacts as far as possible, and this should involve such measures as:

(i) A thorough examination of potential sources of all construction materials in the design stage to identify sources that are as close to the project area as possible;
(ii) Use of alternative materials, such as rubble from war-damaged buildings, which may be suitable as rip-rap or as an aggregate substitute after crushing;
(iii) Reduction of waste by re-using materials wherever as possible (e.g., excavated soil may be used for the tank bund; demolished concrete may be used for rip-rap, etc.), or by providing material for other projects (e.g., several current road projects in the north).

231. Construction at Iranamadu Tank will need to be carefully planned to ensure there is no interruption in the supply of water for the downstream irrigation schemes. The likelihood of most work being conducted in the dry season (when the upstream side of the bund and spillway are accessible) will be beneficial in this regard as it should mean that work can be completed without requiring a change in normal spillway operations. Work planning will also need to take into account the current presence of the Sri Lankan Army at this strategic location (see Appendix 2). The army should therefore be included in project consultations as an important stakeholder, and all work at Iranamadu (and elsewhere) should be discussed with appropriate commanding officers and measures agreed to allow construction to proceed without compromising army operations, safety, or security. Practical measures to reduce noise, dust, and other nuisance impacts will also need to be applied at the Iranamadu site, to avoid affecting the soldiers who currently guard and patrol the area. Conducting work in the dry season should avoid certain other impacts, such as an increase in turbidity in the tank, from runoff of rainfall over stockpiled or unprotected soil.

232. At most other locations, impacts will be reduced by measures that collectively require contractors to maintain clean and tidy worksites and conduct their activities in a professional manner. For example, contractors will be required to spray site roads during dry weather to reduce dust, ensure that toxic materials are stored securely in areas protected by concrete bunds, and implement other similar measures that are now standard precautions at most construction sites (see Section 5.4.2 below). The health and safety of workers is another area where practices have changed over the past few decades, and it is now very much the norm for construction contracts to require contractors to prepare and operate a Health and Safety Plan to protect their workers, site visitors, and local residents. This is another key recommendation of the mitigation strategy for this project outlined below.

233. Another measure that has become more prominent in recent years is for contractors to be required to pay much more attention to the risk of damaging buried remains that are of archaeological and/or cultural/historical importance, which may not be known about until they

are accidentally uncovered during excavation work. Action to avoid damaging such material depends on the nature of the risk, which is not major in this case as this is not an area of special historical or archaeological importance and most of the facilities (such as the pipelines) will be located in areas that have already been disturbed by previous construction (e.g., road building). All that should be necessary in this case is to require contractors to establish what is known as a “chance finds procedure”, which requires them to stop affected work and notify the appropriate government authority immediately that any such material is discovered, so that the value of the find can be assessed and appropriate action taken.

234. It is therefore not expected that there will be major impacts as a result of the construction process, because of action already taken during the preliminary design and site selection, and because the natural environment in this part of the country is not especially sensitive. Impacts that would occur should all be reduced to the level of not significant, providing the mitigation recommended below is implemented. It is inevitable that there will be some disruption of people and their activities when the distribution network is installed in the heavily populated parts of Jaffna, but recommended mitigation should also reduce these impacts to a minimum. It is also worth noting that people will generally tolerate such temporary disturbance if they know that they will benefit significantly from the completed scheme, which will be the case here.

C. Impacts of Operation and Maintenance

1. Operation and Maintenance (O&M) Procedures

235. Once the new water supply system is operating it will be essential to maintain all elements in full working order so that the system remains functional throughout the 20 year design life of the scheme. This will require regular inspection and maintenance of all of the main elements, comprising the Iranamadu Tank source, raw and treated water mains, treatment plant and the water distribution network, including sumps, tanks, and pipelines.

236. The main requirement will be for the detection and repair of pipeline leaks, which are costly in terms of loss of revenue and resource, and can be both environmentally damaging and inconvenient for those living in the vicinity. The generally flat topography and the usage of good quality DI pipes should mean that pipeline breaks are relatively rare, and that leaks are mainly limited to joints between pipes. These are repaired in essentially the same way that the pipes were installed, by digging trenches to expose the leaking area and re-fitting the connection or replacing the faulty section if necessary.

237. Sludge will need to be removed periodically from settlement tanks at the WTP, and this will be dried in lagoons on site and taken to landfill on trucks for disposal. There is also some small scale maintenance at the WTP and other facility sites (pumping stations and overhead tanks), which involves regular checking and recording of the performance of the components for signs of deterioration (pumps, pipes, valves, meters, etc.), and servicing and replacement of parts where necessary. Three or four people should be employed at each site to conduct this work. The Iranamadu bund and reservoir will need a separate operation and maintenance (O&M) schedule, to ensure the continuing operation of the intake pumps and other equipment, and ensure that agreed rates of abstraction are not exceeded. A similar small team will be employed at Iranamadu for this purpose.

238. The regional office of NWSDB will be responsible for all O&M in relation to operating the scheme, and given their relatively limited financial and human resources, it is essential for the project to provide capacity building and institutional strengthening measures to enable staff to

adequately perform their new responsibilities. This should comprise training and assistance in such diverse elements as financial management, recruitment, project management, work planning, scheduling and implementation, etc. Technical experts should also be employed to work with NWSDB staff in preparing O&M manuals setting out the procedures to be followed in all aspects of the work, and training the site operatives accordingly.

2. Impacts of Operation and Maintenance

239. Raising the FSL of Iranamadu Tank by 0.61 m to 31.39 m will not raise the existing HFL of the tank (33.10 m), but the stored water will cover a larger surface area than at present and will inundate an additional 200 ha of land. Because of security concerns it was not possible to visit this area during either the feasibility study or the recent project review studies so there is no firm information on current land-use. NWSDB staff who are familiar with the area describe it as mainly covered with scrub and woodland and that is how it appeared when viewed from a distance via binoculars in March 2010. NWSDB also affirm that, as the area is within the HFL contour and is therefore inundated each year during the monsoon, there is no agriculture or any other use on the land. This also seems likely, but should be checked once the area is cleared of landmines, so that measures can be included in the Resettlement Plan for the project if necessary, to compensate affected people for any income losses if there were any economic activity on any of the land.

240. There would almost certainly be conflicts with downstream farmers who use irrigation water from the tank if O&M procedures were not adequately followed and abstraction exceeded the rate defined in the MOU, or if there were any other deviations from this agreement. It will be essential, therefore, that standards of O&M are maintained as recommended above to ensure that this does not happen.

241. It will also be important to maintain the WTP in a fully functional condition, given the risk of deteriorating source quality from algal blooms in the Iranamadu Reservoir. These risks would be exacerbated if the tank became eutrophic[19] as a result of increases in plant nutrients (nitrate and phosphate) from inputs of sewage, agricultural fertilizers or livestock excrement. NWSDB should therefore implement a system of catchment planning and management to prevent such incidents as recommended above.

242. If these procedures are properly followed, the system should continue to operate without major faults and problems, except for such leakages as may occur in the pipelines. Any repairs to these elements should not cause major impacts as the work will be localized and completed in a much shorter time than the original installation, and again local residents are likely to tolerate any related temporary disturbance as the work will restore the functioning of their water supply system.

[19] Eutrophication occurs when high levels of plant nutrients (mainly nitrate and phosphate) in the aquatic environment cause extensive blooms of normally microscopic algae. Populations increase to levels that reduce the penetration of sunlight, causing the algae to die. Oxygen is depleted in the water as the algae decay and the water becomes anoxic. This may then cause the death of fish and other animals. Eutrophication normally occurs where nutrients (from STP effluent or other sources) are discharged into an area of poor circulation, where the nutrients are not dispersed and diluted.

D. Mitigation of Environmental Impacts

1. Pre-Construction and Detailed Design

a. Storage and Abstraction of Water

243. Re-confirming the water-use agreements with the PID, Iranamadu farmers and their representatives is one of the most important activities of the pre-construction period, and NWSDB should continue and expand their consultations with these and other stakeholders, and in due course should formalize these agreements in a revised MOU setting out the water-use conditions. Any disagreement should be the subject of further discussion and resolution in the same open and transparent manner as the original negotiations and no action should be taken until farmers' representatives and other key stakeholders are satisfied with the measures adopted.

244. During this period, NWSDB should also conduct a survey of current land-use in the 200 ha area at the margins of Iranamadu Tank that will be inundated when the FSL is raised, to determine whether there are any economic activities (such as farming, livestock grazing, wood gathering, etc.), and to identify the users of the land if this is the case. They should then ensure that any such individuals and households are included in stakeholder consultations and incorporated into the resettlement activities that are conducted in the pre-construction stage. Such activities are likely to be quite limited because as explained above the project will involve little land acquisition and no relocation of people. The Resettlement Plan however includes measures to compensate Affected Persons (AP) for losses of income and assets, and these should be applied to any people who will be unable to continue activities they currently conduct in the area to be inundated.

b. Water Quality

245. As water quality data suggested that there could be blooms of blue-green algae in Iranamadu Tank. Water treatment specialists should examine the proposed treatment method, to confirm that it will remove any potential toxins before supply to the public. Designs should be amended to include appropriate treatment if necessary. NWSDB should also establish a system of regular water quality monitoring in the tank to detect any risks of eutrophication or other water quality problems in advance and enable remedial action if necessary.

246. NWSDB should also incorporate into this project at least preliminary planning towards the establishment of an effective system of catchment management in the Iranamadu basin, to protect the quality of this vital water resource over the long-term. This needs to deal with complex issues of land use, development planning, poverty alleviation, post-conflict resettlement, etc., and would need to be developed in partnership with key stakeholders including Divisional Secretaries, the Forest Department, Irrigation Department, Department of Agriculture, Agrarian Services Department, Land Commissioner's Department, Coconut Cultivation Board, and farmers' organizations. This would therefore probably need to be the subject of a separate project, but preliminary work should be conducted now, enabling a catchment management proposal to be considered for future funding. Officials of the Central Environmental Authority informed the study team that the CEA is currently conducting a Strategic Environmental Assessment for the Northern Province, funded by the United Nations Development Program, and it is likely that the scrub and forested areas around the reservoir may be declared as sensitive areas requiring protection.

c. Intake at the Iranamadu Reservoir

247. The water supply intake in Iranamadu Tank should be located near the existing left bank sluice because other locations considered in the feasibility study are closer to inhabited areas and therefore carry a greater risk of water pollution from surface runoff. A left bank intake would have the further advantage over other options in that it would not increase the quantity of water in the Dri Aru, which might encourage farmers to expand their cultivated areas.

d. Transmission Mains

248. To avoid the need to acquire privately-owned land and relocate owners and occupants, and to avoid damage to sensitive sites (for biodiversity, archaeology, etc.), it is recommended that transmission mains are located in the Right-of-Way alongside main canals and highways, which are government-owned and have already been subject to disturbance by previous construction. Raw water transmission mains should therefore be buried under the maintenance road on the bank of the left bank main canal and Paranthan Main Canal up to the A9 road, and then along the A9 road reservation to the raw water sump at the WTP at Palai. The following safeguards must be incorporated into designs to minimize impacts on these locations:

(i) Transmission mains should be located at a sufficient distance from the railway to prevent undermining of the track by any leakage in water pipes (releasing water at high pressure);
(ii) Passage along the A9 road section through the highly populated (and congested) towns of Kodikamam and Chavakachcheri should be avoided and instead the transmission main should be diverted along the road to Meesalai;
(iii) Coordination should be established with ongoing and planned road projects in the area to make provisions for future pipe laying alongside the A9 road and the causeways across Jaffna lagoon to Karainagar and Kayts islands;
(iv) Where transmission mains are required to cross lagoons to supply water to islands without road crossings, ecological surveys must be conducted in the design stage to enable routes to be planned avoiding any sensitive seabed habitats.

249. NWSDB should also make arrangements to inform the relevant land authorities (government agent, district secretary, RDA and Railway Department) about the transmission facilities and to provide them with as-built-plans once the laying of pipes is complete. These authorities will then be able to avoid the pipeline areas when planning future development and to prevent any land encroachment by people into the reservation areas around the pipeline.

e. Water Treatment Plant

250. As noted above, the proposed water treatment process must be reviewed and re-designed if necessary to incorporate adequate features to deal with any algal problems (including toxins, odor, and taste). This may include:

(i) Dissolved Air Floatation (DAF), which is an alternative to horizontal sedimentation tanks for removal of algae;
(ii) Powdered Activated Carbon (PAC) dosing before the DAF process, which removes taste, odor, and toxins produced by seasonal high algae levels. If however algae levels are a year-round problem, the use of GAC filters after the rapid sand filters may be preferred.

f. Water Towers and Other Facilities

251. Inspections in 2009-2010 (Appendix 1) confirmed that all sites proposed for construction of pumping stations or water towers are owned by the government and are unoccupied and not used for any purpose, with the exception of: a) three proposed sites for towers where the land-owners are prepared to donate 0.05 ha plots to NWSDB; and: b) the proposed site for a sump and tower at Kaddudai, where NWSDB is considering purchasing a 0.3 ha plot from a willing seller. Both transactions will follow the appropriate legal procedures, and if the 0.3 ha plot is acquired (in preference to the government-owned alternative site), NWSDB should ensure that compensation is provided as set out in the Resettlement Plan, to address resettlement impacts.

252. For the water distribution network, the same site selection principles as adopted for the transmission mains should be used, to avoid the need to acquire private land and relocate households, and to avoid damaging sensitive areas. Pipelines should therefore be buried in the ROW alongside existing roads, in an area that is owned by the government and has already been disturbed by the original road construction.

2. Construction

253. Most of the impacts identified in Section 5.2.2 above as potential risks during the construction process are those that can occur during most types of building work, especially projects such as this that involve a substantial amount of excavation. Most of these impacts could occur at any of the construction sites used in this project, and their significance would generally be greater if they occurred at the Iranamadu Tank (impacts related to water pollution) or in inhabited areas around Jaffna and elsewhere (noise, dust, safety risks, traffic disruption, etc.). Because these impacts are a risk at most construction sites, there are well known methods for their mitigation, which are routinely adopted by contractors worldwide.

254. Actions recommended to address these risks in this project are shown in Table 29. Additional mitigation is included for certain impacts that could be of greater significance because of particular circumstances relating to this project, for example impacts of transporting construction materials.

Table 29: Measures Recommended to Mitigate Impacts of Construction Activities

Potential Negative Impacts	Mitigation Measures
1. Erosion of soil during rainfall at excavation sites and drainage of sediment-laden runoff into ponds, lagoons, wetlands and tanks, causing water quality problems and sedimentation.	▪ Careful planning of construction schedules to conduct excavation in the dry season, avoiding the heavy rainfall period of the N-E monsoon in November-January; ▪ Clearing vegetation only to the required working width to avoid unnecessary exposure of soil and minimize erosion; ▪ Design slopes to maintain stability of cut or filled surfaces; ▪ Protection of exposed surfaces with geo-textile fabric if heavy rainfall is expected; ▪ Adequate compaction of filled surfaces on completion and seeding with grass where possible to reduce erosion; ▪ Protection of drainage channels with berms (i.e., ridge or embankment bordering channel) to prevent overspill; ▪ Use of sedimentation ponds to reduce suspended solids before water is discharged to water bodies, particularly in areas where soil is stockpiled.
2. Changes in	▪ Avoid excavating in the rainy season as suggested above;

Potential Negative Impacts	Mitigation Measures
hydrology/drainage if rain or groundwater collects in excavated areas.	▪ Re-fill trenches and build reinforced cement concrete components quickly in dug areas so that voids are only open for short periods.
3. Pollution of surface and ground-water by spillage of oil, grease, fuel and other toxins used on site.	▪ Careful site selection to avoid locating facilities near sensitive areas such as tanks, ponds, wetlands, conservation zones and places of scenic beauty or recreational value; ▪ Ensure contractors apply effective pollution prevention and abatement measures at construction sites, including: storage of fuel, oil, and other toxic liquids in leak-proof areas with concrete floors and bunds; and not storing such materials near water bodies or other sensitive sites; ▪ Require contractors to implement good site practices to avoid accidental spills, and prepare and implement contingency plans for immediate removal of any spill.
4. Visual and chemical pollution from inappropriate disposal of waste materials from worksites and labor camps (if used)	▪ Require contractors to collect and recycle or dispose of safely (to designated sites approved by the appropriate *Pradeshiya Sabha*) all used lubricants, oil drums, etc.; ▪ Dispose of excess spoil and waste to designated areas, in an appropriate manner as stipulated by the responsible authority, without causing visual pollution, water pollution from leachate, or hazards to other site users.
5. Landscape impaired by scars left by quarries, borrow pits, vegetation clearance, and by creation of large new water storage tanks.	▪ Careful site selection to avoid excavation and creation of large structures where scenery would be spoiled; ▪ Ensure that construction materials are only sourced from licensed quarries and prohibit creation of new borrow pits; ▪ Limit vegetation clearance to the minimum possible and replant disfigured surfaces quickly after construction.
6. Health risks from mosquitoes and other disease vectors if stagnant water bodies are created in quarries and borrow pits from which construction materials are obtained	▪ Require contractors to source materials from licensed quarries only and prohibit creation of new borrow pits; ▪ Use waste from excavated areas to re-fill cavities created by removal of material at quarry sites; ▪ Incorporate drainage into any unfilled cavities to avoid creating new aquatic habitats.
7. Impacts of transportation of material and equipment (noise, dust and vehicle emissions along haulage routes)	▪ When sourcing material, give priority to locations that are close to construction sites; ▪ Plan haulage routes carefully to avoid densely populated areas as much as possible; ▪ Validate identified routes considering condition of roads, carriageways, bridges, present traffic loads, safety, etc.; ▪ Consult authorities responsible for proposed haul roads and prepare plans to improve conditions before use, to maintain during use and to rehabilitate after use; ▪ Avoid transporting materials during peak traffic hours on roads with heavy traffic.
8. Health hazards and nuisance from dust raised during construction, material transport and blown by vehicles	▪ Spray site roads with water during dry weather; ▪ Limit vehicle speeds to a maximum of 20 meters per hour (mph) on site; ▪ Cover loose material with tarpaulins when carried by truck; ▪ Protect stockpiled material from wind and rain by storage in walled areas and/or covering with secure tarpaulins.
9. Air and noise pollution from operation of vehicles and equipment in populated areas	▪ Ensure that contractors adhere to engine maintenance schedules and standards to reduce air pollution; ▪ Ensure that all operations comply with ambient air quality

Potential Negative Impacts	Mitigation Measures
	standards. ▪ Use appropriate noise reduction devices on all vehicles and machinery used in population centers; ▪ Avoid work during night and weekends in populated areas; ▪ Cover loose material with tarpaulins when carried by truck; ▪ Obtain necessary permits from relevant authorities for all blasting and quarrying activities; ▪ Inform residents in advance regarding any blasting; ▪ Complete excavation work quickly in inhabited areas to reduce dust ▪ Dig and complete short lengths of trench in populated areas to ensure that soil is only stockpiled for a short time.
10. Risks to health and safety of workers and public from construction work	▪ Require contractors to prepare and operate a health and safety plan for all construction sites, which includes: - Maintenance of worker safety in compliance with labor laws and other relevant legislation; - Provision and use of appropriate personal protective equipment by all workers; - Security fences and patrols to exclude the public from construction sites; - Regular health and safety training for all personnel; - Documented procedures for all site activities; - Accident and training records and remedial action. ▪ Ensure that properly trained personnel conduct and supervise potentially hazardous activities, such as traffic control, site safety and accident prevention, etc.
11. Encroachment into and damage of areas and artefacts of historical/cultural importance and areas of recreational value or scenic beauty	▪ Select pipeline routes and facility sites that avoid excavation in areas known to be historically or culturally important, or of recreational or scenic value; ▪ If encroachment into such areas is unavoidable, liaise with responsible regional authorities (Department of Archaeology; Divisional Secretary; Department of Wildlife; Department of Forest) to agree on construction procedure and appropriate mitigation and compensation for damage; ▪ Consult the Department of Archaeology to determine whether any of the construction sites are in areas with the potential to yield discoveries during excavation work; ▪ With assistance from the Department of Archaeology, develop a “chance finds” procedure specifying action to recognise and avoid damage to any material of archaeological and/or cultural importance that is found; ▪ Take any other action that may be recommended by the relevant authorities and ensure that these procedures are followed throughout all construction work.
12. Accidental damage of existing infrastructure and disruption of public utilities	▪ Prepare an inventory of infrastructure at construction sites or pipeline routes by obtaining layout plans from service providers and conducting surveys where necessary; ▪ Plan site locations and pipeline routes to avoid existing infrastructure as much as possible; ▪ If it is necessary to move infrastructure, prepare relocation plans with service providers; ▪ Establish plans for immediate attendance by service providers to deal with any accidental damage to utilities; ▪ Make provision to allow satisfactory access to buildings, dwellings, or other activity areas throughout construction

Potential Negative Impacts	Mitigation Measures
	(e.g., provide wooden walkways and metal plates to allow pedestrian and vehicle access across trenches). ▪ Replace or provide monetary compensation to the owners of any public and private structures damaged by construction (including vibration damage); ▪ Use vehicles and machines that adhere to accepted standards for vibration; ▪ Ensure that contractors keep sites free from all unnecessary obstructions by storing or disposing of any equipment or surplus material after use; ▪ Ensure that contractors remove from site any debris and temporary works that are no longer required.
13. Conflicts with other planned projects in the area	▪ Consult relevant authorities to obtain details of the other planned projects in the area; ▪ If there is any conflict, such as the same site being chosen for facilities by different projects, discuss and resolve in coordination with the implementing agencies.
14. Environmental and social disruption by construction camps, if these are used to house workers	▪ Avoid the use of worker accommodation camps and provide socio-economic benefits to the local community to assist in post-conflict rehabilitation, by employing local people in the construction workforce as much as possible; ▪ If there is no alternative to employing workers from outside the project area, ensure accommodation camps are sited on land that is obtained from willing sellers and located in a suitable distance from any neighbouring communities; ▪ Ensure that any worker camps are properly managed and provided with adequate sanitation, health facilities and waste disposal according to Labor Laws; ▪ Ensure adequate and total clearance of any work camp sites after use, and reinstate appropriate vegetation. ▪ Conduct programmes to raise worker awareness of the risks and dangers of HIV/AIDS.
15. Disturbance by noise, dust, visual intrusion at sites used to store and process construction materials (batching and crushing plants)	▪ Locate all sites for the storage and processing of construction materials on unused government land, well away from main roads and inhabited areas; ▪ Require contractors to operate measures to reduce noise and dust from such operations, including noise reduction and dust suppression equipment, covered storage of loose materials, watering site roads, etc.
16. Impacts from large volumes of heavy vehicle traffic, carrying construction materials from distant quarries and taking waste spoil for disposal (noise, dust, vehicle emissions, disturbance, reduced road safety, greenhouse gas emissions)	▪ Conduct a thorough examination of potential sources of all construction materials to identify sources as close to project sites as possible; ▪ Use alternative materials wherever possible (e.g., war damaged building rubble as rip-rap or aggregate); ▪ Reduce waste by re-using spoil in the project where possible and provide material to other projects in the area.
17. Reduced income for downstream farmers if irrigation water is reduced or interrupted	▪ Plan work at Iranamadu Tank carefully to avoid any need to alter normal tank operations; ▪ Conduct work on Iranamadu Tank in dry season.
18. Construction at Iranamadu	▪ Include the Sri Lankan army as a stakeholder in project

Potential Negative Impacts	Mitigation Measures
Tank could interfere with activities of the army camp that is now located alongside the tank to maintain security	consultations; ▪ Discuss all proposed work with appropriate army commanders and agree measures to allow construction to proceed without compromising army operations, safety or security; ▪ Apply noise and dust reducing measures at Iranamadu and other army posts site to avoid affecting personnel.

3. Operation and Maintenance

a. Institutional Strengthening

255. Once the new water supply system has been built and commissioned, the regional office of NWSDB will be responsible for maintaining the scheme in working order. This will require routine inspection and maintenance of all elements of the system (intake, transmission mains, treatment plant, pumping stations and distribution network) plus repairs where and when necessary. To enable NWSDB to fulfil these responsibilities to the requisite high standards it is essential that the regional office is strengthened and supported by the project as proposed in Section 5.3.1 above. Measures should include:

(i) Training in financial management, recruitment, project management, work planning, scheduling, implementation, etc.;
(ii) Preparation of O&M manuals and procedures setting out how all aspects of the work involved are to be conducted (inspection, maintenance and repair);
(iii) Training managers and site operatives in application on the O&M procedures.

256. Strengthening should commence during the construction period, and on-the-job training and support should extend throughout the initial years of scheme operations.

b. Water Storage and Abstraction

257. One of the most important requirements of the operational phase is for NWSDB to ensure that the rate of abstracting water from Iranamadu Tank agreed in the MOU is not exceeded. As explained above, this is likely to be 27,000 m^3/d for the first few years, as proposed by the water resources review study of 2010. Procedures to guarantee abstraction at the agreed rate should be set out in the O&M manuals and NWSDB should ensure that these are strictly followed. They should also ensure that all other agreements and conditions set down in the MOU with the PID are adhered to and again should include necessary action in the O&M manuals where appropriate and should conduct regular inspections to check that the procedures are conducted as prescribed.

258. If the MOU includes an agreement to increase abstraction to levels needed for Phase 1 Stage 2 of the scheme (which requires an additional 23,000 m^3/d), NWSDB should ensure that actions recommended by the water resources review study and this IEE are implemented beforehand. These are to:

(i) Conduct an engineering review of the performance of the tank (storage, bund safety and security, functioning of the spillway and gates, etc.) and implement remedial action if necessary;

(ii) Implement the necessary changes in agricultural practice in the areas irrigated by Iranamadu Tank, so that in the dry season farmers cultivate other field crops (OFC) instead of the current mixture of rice and OFC;
(iii) Ensure that changes in agricultural practice are implemented voluntarily by farmers and that they are provided with training, assistance and financial support as necessary to ensure that their livelihoods continue, or preferably improve.

259. Any other provisos required by the MOU should also be fully implemented to the satisfaction of PID.

c. Water Quality

260. The main prerequisite for the operating scheme is to maintain the quality of treated water supplied to the public. The O&M manuals will include inspection and maintenance procedures for the WTP to ensure that it is kept fully functional, and NWSDB should conduct regular inspections and training sessions to ensure that these are correctly followed. They should also routinely monitor the quality of the water delivered to consumers, and the project should upgrade the regional NWSDB laboratory to enable them to design and conduct an appropriate program of sampling and analysis.

261. This study has identified a risk of algal blooms liberating toxins into the source water at Iranamadu Tank, and NWSDB should therefore implement the measures recommended in Sections 5.3.2 and 5.4.1 above to assess such risks and take remedial action in both the short and longer term if necessary. This comprises:

(i) Design and implementation of a program of routine sampling and analysis of water from Iranamadu Tank to allow early detection of algal blooms or water quality changes that could lead to bloom conditions;
(ii) Preliminary planning of a project to establish a system of catchment management in the Iranamadu basin (to protect the quality of water over the long term); initial development funded by this project should lead to a future funding application.

262. Identification of the existing distribution system for deteriorated cast iron pipes and replacement of such sections with new pipes early during the project operation phase and replacement of all the old cast iron pipes at least at a later stage if resources are limited, is also recommended.

VI. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: SEWERAGE AND SEWAGE TREATMENT

A. Environmental Impacts Related to Location and Design

1. Sewerage System and Pump Stations

263. The feasibility study proposes to install sewer pipes throughout the Jaffna Municipal Council and University of Jaffna areas, and provide connections to all domestic and commercial premises that have water-operated toilets. The present outline design indicates that the land is very flat throughout most of this area, so collection and transfer of wastewater will require a relatively large number of pumps, estimated at around 39.

264. According to the feasibility study, pumps will be positioned below ground in brick and concrete pumping stations, each within a site of around 10 x 5 m, with a short access road. Locating the pumps below ground would reduce the noise of the pumps, so this design measure should be implemented if it does not compromise pump operation.

265. Locations for the pump stations were not identified during the feasibility study, as these depend on the results of topographic surveys and hydrodynamic modelling to be conducted during the detailed design. These studies will determine the general location of each *Pradeshiya Sabhas*, but specific sites are then chosen by scheme designers. Pump noise and sewage odor are the main environmental issues associated with pumping stations, so to minimize the effects of these on the neighbouring community, sites should be chosen that are as far as practicable from residential and commercial areas. Wherever possible sites should also be located on government-owned land that is not occupied or used by any persons (including the non titled) to avoid the need to acquire privately-owned land and relocate and resettle people.

2. Service Connections to Sewers

266. Wastewater discharge into the sewers will be mostly through connections to households and commercial establishments, and at this stage, it is unlikely that industrial connections will be permitted. Nevertheless, a coordination committee should be established to take on responsibility for licensing service connections from all non-residential premises (commercial and light industries) to ensure that only wastewater with constituents suitable for conventional sewage treatment enter the system. The committee should comprise representatives from the Municipal Council, NWSDB and the Sub-Regional office of CEA, who should be given consultancy support by the project to enable them to set up and manage a licensing system that stipulates the effluent quality for discharge into sewers. This should involve frequent monitoring of premises and the quality of untreated effluent to ensure that illegal connections are not made.

267. The Environmental Division of the MC and the sub-regional office of CEA are responsible for the current Environmental Protection Licensing (EPL) system for industries. Their involvement in the proposed coordinating committee means that, if the system was expanded to include industrial connections in the future, these agencies would have the expertise to consider possible threats from hazardous materials, and to require appropriate pre-treatment.

3. Strategy and Location of Treatment Plant

268. Two options for sewage treatment were considered in the feasibility study: (i) the activated sludge process; and (ii) treatment via waste stabilisation ponds. While option (ii) is preferred on environmental grounds because it produces much less sludge and odor than the alternative method, due to land constraints the option selected is the activated sludge process. The use of stabilisation ponds requires a much larger area than an activated sludge plant, and it is not possible to find such a large extent of land in the Jaffna Peninsula, within feasible distance of the catchment area. The selected plot is the coast at Kallundai.

269. Inspection of the Kallundai site in 2009 and 2010 revealed two key issues that need to be resolved by action during the pre-construction period. Firstly the site is low-lying with little natural drainage, and was partially covered by standing water following recent rain in December 2009 (see Appendix 2). This finding too indicates that the topography of the site is more suited to locate a mechanical treatment system.

270. There is also a Hindu cremation area on the landward side of the site, and although it is 200 m or more from the edge of the proposed STP it would not be appropriate for the two activities to coexist in such close proximity (Appendix 2). The site contains no formal cremation infrastructure apart from a small open-sided building and a platform on which the cremation occurs, so it is possible that the site could be moved with the agreement of the local community. NWSDB should therefore hold discussions with community leaders and the custodians of the site to ascertain whether relocation is possible, and should identify alternative plots of land for their consideration. If the community is willing to relocate the site, NWSDB should:

(i) Acquire the alternative land as set out in the project Resettlement Plan, and provide additional practical and financial assistance to support the relocation and rehabilitation process; and
(ii) Ensure that the community is provided with water and (if possible) sewerage facilities by the project.

271. If potential conflicts with the existing use of adjacent land are avoided, this should be a very suitable site for an STP facility. It has the major advantages of providing sufficient land nearby for future expansion, and being in a remote location, so odor and noise from plant operations should not be a problem.

4. Sludge Handling

272. The activated sludge process will produce sludge daily, which after de-watering has to be left on purpose-built drying beds for desiccation and sunlight or use other appropriate technology to kill the enteric bacteria and pathogens it contains, before being deposited in a landfill or be reused as a soil conditioner. Basic units of an activated sludge treatment process will include, screening, primary sedimentation, aeration tank, secondary sedimentation with recirculation, sludge thickener, and sludge stabilization, more details of units to be adopted will be available during detailed design.

273. Research conducted during the feasibility study suggests that farmers may be unwilling to use sewage sludge in agriculture, which represents a loss of a valuable resource, given that appropriately stabilized sludge is safe to handle. There is some evidence that farmers may be persuaded to use fertilizer produced from sludge if it has been broken down by composting, so STP design should include a small composting plant to produce this material. The project should also finance a program of awareness-raising amongst the farming community to inform them of the benefits of using sludge-derived compost and to demonstrate its safety from a health perspective. If the relevant state organizations, such as the Jaffna Municipal Council and NWSDB, could demonstrate the viability through the use of sludge as a soil conditioner in their compounds and public places under their purview, the rest of the community may be encouraged to reuse the sludge-dewed compost.

5. Effluent Discharge

274. Options for the disposal of treated effluent from the STP involve either: (i) re-use of the effluent for irrigation (crops, sports fields, etc.), with the excess discharged to the sea; or (ii) discharge of all of the effluent through a sea outfall. In Jaffna Municipality only 1% of the area is under agriculture, so irrigation would utilize only a fraction of the effluent. Disposal through a sea outfall is therefore the only practical solution.

275. The eastern land mass of the Jaffna Municipal Council area is bound by Jaffna Lagoon and the wetlands of Jaffna Peninsula and not by open sea. As described in Chapter 4 above, these wetlands are very shallow (generally <1m deep), with large expanses of mudflats; and are extensively fished, providing most of the locally consumed fish, crabs, prawns, etc. In the Kakaithivu area there are about 250 traditional fishing craft (wallam) and fishing in these wetlands is the main source of livelihood for many families. There is also a saltern (shallow ponds producing salt from seawater) at the periphery of the lagoon, and although the operation was suspended during the conflict it is expected to resume in the future.

276. If treated sewage effluent was discharged into these wetlands and lagoons, it is very likely that the water would become organically polluted, with high levels of BOD, COD and plant nutrients, leading to eutrophication and algal blooms, plus low levels of dissolved oxygen as the organic material decomposes. This would have adverse impacts on fisheries, the saltern, the aesthetics of these areas and aquatic ecosystems. The likelihood of such conditions occurring is increased by the shallow depth of the water and the generally poor circulation, which restricts exchange of water between inshore and offshore areas. Mixing with sea water is also restricted by the causeway embankments, one connecting the mainland to Karainagar and other connecting the mainland to Kayts.

277. Two outfall locations at more open coastal sites were considered in the feasibility study but a firm decision was not made regarding the preferred location. Because of the risks to the sensitive and important inshore areas and fishery, a more detailed study should be conducted in the design stage to determine the optimum location and length of the outfall required in order to prevent STP effluent becoming “trapped” in the inshore area causing pollution as described above. This should include computer modelling of effluent dispersion and the effects of the discharge on water quality, and outfall location and length should be designed to achieve maximum dispersion and dilution of the effluent and avoid it being carried back towards the coast by the prevailing currents.

6. Sea Outfall

278. Design studies to determine optimum outfall length and location as recommended above can be compromised when the system is operating, if the submerged pipeline leading to the outfall becomes perforated under the corrosive action of seawater or damaged by ship anchors or fishing gear, causing effluent to leak out before reaching the outfall. The pipeline should therefore be buried below the seabed to provide protection from accidental damage and its location should be marked with warning buoys or other maritime signage. Pipeline materials should be selected with long-term durability as a key criterion.

279. The process of burying the pipeline will damage seabed habitats so the pipeline route should be designed to avoid any areas of seabed that are important to the fishery, or which contain any rare or important species. This will require a detailed study of the seabed habitats along potential pipeline routes during the design stage.

280. If the outfall design achieves the aim of diluting and dispersing the effluent away from the coastline, then the input of organic matter to the marine environment could be of benefit to the fishery in stimulating the growth of phytoplankton which forms the food of some species of fish and shellfish. Given the sociological and economic importance of the fishery and the difficulties faced by formerly displaced people returning to their homes and livelihoods, this reinforces the need to design the outfall structure and its length and location to optimize effluent dilution and dispersion.

B. Environmental Impacts Related to Construction

1. The Construction Process

281. The basic elements of the sewerage and sewage treatment system are similar to those of the water supply scheme and include pipelines, pumping stations and a treatment plant. The main differences are that the water supply system includes overhead tanks and ground tanks at the WTP that are constructed from RCC, and the wastewater treatment plant includes a sea outfall for effluent disposal and treatment tanks that are mainly bunded with earth and sealed with HDPE sheeting.

282. Like the water supply mains and distribution network, sewer pipes will also be located in the Right of Way alongside main highways and local roads in the serviced area, which in this case comprises the Jaffna Municipal Council and Jaffna University areas. The excavation will again be conducted by backhoe diggers, working with small teams of laborers and other workers. Dug soil and stone will be deposited alongside the trench, and the excess will be loaded into trucks and taken offsite for disposal. Pipes will be brought in on trucks and offloaded by crane, and positioned in the trench by hand or pipe-jack and connected to by hand. If pipes are bedded into sand this will be brought in on trucks from the nearest quarry and stored nearby before being shovelled into trenches by hand. Soil will be replaced on top of the trench and tamped down by hand-operated compactor.

283. Excavation at the pumping stations will also be conducted by backhoe to create trenches for pipes, voids for the wet-wells, and foundations for the pump houses and boundary walls. Masons will apply bricks and mortar by hand to build the walls around the site, and the pump-house and wet-well, and surfaces will be covered with plaster as necessary. Pumps, pipes, switchgear and other fitments will be brought in on trucks, offloaded and positioned by crane and connected to by hand. Plumbing, electrical components and other fixtures and fittings will also be connected to by hand.

284. At the STP site, cavities for the treatment units will be dug by backhoe, with excess soil and stone again being loaded onto trucks and taken for disposal. Units for screening/preliminary treatment, primary sedimentation, aeration and secondary sedimentation will be constructed from RCC. After excavation, metal reinforcing rods will be put into place by hand to form the core of the floor and walls of the tank. Sections of reinforcing will then be encased in wooden shuttering and concrete (mixed on site) will be poured in (Photos 7 and 8). After drying, the shuttering is removed to reveal the completed RCC section and any final finishing is done by the application of mortar and plaster by masons by hand. The adjacent section is then formed in the same way and this process is repeated until the tank is completed. Metal grids/screens will then be attached by hand to fixing bolts embedded into the concrete.

285. The outfall pipe will be buried in a trench and in the on-land portion this will be dug by backhoe as described above. The trench in the seabed will also be dug by backhoe, mounted on a small barge. Excavated sand will be piled on the seabed nearby, and pushed back around and over the pipe by backhoe once it is installed. Pipes are mounted and connected to on barges and lowered into the trench section-by-section.

286. The outfall structure has not yet been designed, but it is assumed that it will be either the simple open end of the pipeline, or a purpose-built outfall structure designed to maximize initial dispersal of the effluent. If an outfall structure is used this will be created from RCC as

described above, once the outfall area is enclosed by watertight piles, drilled into the seabed by hydraulic hammer, and the seawater has been pumped out.

2. Construction Impacts

287. Because the sewerage and sewage treatment system will be built in essentially the same way as the water supply scheme, the two construction projects are expected to have similar environmental impacts. The main difference is that the impacts of building the sewerage system should be less extensive than those of the water distribution network because the sewerage system service will cover a smaller area and the construction process should therefore be more straightforward. There will however be more impacts in the marine environment, where a sea outfall will be built to dispose of treated sewage effluent.

288. As with the water supply scheme, many impacts have already been avoided or reduced by action taken in preparing the outline designs during the feasibility study. This includes:

(i) Avoiding involuntary resettlement (acquisition of privately-owned land and relocation of occupants) by locating the treatment plant (and pump stations as recommended above) on government land that is not used for any purpose;
(ii) Avoiding the need to relocate households or businesses by locating sewer mains and pipes in the government-owned ROW at the shoulder of roads.

289. The other environmental risks are mainly those that are normally associated with large construction projects involving excavation, installation of pipelines and creation of RCC structures, and construction in urban areas. These were described in Section 5.2.2 above.

290. The main impacts are again likely to be those that occur in the urban areas, where residents may be disturbed by noise, dust and the physical/visual presence of the construction sites; and their activities could be disrupted by traffic diversions, temporary access restrictions, etc. People could also be disturbed along routes used by heavy trucks bringing equipment and construction materials to the sites and removing waste for disposal. These and the other potential impacts are however not difficult to mitigate, by applying the same measures as recommended for the water supply system above (see Section 6.4 below).

291. It is not possible to avoid impacts in the marine environment, where there is no alternative to running the pipeline from the STP along the seabed to the point of discharge. There will therefore be impacts on the benthic habitats and communities from the installation of the outfall pipe in a submarine trench. Habitats will be disturbed and the inhabitants dispersed into the surrounding sediment and seawater as the trenches are dug and refilled, and many of these delicate creatures will probably be killed by the mechanical effects of the disturbance. These impacts are unlikely to be of major significance because areas that are damaged in this way normally become re-colonized in time. However efforts should be made to minimize the extent of these impacts, to avoid affecting the fishery (as some fish feed on benthic animals) and to reassure fishers that their livelihoods will not be affected. This will require a range of actions aimed at avoiding sensitive areas and keeping the damaged area to a minimum. These are described in Section 6.4.2 below.

C. Impacts of Operation and Maintenance

1. O&M Procedures

292. Like the water supply system, operation and maintenance of the completed sewerage and sewage treatment scheme will be the responsibility of the regional office of NWSDB. Given their limited manpower, expertise and budget, and the disruption to normal functioning caused by the conflict of the past few years, it will be essential for the project to strengthen the NWSDB office by providing training and support to assist them in planning and implementing their new responsibilities. This should be integrated with the similar support provided with respect to the new water supply system to avoid duplication and maximize the impact and long term sustainability of the measures.

293. There are three main O&M requirements for a wastewater collection and treatment system, which are to keep the pumping stations and treatment plant in working order and repair any pipeline leaks immediately. All inspection, maintenance and repair procedures will be specified in O&M manuals prepared by the scheme designers during the detailed design stage.

294. Pipeline leaks will almost certainly be reported by local residents, and NWSDB should set up a mechanism at their office through which this can be done effectively. They should also ensure that maintenance teams respond rapidly to any such incidents, given the health risks of sewer leaks and the risk of contaminating the water supply if there are leaks in the two systems in close proximity. As with the water supply network, sewer leaks will be repaired in much the same way as the system was installed, by re-digging the trench to expose the source of the leak and repairing the connection or replacing the damaged pipe.

295. A small number of people will be employed at each pumping station to conduct regular inspection and maintenance of the pumps and other equipment, and to inform NWSDB when pumps need to be replaced. NWSDB should ensure that all persons engaged in O&M teams are fully trained before commencing work, and that the pumping stations and the maintenance schedule are regularly inspected and checked. They should also ensure that sufficient provision is made in their annual budgets to enable pumps to be replaced promptly when necessary.

296. Routine operation of the STP will involve the same kind of inspection and maintenance of pumps as conducted at the pumping stations, plus the additional task of routine monitoring to ensure effective operation of the activated sludge treatment and sludge management. Sludge removed from the sludge drying beds will be removed by hand shovelling and taken to landfill on a truck. Procedures for effective operation of the treatment plant will again be set out in detail in the O&M manuals.

2. Impacts of Operation and Maintenance

a. Institutional Strengthening

297. Given the health risks associated with sewage and its potential as an environmental pollutant, it will be essential for NWSDB to maintain all elements of the new system in a fully functioning condition throughout the design life. It is very important therefore that some of the project budget is devoted to strengthening and supporting NWSDB as recommended above by providing both training and assistance from consultants. This should be aimed at enabling the regional office to: a) recruit properly skilled and dedicated staff for the O&M teams; b) plan and

manage the routine inspection and maintenance activities; and c) organize and implement repairs promptly when needed.

b. Sewerage System and Pump Stations

298. Sewer repairs should be infrequent, but will need to be effected promptly to avoid the considerable nuisance and public health risks that could arise from sewage being exposed in urban areas. To protect the health of workers and the public, damaged and/or leaking sections should be isolated by closure of valves before any work is conducted, followed by pumped removal of the sewer contents into a tanker, which is then emptied at the STP.

299. The operating pumping stations should not have significant impacts on neighboring communities if the recommendations made above regarding site selection are followed and pump stations are not located close to inhabited areas, and if pump maintenance and repair are conducted effectively. As noted above, NWSDB should routinely inspect all sites to ensure that O&M procedures are properly followed.

300. Metal screens at pump stations (installed to remove materials like wood and plastics that could damage the pumps) will need to be cleared of debris periodically. O&M manuals will describe how this is to be done, including precautions for safe handling of the material and storage in sealed containers prior to disposal to landfill. NWSDB should also make arrangements with the local authority for the containers to be collected by refuse trucks.

c. Treatment Plant

301. If the Hindu cremation area is relocated from the landward side of the proposed STP site as recommended above, then the remote location of the site should ensure that there are no significant impacts from odor, noise, visual disturbance, etc. when the facility is operating, as there will be no people in the vicinity who would be affected.

302. It can also be assumed that, as recommended above, the design of the STP will include adequate flood protection and drainage, and that the site will therefore not become flooded during heavy rain, high sea levels or storms. The new sewer system should in fact greatly reduce the present pollution of surface- and ground- water resources in the serviced area, caused by pit latrines and septic soakaways, wastewater discharges to drains, etc. The scheme should therefore improve the environmental condition of groundwater and wetlands/lagoons and improve public health.

d. Sludge Handling and Disposal

303. Since sludge will be stabilized no major health or environmental problems are anticipated in the handling and disposal of sewage sludge at the STP. NWSDB should however ensure that inspections are conducted during sludge handling operations, to ensure that correct procedures are followed.

304. Stabilized sludge can be safely landfilled after drying by sunlight on drying beds at the STP, in which case NWSDB should make arrangements with the relevant municipal authorities regarding deposition of the material, and O&M procedures should ensure that the dry waste is covered by secure tarpaulins when carried away on trucks. It would however be much better in environmental terms if, as suggested above, the material was put to beneficial use as an agricultural fertilizer, replacing organic matter in paddy soil, from which essential nutrients are

leached by over-application of irrigation water. Thus, as recommended above, NWSDB should invest some of the project budget in establishing a sludge composting plant at the STP and should demonstrate the safety of the material from a health perspective and raise the awareness of farmers regarding the benefits of using sludge-based fertilizer.

305. Such plans would be compromised if hazardous material was discharged to sewers, and this would also affect the quality of the treated effluent and could pollute the receiving waters causing ecological damage and possibly affecting fishery. Keeping the system free of such materials was the reason for recommending above that NWSDB prohibits any heavy industry from discharging process effluents to sewer and establishes a Coordination Committee to license non-domestic service connections, with powers to stipulate any necessary pre-treatment. If this is done, hazardous materials should not be discharged into the sewers and the treatment process can be expected to function as designed, producing an effluent that complies with national wastewater discharge standards. If in the future heavier industries become established, NWSDB may wish to consider allowing them to discharge to sewer. In that case the Coordinating Committee should develop standards for effluents to be discharged into the sewers, and enforce the licensing system with frequent monitoring of effluent quality.

e. Effluent Discharge

306. Providing the recommendations made above are followed thoroughly and no toxic or hazardous material enters the sewers, the treatment plant produces an effluent that complies with wastewater discharge standards, and the outfall design, length and location ensure that the effluent is diluted and dispersed rapidly−then the release of treated effluent should not have significant impacts on the ecology, fishery or aesthetic value of the discharge area. As suggested above, the input of organic material in non-toxic quantities, without becoming concentrated in any particular area, might in fact have beneficial impacts by stimulating the growth of phytoplankton, upon which certain species of fish and other organisms feed.

307. If the outfall pipe is buried and clearly marked with buoys or other appropriate signs as also recommended above, it should not impede fishing, shipping, or smaller vessels. There are no aquaculture farms or recreational facilities in the marine or coastal areas near the proposed STP site. Even if such facilities are set up in the future, the proposed mitigation measures would prevent any adverse impacts on them.

D. Mitigation of Environmental Impacts

1. Pre-Construction and Detailed Design

a. Sewers and Pump Stations

308. To avoid the need to acquire privately-owned land and relocate households or other infrastructure, sewer pipes and pumping mains will be located in the government-owned ROW at the shoulder of main roads, secondary roads, and local roads in and around the served area.

309. Topographic surveys of the service area and hydrodynamic studies of the proposed sewer network will be conducted during the detailed design stage and these will indicate the general locations where pumping stations need to be situated. The specific sites should then be chosen on the basis of the following criteria to avoid or reduce social and environmental impacts. Sites should be located:

(i) On government-owned land that is not occupied or used for any purpose, including usage by non-titled (to avoid physical or economic displacement and resettlement);
(ii) As far as possible from residential and commercial areas (to reduce the effect of noise and odor).

310. If at any location there is no alternative to acquiring privately-owned land, this should be purchased according to the procedures set out by Sri Lankan law and government policy, and additional compensation required to comply with ADB policy (as set out in the Resettlement Plan for the project) must also be provided.

311. To further reduce the operational impacts of pumping stations, the pumps should be located below ground as suggested in the feasibility study reports, provided this does not impair their function.

b. Service Connections

312. To ensure that only domestic wastewater enters the sewers and therefore enable correct functioning of the STP, it is recommended that NWSDB establishes a Coordination Committee comprising senior experts from the Municipal Council, NWSDB, and the sub-regional office of CEA, to be responsible for licensing service connections from non-domestic premises (commercial and light industry). If heavy industries become established in the peninsula in the future, these should be required to apply for service connections and the Coordination Committee should stipulate the required effluent quality, specifying pre-treatment methods if necessary. The Committee should enforce the licensing system with frequent monitoring (at least once every 3 months) of all non-domestic premises. The project should assist NWSDB in setting up the committee and should provide them with consultancy support in the early stages.

c. Treatment Plant

313. The proposed STP site at Kallundai is very suitable from a social and environmental perspective as the land is owned by the government and is un-used and unoccupied, and is also in an uninhabited area, so there should be no major impacts on people. There is also additional government-owned land nearby that would be suitable for future expansion.

314. The only constraints to development of the site are the lack of effective drainage and the presence of a Hindu cremation area approximately 200 m from the site boundary, which could be affected by views of the STP and odor. These issues should both be addressed in the design stage as recommended above. The design consultant should thoroughly examine flooding risk because if the site gets flooded, the site may become inaccessible:

(i) Extensive drainage within the site, capable of removing maximum monsoon rainfall; and
(ii) Improvements to the access road with drainage, so that it is usable in the monsoon.

315. NWSDB should meet community leaders and custodians of the cremation site to determine whether the facility could be moved to another area and should identify potential alternative sites to aid the discussion. If relocation is possible NWSDB should:

(i) Acquire an agreed alternative plot following procedures set out in the Resettlement Plan and provide practical and financial assistance to support the relocation;
(ii) Provide the affected community with water and (if possible) sewerage connections.

316. NWSDB should also improve the environmental setting of the STP site. Even with no settlements in the vicinity, a buffer zone planted with trees at the perimeter of the site would improve its appearance, as would grass seeding of the flood protection bunds. The site should also be fenced to prevent entry of scavenging animals, cattle, etc.

d. Sludge Management

317. If the sludge is well stabilized no special precautions for handling or disposal is required and it can be safely land-filled, or beneficially used as an agricultural fertilizer, replacing much needed organic matter and nutrients in irrigated soils. To overcome farmers' resistance to using sewage sludge for this purpose, NWSDB should ensure that STP designs include a small composting facility, to reduce the material into a form in which it should be acceptable. NWSDB should also conduct a programme to raise farmers' awareness of the benefits of using sludge-based fertilizer and to demonstrate its safety from a health perspective.

e. Effluent Discharge

318. Shallow inshore areas are important to fisheries as they are the locations where many fish and shellfish pass through the early stages of their life history; and they are also of amenity value as a tourist attraction. Given the local and national importance of the Jaffna fishery and the increasing tourism potential, the STP outfall must be designed to ensure there is no risk of the effluent polluting coastal areas. Outfall design must therefore include a detailed computer modelling study to determine the optimum outfall length and location to achieve maximum rapid effluent dilution and dispersal and ensure that it is not carried by currents into inshore areas.

f. Sea Outfall

319. The outfall pipe should be composed of a material that is not vulnerable to corrosion by seawater, and should be buried in the seabed to protect it from damage by anchors or fishing gear, and to ensure that it is not a hazard to these craft. The location should be clearly marked with buoys or other maritime signs. The process of burying the pipeline will damage the seabed and inhabiting plants and animals, so a detailed study of potential routes should be conducted in the design stage and the location amended if necessary to avoid any rare, endangered, or otherwise important habitats or communities.

2. Construction

320. The sewerage system and STP will be built in similar locations using the same types of construction methods as those of the water supply system and WTP, so construction-related impacts are expected to be similar for both sub-projects, and somewhat less significant for the sewerage network, which covers a smaller area. Action to avoid or reduce certain impacts has already been taken during the feasibility study, including locating treatment plants and pipelines on government-owned land to avoid the need to relocate households and resettle people.

321. Most of the other impacts of this phase will be those that are common to most construction projects, particularly those involving excavation, installation of pipelines and creation of RCC structures. There are therefore well established methods of mitigation, which are set out in Table 5-3 above. These methods should be applied to the sewerage and sewage treatment sub-project where appropriate.

322. The sea outfall will also produce similar impacts in the construction phase to those elements of the water supply component that involve routing of transmission mains onto the islands without road connections, as both processes involve submersion of a pipeline into the seabed, which will be damaged in the process. The same kind of mitigation should therefore be applied. Surveys of potential locations will be conducted during the design stage to avoid any areas that are important for fisheries, or which contain important marine habitats or species, and these will be avoided when selecting the outfall site. Further action should be taken to keep construction impacts to a minimum and to reassure fishers that their livelihoods will not be affected by the work. Scheme designs should specify a maximum working width to be used when installing the pipeline and this should be kept to the minimum practicable. Contractors should then be supervised closely when conducting this work to ensure that no damage occurs outside this zone. NWSDB should also hold meetings with fishers and their organizations in advance of the work to explain how any areas that are of fisheries importance have been avoided, and how impacts along the chosen route are being minimized.

3. Operation and Maintenance

a. Institutional Strengthening

323. One of the most important recommendations is for the project to raise the capacity of the regional office of NWSDB to enable them to fulfil their responsibilities of managing the operation of the new sewerage and sewage treatment system, keeping it fully repaired, maintained and functioning throughout its intended design life. This will involve provision of training and support from consultants before and during the initial stages of operation, to help NWSDB establish and implement the necessary management systems and procedures. This should focus on: a) recruitment of appropriately skilled and dedicated staff for O&M teams; b) planning and management of routine inspection and maintenance; and c) organizing and implementing repairs when needed. The strengthening will be similar to the support provided to NWSDB in relation to the operation of the water supply system, so these elements should be integrated to avoid duplication and maximize use of training resources.

b. Sewerage System and Pump Stations

324. If NWSDB is strengthened as recommended, sewers and their component parts, including pumping stations, should be serviced and maintained to appropriate standards, and repairs should be conducted rapidly. To facilitate effective repairs, NWSDB should set up a mechanism through which residents can report sewer leaks, and ensure that repair teams respond within a suitable time-frame, say 3 days. To protect the health of workers and residents, leaking sections should be isolated by closure of valves before repair work begins and sewer contents should be pumped into a tanker and discharged at the STP.

325. All maintenance and repair procedures will be set out clearly in O&M manuals prepared in the design stage. NWSDB should ensure that these cover all activities, including pump maintenance and repair, and removal and safe disposal of debris from pump station screens. They should also ensure that all workers (newly-employed and existing) engaged in

maintenance or repair are fully trained in their roles and responsibilities before starting work on the new system, and are then re-trained at least every two years. Pumping stations and their maintenance schedules should be regularly inspected and NWSDB should make adequate provision in their annual budgets for all maintenance and repair activities and materials, including replacement parts.

c. Treatment Plant

326. Key operational issues at sewage treatment plants generally relate to the management and disposal of the two main waste products: treated effluent and sewage sludge. For this project the Coordination Committee and licensing system recommended above should ensure that hazardous materials do not enter the sewers and that the material is thus treatable to national discharge standards by the sewage treatment system as designed. The project should therefore assist NWSDB in establishing the Coordination Committee and funding its operations and should provide the committee with consultancy support to set up the licensing system and to monitor effluent from non-domestic premises as recommended above. NWSDB should also set up a system to routinely monitor the quality of the treated effluent produced by the STP to ensure that it is in compliance with national discharge standards at all times.

327. Given the potential of stabilized sludge to rejuvenate agricultural lands and increase yields by the addition of organic matter including plant nutrients, and the reluctance of local farmers to use the material in this way, NWSDB should set up a small composting plant at the STP and conduct a public education programme to raise farmers' awareness of the benefits of using sludge as a fertilizer.

d. Effluent Discharge

328. The coastal area into which the effluent is discharged is sensitive ecologically and as a fishery resource, and has potential as a tourist attraction. Monitoring of effluent quality before discharge should ensure that the effluent complies with national discharge standards, but this does not guarantee that water quality will not deteriorate in the discharge zone. The outfall structure and location will be designed to ensure maximum dilution and dispersal of effluent, and NWSDB should reinforce these measures by establishing a system to regularly monitor seawater quality around the outfall and inshore and to take remedial action if any deterioration is detected at any time.

VII. ENVIRONMENTAL MANAGEMENT PLAN

A. Mitigation

329. Table 30 lists the potential adverse impacts of the water supply and sanitation sub-projects as identified and discussed in Chapters 5 and 6, and the mitigation proposed to reduce these impacts to acceptable levels. The table also shows how the mitigation should be implemented, who should be responsible for each action, and where and when the mitigation activities should take place. It also provides a broad program for the mitigation plan, showing the period during which each activity should occur, from detailed design and tendering of contractors for the various work elements in 2011, through the proposed four-year construction stage (2012-2016), to the period in which the completed water and wastewater systems will be in operation (2016 onwards). The final column of the table assesses whether the proposed action will successfully mitigate the impact (shown as 0), and indicates that some of the measures will provide an additional benefit (shown as +).

330. After loan approval, NWSDB will take on responsibility for developing the two subprojects through the detailed design and construction phases, with assistance and support from ADB as necessary. NWSDB will appoint consultants to design each scheme in detail, and assist in tendering of construction contractors to build specific elements of the schemes, who will be appointed towards the end of the design period in 2011. Consultants will also be responsible for supervising construction of the sub-project they have designed.

331. Table 3 shows that action to mitigate impacts in the pre-construction period mainly requires either: discussion/negotiation with stakeholders (which will be conducted by NWSDB and NPC-Provincial Irrigation Department as the Implementing Agencies); or decisions on the approach to each scheme and the location of components, which will be the responsibility of the design and supervision consultants (DSC) with review and approval by NWSDB. During construction most of the impacts are caused by the construction process itself, so mitigation is mainly the responsibility of the construction contractors, although there is also some action required by the DSC and by NWSDB. Mitigation during the operational period will mainly involve strengthening the regional office of NWSDB to enable them to fulfil their responsibilities of managing the O&M of the two schemes, and preparing procedures describing how the various operation, maintenance, and repair activities are to be conducted. Capacity building will be implemented by NWSDB, with guidance and support from ADB, and O&M manuals and procedures will be developed by the scheme designers, the DSC.

332. NWSDB will conduct those activities that are their responsibility as part of their management of the project in the role of implementing agency through its project management coordination and implementation unit (PMCIU). They will prepare tender documents and contracts for the Design and Supervision Consultants and should ensure that these require the DSC to: (i) provide the mitigation that is their responsibility; and (ii) pay particular attention to environmental measures in their supervision of the contractors conducting the construction process. DSCs will prepare construction contracts during the design stage and these should include clauses specifying each of the actions allocated to the construction contractors in Table 30. All parties will therefore be contractually required to provide the specified mitigation, and penalty clauses in the contracts may be applied in the event of any deficiencies. It is recommended that NWSDB attach a copy of this IEE to all tender documents to make all parties aware of what is expected of them.

Table 30: Environmental Management Plan for Water Supply & Sanitation Subprojects (black=continuous activity; grey=intermittent)

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	D	Construction				Op	
WATER SUPPLY						11	12	13	14	15	16	[a]
Location and Design												
Feasibility study studies showed that Iranamadu Tank could store and provide extra 50,000 m^3/d for the water supply scheme if FSL was raised by 0.61 m, and farmers using irrigation water from the tank cultivated other crops instead of rice in dry season. This was agreed with PID and farmers in a MOU in 2006, but discussions in 2010 suggested that changes in agriculture were no longer acceptable	S	P	Improve & raise bund & head-works. Abstract 27,000 m^3/d for phase 1 in first instance (with no change in farming)	NWSDB/ DSC	Iranamadu Tank							0
			Increase abstraction to 50,000 m^3/d if improved bund & head-works perform satisfactorily and if changes in farming practice are successfully introduced	NWSDB	Iranamadu Tank							0
			Meet PID & farmers to negotiate new agreements and MOU									0
			*Provide training & financial support to farmers in adapting farm practices; ensure there is no reduction in livelihoods									0
Raising the FSL to 31.39 m will inundate 200 ha of land, which is currently only under water during high floods and may therefore be used for farming, grazing, wood collection, etc. Users' livelihoods would be reduced if they were unable to continue with these activities	S	P	Once the 200 ha is cleared of landmines, survey land use; identify any persons who use land for economic purposes	NWSDB	Iranamadu Tank							0
			Include land users in project stakeholder consultations									0
			*Compensate users of the 200 ha for reduction in livelihood via measures set out in project Resettlement Plan (RP)									0
Tank operates at 0.61 m below FSL because of bund seepage. Bund top is lower than design level and head-works have deteriorated from lack of maintenance	S	P	Include in project: bund repair, strengthening and erosion protection; repair of concrete stilling basin, spillway & gates	NWSDB	Iranamadu Tank							+
People living near the source may object to water being used to supply those living some distance away in Jaffna	S	P	Proceed with proposals to supply water to communities local to the source as part of this scheme	NWSDB, DSC	Kilinochchi District							+
The flora of Iranamadu Tank includes blue-green algae, which could bloom in the presence of high levels of nitrate or phosphate, liberating toxins into source water	S	T	Include in the WTP measures to remove algae and any poisonous constituents they may release, redesigning the facility to include Dissolved Air Flotation, Powdered Activated Carbon or other treatment methods if necessary	DSC	WTP							0
Future development in the Iranamadu catchment (e.g., along the A9 highway) could introduce pollutants into the source water, especially if minor tanks were rehabilitated	S	P	Set up systems of long term water quality monitoring and catchment management to ensure that quality of source water remains acceptable for conventional treatment	NWSDB	Iranamadu catchment							+
If Iranamadu intake is located in the Dri Aru or D5 canal, water could be polluted by runoff from nearby inhabited areas and increased water present could encourage farmers to increase irrigation use, causing conflict	S	P	Locate the new intake inside Iranamadu Tank as planned, near the existing left bank sluice	DSC	Iranamadu Tank							0
If any water supply facilities or pipelines were located on private land, income of land owners and users (including squatters) may be reduced and households might need to be relocated	S	P	Locate water supply pipelines and transmission mains in the government-owned ROW beside roads (or alongside irrigation canals for the raw water main from the intake)	DSC	Pipelines							0
			Locate WTP and pump stations on government land that is not occupied or used by any persons	DSC	WTP, Pradeshiya Sabha							0
			*If private land is acquired, compensate owners & users of land as set out in project Resettlement Plan	NWSDB	All sites							0

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	D	Construction				Op	
If the raw water transmission main was buried alongside or in the bed of the left bank main channel and Paranthan canal, the waterway would be closed during construction, when farmers would be deprived of irrigation water	S	T	As proposed in the feasibility study, bury the raw water transmission main in the maintenance road below the canal bank up to the A9 road, and then in the A9 road reservation to the raw water sump at the WTP at Palai	DSC	Raw water main							0
Transmission mains are large diameter pipes, so residents would be disturbed during construction if mains were laid alongside main roads through inhabited areas	M	T	Locate the transmission mains alongside the A9 highway as planned, but route the pipeline along Meesalai road to avoid the townships of Kodikarman and Chavakachcheri	DSC	Mains							0
Leakage from operating pipelines could compromise safety if it affects railway lines present in this area	S	T	Plan pipeline routes to ensure that pipes are not laid in the vicinity of railway lines	DSC	Pipelines							0
Coastal habitats would be damaged if pipelines were run across the seabed to supply water to islands, and this could affect ecology, fisheries and amenity value	S	T	Reduce damage of coastal habitats by locating pipelines alongside causeways providing road connections to islands	DSC	Pipelines							0
			Liaise with agencies executing current and future road projects; arrange for pipe laying beside A9 and causeways	NWSDB								0
			Where islands have no road connections, conduct seabed surveys and select routes avoiding sensitive areas	DSC								0
Operating pipelines could be damaged in the future by excavation conducted by other projects	S	T	Inform all relevant land authorities (Government Agent, District Secretary, RDA, Railway Dept, etc.) of the construction plans and provide them with as-built location plans once pipe-laying is complete	NWSDB	All sites							0
Construction												
Rainfall at excavation sites may cause erosion and silt-laden runoff could cause water quality problems and sedimentation in nearby ponds, lagoons & wetlands	M	T	Plan construction schedules to conduct excavation in dry season and avoid NE monsoon in November-January	Construction Contractor	All sites							0
			Clear vegetation only from the required working width to minimise soil exposure	Construction Contractor	All sites							0
			Design slopes to maintain stability of cut or filled surfaces	DSC	All sites							0
			Protect exposed surfaces with geo-textile fabric in rain	Construction Contractor	All sites							0
			Compact filled surfaces when completed to avoid erosion	Construction Contractor	All sites							0
			Build earth bunds beside drain channels to avoid overspill	Construction Contractor	All sites							0
			Hold drainage water in ponds to reduce sediment before discharge to water bodies, especially if soil is stockpiled	Construction Contractor	All sites							0
			Avoid erosion by rapid seeding of exposed soil with grass	Construction Contractor	All sites							0
Natural hydrology/drainage is changed if rain or groundwater collects in excavated areas.	M	T	As above: plan work to avoid excavating in rainy season	Construction Contractor	All sites							0
			Re-fill trenches and build RCC components quickly in dug areas so that voids are only open for short periods	Construction Contractor	All sites							0
Spills of oil, grease, fuel and other toxic materials used on site can pollute surface- and ground- water	M	T	Avoid locating pipelines and facilities near sensitive areas, e.g., ponds, wetlands, conservation zones, recreation areas	DSC	All sites							0
			Adopt effective pollution prevention/abatement measures	Construction	All sites							0

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	D	Construction				Op	
			on site: store fuel, oil, etc. in leak-proof areas with concrete floors & bunds; avoid storing toxins near sensitive sites	Contractor								
			Adopt good site practices to avoid accidental spills and set up contingency plans for immediate removal of any spill	Construction Contractor	All sites							0
Inappropriate disposal of waste materials from worksites and labor camps can cause visual/chemical pollution	M	T	Collect and recycle or dispose of safely to designated local authority sites all used lubricants, oil drums, etc.	Construction Contractor	All sites							0
			Dispose of all spoil and other waste to designated local authority sites, without causing visual or leachate pollution or hazards to other users of the disposal site	Construction Contractor	All sites							0
Vegetation clearance, excavation from quarries and borrow pits and construction of large water storage tanks can impair the visual quality of the landscape	M	P	Choose sites to avoid excavation and creation of large structures where valuable scenery would be spoiled	DSC	All sites							0
			Source materials from licensed quarries and prohibit creation of new borrow pits	Construction Contractor, DSC	All sites							0
			Keep vegetation clearance to a minimum and replant disfigured surfaces quickly after construction	Construction Contractor	All sites							0
If quarries and borrow pits fill with stagnant water this could encourage mosquitoes and other health vectors	M	P	As above: source materials from licensed quarries and prohibit creation of new borrow pits	Construction Contractor, DSC	All sites							0
			Re-fill cavities at quarries with un-used excavation waste	Construction Contractor	Quarries							+
			Dig drains in unfilled cavities to prevent water collecting	Construction Contractor	Quarries							0
Transportation of material and equipment will cause dust, noise and vehicle emissions along haul routes	M	T	Source material from locations close to construction sites	Construction Contractor	All sites							0
			Prepare Traffic Management Plan with relevant govt agency: plan routes to avoid narrow roads, high populated areas; plan diversions to allow trenching in narrow roads	Construction Contractor	All sites							0
			Validate routes by considering condition of roads, bridges; present traffic loads; safety records, etc.	Construction Contractor	All sites							0
			Consult responsible authorities and prepare plans to improve condition of haul roads before and after use	Construction Contractor	All sites							+
			Avoid using roads with heavy traffic during peak hours	Construction Contractor	All sites							0
Dust produced during construction, by material transport and other vehicles may be a health hazard and nuisance	M	T	Spray site roads with water during dry weather	Construction Contractor	All sites							0
			Limit vehicle speeds to a maximum of 20 mph on site	Construction Contractor	All sites							0
			Cover loose material with tarpaulins when carried by truck	Construction Contractor	All sites							0
			Store stockpiled material in walled areas and/or cover with tarpaulins to protect from wind and rain	Construction Contractor	All sites							0
Vehicles and equipment cause air and noise pollution	M	T	Maintain vehicles and equipment according to	Construction	All sites							0

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	D	Construction				Op	
which could be a nuisance in populated areas			manufacturers' schedules and standards	Contractor								
			All operations must meet ambient air quality standards	Construction Contractor	All sites							0
			Use noise reduction devices on vehicles and machinery used in population centers	Construction Contractor	Inhabited areas							0
			Avoid work at night and weekends in populated areas	Construction Contractor								0
			As above: Use tarpaulins to cover loose material on trucks	Construction Contractor	All sites							0
			Obtain necessary permits for all blasting and quarrying	Construction Contractor	All sites							0
			Inform residents in advance of all blasting activity	Construction Contractor	All sites							0
			Complete excavation quickly in residential areas	Construction Contractor	Inhabited areas							0
			Dig and complete short lengths of trench in populated areas so that soil is only stockpiled for a short time	Construction Contractor								0
There are inherent dangers in all construction work that present risks to the health and safety of workers and the public	S	T	Prepare and operate a Health and Safety (H&S) Plan for all construction sites, which includes:	Construction Contractor	All sites							0
			- Maintenance of worker safety in compliance with labor laws and other relevant legislation;									0
			- Provision and use of Personal Protective Equipment;									0
			- Secure fences and patrols to exclude the public from site									0
			- Regular H&S training for all personnel;									0
			- Documented procedures for all site activities;									0
			- Accident and training records and remedial action.									0
			Traffic control, site safety and other hazardous activities should be conducted by properly trained personnel									0
Excavation may encroach into and damage areas and artefacts of historical/cultural importance and areas of recreational value or scenic beauty	M	P	Choose pipeline routes and facility sites that avoid areas of known historical, cultural, recreational or scenic value	DSC	All sites							0
			Liaise with responsible authorities to agree on construction procedure and mitigation/compensation for any damage	Construction Contractor	All sites							0
			Consult Dept of Archaeology to assess whether any sites have the potential to yield discoveries during excavation	Construction Contractor	All sites							0
			With assistance from Dept of Archaeology develop "chance finds" procedure of action to recognise and protect any important archaeological or cultural material that is found	Construction Contractor	All sites							+
			Take any other action recommended by relevant authority	Construction Contractor	All sites							0
Excavation and other construction work could damage existing infrastructure and disrupt public utilities	S	T	Prepare inventory of infrastructure at proposed sites via plans from service providers plus surveys if necessary	DSC	All sites							0

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	D	Construction				Op	
			Plan pipeline routes and facility sites to avoid existing infrastructure wherever possible	DSC	All sites							0
			If infrastructure must be moved, prepare relocation plans with service providers	Construction Contractor	All sites							0
			Arrange for service providers to attend site immediately to deal with any accidental damage to utilities	NWSDB	All sites							0
			Provide pedestrians and vehicles with safe access to buildings, houses, etc. when construction is in the vicinity	Construction Contractor	Inhabited areas							0
			If any public or private structures are damaged (including by vibration), replace the structures or compensate owners	Construction Contractor	All sites							0
			Use vehicles/machines that adhere to vibration standards	Construction Contractor	All sites							0
			Store or remove all equipment or surplus material after use	Construction Contractor	All sites							0
			Remove from site any temporary works and debris	Construction Contractor	All sites							0
The proposed works could come into conflict with other planned projects in the same area, which will probably increase in number as government, NGOs etc. support returning displaced people	S	P	Obtain details of planned projects from relevant agencies	DSC	All sites							0
			If conflicts occur (e.g., same site being chosen by different projects) discuss and resolve with implementing agencies	NWSDB, DSC	As necessary							0
If workers are housed in accommodation camps this may cause environmental damage and social disturbance in the vicinity	S	T	Avoid hosing workers in camps and provide socio-economic benefits locally by employing local people	Construction Contractor	All sites							+
			If there is no alternative to employing workers from elsewhere, locate accommodation camps away from communities on land acquired from willing sellers	Construction Contractor	Accomm camps							0
			Provide labor camps with adequate sanitation, waste disposal and health facilities according to labor laws	Construction Contractor								0
			Clear work camp sites after use and reinstate vegetation	Construction Contractor								0
			Conduct programs to raise worker awareness of HIV/AIDS	Construction Contractor								+
Construction impacts in general will be more acute where sites are located in inhabited areas, because people and their activities will inevitably be disturbed	M	T	Establish effective and regular communication with stakeholders including affected communities	NWSDB, Construction Contractor	All sites							0
			Inform communities in advance when work is to be carried out in their vicinity and the nature and effects of the work	NWSDB, Construction Contractor	All sites							0
			Complete work quickly in inhabited areas	Construction Contractor	All sites							0
Residents near sites used to store and process building materials (batching/crushing plants) may be disturbed by noise, dust, visual intrusion	M	T	Locate all sites for materials storage/processing on un-used government land away from roads & inhabited areas	Construction Contractor	Materials Storage/ Processing							0
			Use noise reduction & dust suppression equipment at storage/processing sites (covered storage; water roads etc.)	Construction Contractor								0

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	D	Construction				Op	
Large volume of heavy vehicles taking waste for disposal and bringing construction materials from quarries south of Kilinochchi will cause noise, dust, vehicle emissions, disturbance, reduced road safety along haul routes; and emissions of greenhouse gases may contribute to global warming	S	T	Search thoroughly for materials sources as close to sites as possible	DSC, Construction Contractor	All sites							0
			Use alternative materials (e.g., war damaged building rubble may be suitable as rip-rap or aggregate after crushing)	DSC, Construction Contractor								+
			Reduce waste by re-using spoil in this project (dug soil may be used to raise bund); provide material to other projects	Construction Contractor								+
Farmers depending on irrigation water from Iranamadu Tank may suffer reduced income if water supply is reduced or interrupted	S	T	Plan work at tank to avoid any need to alter tank operation									0
			Conduct work on tank in the dry season									0
Construction at Iranamadu and elsewhere could interfere with activities of Sri Lanka army which is now stationed in large numbers in the project area	S	T	Include Sri Lankan army in stakeholder consultations									0
			Discuss all proposed work with army commanders and agree measures allowing construction to proceed without compromising army operations, safety or security									0
			Apply noise and dust reducing measures near army posts									0
Operation and Maintenance												
The new water supply system will fall into disrepair if it is not regularly maintained and repaired. Leaks could damage infrastructure and the environment and compromise public safety; and any reduction in water quality may present a risk to public health. There would also be conflicts with downstream farmers if abstraction exceeded the rate agreed in the MOU, resulting in insufficient water for irrigation.			Strengthen the regional office of NWSDB with training and support from consultants to enable them to manage the new system effectively. This should include financial and project management, recruitment, work planning, scheduling, implementation, monitoring, etc.	NWSDB	NWSDB Regional Office							+
			Provide technical experts to assist NWSDB in preparing O&M manuals setting out how all maintenance and repair work is to be conducted.	DSC	NWSDB Regional Office							0
			Include in O&M manuals procedures to be followed at the Iranamadu intake to maintain abstraction at the agreed rate	DSC	NWSDB Regional Office							0
			Draw up O&M procedures to ensure that all agreements set out in the MOU are fully adhered to	DSC	NWSDB Regional Office							0
			Train all site operatives in implementing relevant O&M procedures and provide refresher training every 2 years	NWSDB	All sites							0
			Regularly inspect all sites to ensure that O&M procedures are conducted as prescribed	NWSDB	All sites							0
			Regularly monitor the quality of water in Iranamadu Tank to detect the onset of eutrophication or other problems in advance and allow remedial action	NWSDB	Iranamadu Tank							+
			Regularly monitor the quality of water supplied to consumers to ensure it complies with legal standards	NWSDB	Community							0

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	D	Construction				Op	
SEWERAGE AND SEWAGE TREATMENT												
Location and Design												
Because of flat topography a large number of pumps will be needed to convey sewage. Pump noise and sewage odor could disturb nearby residents	M	T	Locate pumps below ground if this will not impair operation	DSC	Pradeshiya Sabha							0
			Locate pump stations as far as possible from houses	DSC	Pradeshiya Sabha							0
If sewers, *Pradeshiya Sabhas* or STP are located on private land, income of land owners and users (including squatters) may be reduced and households might need to be relocated	S	P	Locate sewers in government-owned ROW beside roads	DSC	Sewers							0
			Locate STP and all *Pradeshiya Sabhas* on government land that is not occupied or used by any persons	DSC	STP, Pradeshiya Sabha							0
			*If private land is acquired, compensate owners & users of land as set out in project Resettlement Plan	NWSDB	All sites							0
Sewage treatment process may not function properly if materials other than domestic wastewater are discharged to sewer	S	T	Set up Coordination Committee (representatives from MC, NWSDB, CEA) to licence all non-domestic connections	NWSDB	Sewers							0
			Provide Committee with budget and consultancy support	NWSDB								0
			Prohibit any discharge of hazardous materials to sewer	Coordination Committee	Sewers							0
			Regularly monitor premises/effluent of licensed discharges	Coordination Committee	Sewers							0
Residents are often disturbed by the appearance and odor of an STP site			Locate STP at selected site on the coast at Kallundai, where there are no residents in the vicinity	DSC	STP							0
			Use stabilisation ponds as treatment method as it produces less odor and sludge than the activated sludge method	DSC	STP							0
Proposed STP site at Kallundai is poorly drained with risk of flooding by rain or sea.			Examine flooding issue in detail and include preventative & remedial measures in STP design if necessary, e.g.,: -- providing extensive site drainage and emergency pumps; - improving access road and adding road drains									
A Hindu cremation site 200 m inland of proposed STP site would be affected by view and odor of STP			Meet community leaders and cremation site custodians to determine whether site can be relocated									
			*If so, acquire suitable agreed plot of land and provide practical and financial assistance to support relocation	NWSDB	STP							
			Ensure affected community is provided with water and if possible sewerage by the project									
Sewage treatment produces waste sludge which has to be removed from the tanks periodically and may be a health hazard and source of noxious odor			Adopt suitable sludge stabilization methods to ensure material is fully degraded and contains no live pathogens	DSC	STP							0
Sewage sludge can be used as agricultural fertilizer, although farmers may be reluctant to use it in this way			Set up composting plant at STP to convert sludge into a form that farmers may find acceptable as fertilizer	DSC	STP							+
			Conduct education program to raise farmers' awareness of benefits of sludge fertilizer and demonstrate its safety	NWSDB	Community							+
Discharge of STP effluent can pollute coastal waters and damage ecology, fisheries, industry (salterns) & amenity			Conduct computer modelling of effluent dispersal and design outfall length, location and structure to ensure	DSC	STP							0

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	D	Construction				Op	
value if effluent is not diluted and dispersed rapidly			adequate effluent dilution and dispersal									
			Regularly monitor water quality in effluent discharge zone	NWSDB	STP							0
Outfall will not operate as designed if underwater pipe becomes perforated by corrosion or accidental damage			Construct pipeline from corrosion resistant material	DSC	STP							0
			Bury pipeline below seabed and mark location with buoys or other maritime signage	Construction Contractor	STP							0
Seabed habitats and communities will be damaged by process of burying pipeline			Survey seabed habitats and communities and route the pipeline to avoid damaging sensitive/important areas	DSC	STP							0
Construction												
This subproject involves building sewers alongside roads in inhabited areas, pumping stations on unoccupied government land, larger pipelines alongside main roads and a treatment plant on government land in an uninhabited area. Most construction activities & impacts will be similar to those of the water supply subproject			Apply the mitigation measures proposed for the water supply subproject (described above) to the equivalent activities during construction of the sanitation subproject (sewers, pumping mains and STP)	Construction Contractor, DSC NWSDB	Where appropriate							0
Construction of the submarine outfall will damage seabed habitats and communities, which may be of ecological or fisheries importance			As above: survey seabed habitats/communities and choose pipeline route to avoid sensitive/important areas	DSC	STP							0
			Specify maximum working width to be used when burying pipeline and keep this to the minimum practicable	DSC	STP							0
			Ensure that contractors keep within specified working width	DSC	STP							0
Fishers may be concerned that marine construction will affect their livelihoods			Meet fishers to explain how areas of fishery importance have been avoided and impacts minimised (as above)	NWSDB	STP							0
Operation and Maintenance												
If the sanitation system is not properly maintained it will fall into disrepair causing leaks and other malfunctions, with attendant environmental and social risks (health, odor, pollution, public safety, etc.)			Strengthen the regional office of NWSDB (via training, budget and consultant support) to enable them to manage the operation and maintenance of the system as required.	NWSDB	NWSDB Regional Office							+
			Set up a mechanism to allow residents to report sewer leaks and ensure that repair teams respond in 3 days	NWSDB	NWSDB Regional Office							0
			Appoint dedicated and experienced persons to O&M teams (sewers, *Pradeshiya Sabhas*, STP) and train them fully before starting work	NWSDB	All sites							0
			Develop O&M manuals specifying in detail how all operation, maintenance and repair work is to be conducted	DSC	NWSDB Regional Office							0
			Re-train all O&M personnel and managers every 2 years	NWSDB	All sites							0
			Inspect facilities regularly and check that maintenance schedules are followed and repairs are prompt & effective	NWSDB	All sites							0
			Allocate sufficient budget annually for all maintenance, repair and replacement that may be needed	NWSDB	NWSDB Regional Office							0
			Routinely monitor the quality of effluent at the STP before	NWSDB	STP							0

Potential Negative Impacts	Sig	Dur	Mitigation Activities and Method	Responsibility	Location	D	Construction				Op	
			discharge to confirm that the plant is operating properly and ensure compliance with legal discharge standards									
Routine maintenance at the STP involves some health risks through accidental contact with enteric pathogens			As above: specify in O&M manuals how all operation, maintenance and repair activities are to be conducted.	DSC	NWSDB Regional Office							0
			Ensure that STP O&M manuals specify procedures that avoid contact with sludge and inhalation of aerosols, and personal hygiene in the event of accidental contact	DSC	STP							0
			Ensure that O&M procedures are strictly followed	NWSDB	All sites							0
Sewer leaks present health risks for the public and repair workers			Isolate damaged sections by closing valves before repair begins; pump sewage into tanker and empty at STP	NWSDB	Sewers							0
STP sites are visually unattractive and produce unpleasant odors			Include in designs a row of densely foliated trees around STP to provide screening/buffer zone. Plant grass seed on earth bunds around site and mow grass regularly	DSC	STP							0
If heavy industry develops in the future, hazardous material may be discharged to sewer, which may not be treated adequately by STP and could pollute sea when discharged			Set up Coordinating Committee and system of licensing connections as recommended above. Committee should develop effluent standards and require pre-treatment for any industrial connections	NWSDB	Sewers							0

Sig = Significance of Impact (NS = Not Significant; M = Moderately Significant; S = Significant). Dur = Duration of Impact (T = Temporary; P = Permanent)
D = Detailed Design period; Op = Period when infrastructure is operating;
DSC = Design and Supervision Consultant; NWSDB = National Water Supply and Drainage Board, STP = sewerage treatment plant, WTP = water treatment plant.
[a] This column shows impacts remaining after mitigation: 0 = zero impact (impact successfully mitigated); + = positive impact (mitigation provides a benefit)
* Mitigation of these impacts will be provided through a separate Resettlement Framework and Resettlement Plan

B. Monitoring

333. Effective implementation of all the mitigation measures recommended in this IEE Report must be monitored during (i) the investigation and detailed design stage; (ii) construction stage; and (iii) the operation and maintenance stage of both sub-projects.

334. The PMCIU set up by NWSDB to manage design and implementation of the project must ensure that all design measures and investigations recommended by the IEE in the pre-construction phase are effectively implemented. PMCIU staff should include a qualified and experienced Environmental Officer to deal with these and other matters related to environment. This officer will also check contract documents (prepared by Design and Supervision Consultants) to ensure that they require contractors to implement all mitigation allocated to them in Table 30. Contracts should also require contractors to behave responsibly towards the environment throughout their work, protecting the environment both on and off site; and limiting nuisance and hazards to people, and damage to property resulting from construction work, material supply and other related activities throughout the construction period.

335. In the tender documents, prospective Contractors must be informed that they are required to prepare, submit and implement an Environmental Management Plan (EMP) describing in detail how they will provide each of the mitigation measures that are their responsibility, and that they must include the cost of such activities in their Financial Proposal. The DSC staff should therefore also include an Environmental Specialist (Consultant) to assist the contract specialist in preparing these aspects of the documents and drafting other specialized clauses relating to the environmental mitigation measures. Once the EMPs are submitted, they must be reviewed by the PMCIU Environmental Specialist and any inadequacies must be identified and rectified before construction begins

336. For monitoring of mitigation measures, required parameters to be monitored are given in outline environmental monitoring plans provided in Tables 31 and 32. During the pre-construction period, monitoring of environmental matters will be the responsibility of NWSDB, with support from ADB as needed. NWSDB must ensure that the design consultants incorporate the various avoidance and mitigation measures into the scheme designs as set out in Table 30 and explained in Sections 5.4.1 and 6.4.1 above. They should also commission the pre-construction surveys (for example seabed habitats along potential pipeline routes and outfall locations) as recommended in Table 30.

337. During the construction period, monitoring will mainly be the responsibility of the Design and Supervision Consultants and will be conducted as part of their supervision of the construction process. Environmental monitoring will be conducted by the DSC's Environmental Specialist and will involve observations of contractor's practices during site inspections, plus checks of documentation and other activities. This monitoring is mainly aimed at ensuring that contractors provide the mitigation measures and do not cause additional environmental damage in the course of the construction work. If deficiencies are noted, the DSC will issue instructions for remediation to the contractor, and penalty clauses may then be applied if there are repeated transgressions.

338. Once the water supply and sanitation systems are in operation, more long-term environmental monitoring will be the responsibility of NWSDB as the operator of the schemes. This is mainly aimed at determining the long-term environmental impacts of the schemes and involves monitoring such aspects as the quality of water supplied to consumers, the quality of seawater in the vicinity of the STP outfall, etc.

Table 31: Environmental Monitoring Plan for Water Supply Component

Mitigation Measure	Parameters to Monitor	Monitoring Location	Nature of Measurements	Frequency	Responsibility of monitoring	Costing
Pre-construction Period						
Renovation of dam	Raising of FSL by 2'	Iranamadu Reservoir	Design specifications	-	NWSDB and NPC Irrigation Department	
Catchment management plan	Target achievement	Iranamadu catchment	Changes in land use and pollution sources	Annually	Involved line agencies and PMCIU	
Construction Period						
Action that contractor is required to take by contract specifications	All mitigation measures shown as contractor's responsibility in Table 30	All sites	Regular observation and checking records to ensure all mitigation is provided	Daily, weekly, monthly as necessary	DSC's Environmental Specialist, with PIU's Environmental Monitoring Officer	Part of cost of employing Design and Supervision Consultant
Minimized impacts at reservoir	Soil erosion & turbidity	Intake location	Physical observation	During construction	PMCIU/PIU and Env. Monitoring Committee	
Pipe laying in lagoons	Turbidity and depth of laying	Transmission mains across lagoons	Physical observation	During construction	PMCIU/PIU and Env. Monitoring Committee	
Soil erosion	Sedimentation of water bodies	Water bodies near constructions	Physical observation	During construction	PMCIU/PIU and Env. Monitoring Committee	
Ground and surface water pollution	Waste disposal	All construction sites, labor camps, equipment yards	Physical observation	During construction	PMCIU/PIU and Env. Monitoring Committee	
Public nuisance	Noise, dust, vibration	All construction sites	Complaints by people	During construction	PMCIU/PIU and Env. Monitoring Committee	
O&M Period						
Adherence to MOU	Amount water abstracted	Iranamadu Intake	Total monthly abstraction	Daily measure	NWSDB and ID	NWSDB facilities and resources
Catchment Management	All water quality parameters algae count	Iranamadu Reservoir-near intake	Laboratory analysis of samples	Monthly	NWSDB	NWSDB facilities and resources
Proper disposal of sludge	Quality of sludge ready for disposal	WTP	Parameters in CEA recommendations	Before disposal	NWSDB with CEA	NWSDB/CEA facilities and resources

Table 32: Environmental Monitoring Plan for Sanitation Component

Mitigation Measure	Parameters to Monitor	Monitoring Location	Nature of Measurements	Frequency	Responsibility of monitoring	Costing
Pre-construction Period						
Pollution of wetlands by sea outfall	Tidal movement	At the site selected for outfall	Tidal movement and direction	Daily for a one month	NWSDB	Detailed design
Construction Period						
Action that contractor is required to take by contract specifications	All mitigation measures shown as contractor's responsibility in Table 30	All sites	Regular observation and checking records to ensure all mitigation is provided	Daily, weekly, monthly as necessary	DSC's Environmental Specialist, with PIU's Environmental Monitoring Officer	Part of cost of employing Design and Supervision Consultant
Laying of pipes for sea outfall	Turbidity	Along sea rout	Observation	During construction	PMCIU/PIU and Env. Monitoring Committee	
Soil erosion	Sedimentation of water bodies	Water bodies near constructions	Physical observation	During construction	PMCIU/PIU and Env. Monitoring Committee	
Ground and surface water pollution	Waste disposal	All construction sites, labor camps, equipment yards	Physical observation	During construction	PMCIU/PIU and Env. Monitoring Committee	
Public nuisance	Noise, dust, vibration	All construction sites	Complaints by people	During construction	PMCIU/PIU and Env. Monitoring Committee	
O&M Period						
No hazardous waste in industrial effluents	Parameters in standards developed by Coordination Committee	At industries connected to sewers	Sample analysis	Quarterly	NWSDB with Coordination Committee	NWSDB facilities and resources
Proper functioning of STP	Water quality – influent and effluent	STP – inflowing water and effluent before discharge	Parameters of legal effluent discharge standards (Appendix 3)	Every week	NWSDB	NWSDB O&M budget
Improper disposal of sludge	Parameters in CEA standards	At the sewerage treatment plant	Sample analysis	Before disposal	NWSDB and CEA	NWSDB facilities and resources

C. Implementation Arrangements

339. The Ministry of Water Supply and Drainage (MWSD) and Ministry of Local Government and Provincial Council is the executing agency with overall responsibility for the project; and the key implementing agencies responsible for successful construction and operation will be the National Water Supply and Drainage Board (NWSDB) for water supply and sanitation, and the Northern Provincial Council (NPC)−Provincial Irrigation Department (PID) for Iranamadu Tank water source and head-works.

340. The NWSDB will set up a Project Management Coordination and Implementation Unit (PMCIU) in Jaffna to oversee detailed design and construction supervision (by the DSC), national level coordination, preparation of O&M manuals and other guidelines, capacity building, and other aspects common to both water supply and sanitation components. PMCIU staff will comprise a Project Director, two Engineers (water supply and sanitation), a Procurement Officer, a Land Acquisition and Resettlement Officer, and an Environmental Officer, plus support staff. These key technical and managerial staff will be supported by consultants funded by the project including specialists to assist in monitoring and supervising implementation of the EMP and in coordinating any land acquisition and resettlement activities.

341. In addition Project Implementation Unit (PIU) will be established in Kilinochchi, responsible for the water intake, raw water mains and treatment works as well as for the improvements to the Iranamadu headworks. The PIU will each be headed by a Project Manager, appointed from PID for the Kilinochchi PIU, and will have two other staff.

342. The project will be overseen by a National Project Coordination Committee (NPCC), with membership comprising Secretaries of relevant ministries, representatives from other relevant institutions/agencies and senior staff of the PMCIU and PIU.

343. Detailed designs will be prepared by design consultants as described above, or by contractors in the event of design and build contracts being the chosen approach. In either event the PMCIU must ensure that all recommendations and investigations recommended in Chapters 5 and 6 and summarized in Table 30 are implemented effectively. The PMCIU must therefore ensure that a qualified and experienced environmental specialist is engaged for the role of PMU Environmental Officer as explained above.

344. The functions and responsibilities of the Environmental Officer shall include the following:

(i) Oversee that the environmental/technical requirements and administrative policies and recommendations are properly integrated in the designing and planning as well as during construction and operation of the project;
(ii) Review the submitted Environmental Management Plans (EMP) as well as the contract of the contractor;
(iii) Ensure that applicable guidelines and criteria on environment are complied with;
(iv) Oversee the regular monitoring activities during construction and operation phases of the project conducted by others;
(v) Ensure that mitigating measures and preventative activities are properly implemented and adequate measures are taken in cases where unexpected impacts arise;

(vi) Prepare Environmental Monitoring Plans and regular reports on the activities undertaken and the results of monitoring for submission to appropriate authorities (NPCC, ADB, and CEA).

345. During the construction phase, the Environmental Monitoring Officer (EMO) will participate in the environmental monitoring activities conducted by the Supervising Consultant's Environmental Specialist (ES - see Section 7.2 above). With assistance from the ES, the EMOs will expand the outline monitoring plans provided in this IEE (Tables 31 and 32) to include specific details of monitoring locations, frequencies, parameters, etc. These monitoring plans will then be implemented by the ES, reporting to the EMOs to ensure that the contractors provide the mitigation measures set out in their contracts and do not cause additional environmental damage.

346. Environmental Monitoring Committees will be formed consisting of representatives based in the locations of proposed activities, authorities/agencies that have legal jurisdiction over concerned activities or premises and communities to be affected by construction or operation of the subprojects. Membership of these committees would be taken from:

(i) National Water Supply and Drainage Board (Project Implementing Agency);
(ii) Provincial Irrigation Department (Project Implementing Agency);
(iii) Jaffna Municipal Council (EPL, land allocation);
(iv) Central Environmental Authority (CEA)–Sub-regional Office at Jaffna−environmental clearance, EPL, etc.);
(v) Coast Conservation Department (CCD)−environmental clearance;
(vi) Road Development Authority/Provincial Road Authority−A9 and other National Roads/Provincial Roads−laying pipes and sewers in road reservations and transport of material/equipment;
(vii) Railway Department−significant infrastructure in the project area;
(viii) Provincial Department of Health, Jaffna−sanitation and health;
(ix) Department of Fisheries, District Office , Jaffna−fisheries in lagoons/wetlands;
(x) Relevant *Pradeshiya Sabhas*−approvals for waste disposal during construction, EPL;
(xi) Relevant Divisional Secretariats−land allocation, public issues;
(xii) Environmental NGOs−communities/natural resources to be affected;
(xiii) Farmers' Organizations (Iranamadu Irrigation Scheme)−possible conflicts with irrigators; and
(xiv) Fishers' Societies−Fishing activities operating in the Jaffna lagoon/wetlands and near-sea areas likely to be affected by the STP outfall.

347. The Environmental Monitoring Committees will monitor local implementation of the project during the construction and O&M phases, in addition to the more structured monitoring activities of the DSC Environmental Specialist and PMCIU Environmental Monitoring Officers. This will ensure a cross check of monitoring by PMCIUs.

348. NWSDB has developed some internal safeguards capacity from past and ongoing ADB-supported projects, but has no professional social or environmental specialists (except chemists for water quality analysis and interpretation). Given the sensitivity of the post-conflict context in the Jaffna Peninsula, it is important that this is remedied by the capacity building elements of the project, to ensure that the lead agency has adequate staff to handle safeguards issues during project implementation. The project will therefore provide an Environmental Officer and a

Land Acquisition and Resettlement Officer in the PMCIU as outlined above, who will be supported by training and practical assistance from PMCIU consultants as necessary.

349. Of the other agencies involved in project implementation and monitoring, there is an Environmental Division in the JMC headed by a qualified Environmental Officer, who attends to the EPL process and other environment related activities of the JMC with his supporting staff. There are also professional environmental specialists in certain other agencies in the region who could assist in the impacts monitoring and implementation of mitigation process through Monitoring Committee activities. For instance, the sub-regional office of the CEA in Jaffna has a qualified and experienced staff member dealing with environmental affairs and District Secretariat and Divisional Secretariat Offices also have an Environmental Officer appointed by the CEA.

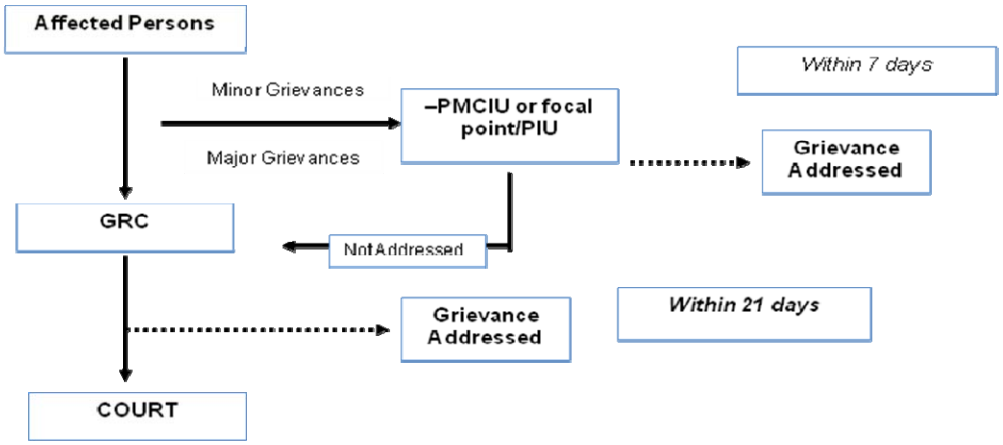
350. A comprehensive training program will be developed and will be implemented during the project construction stage and will continue after commissioning of the project. The main objective of the program is to guide and prepare the concerned staff of the regional office (NWSDB) and other stakeholders to manage and operate the water schemes in Jaffna and Kilinochchi areas effectively.

351. The capacity building program will strengthen the institutions by providing infrastructure and equipment related facilities to improve the performance and efficiency of services and by carrying out appropriate training/seminars. A series of workshops as well as on-the-job training are also planned to enhance the capability of the staff involved. Apart from the NWSDB and JMC, training will also be provided to other stakeholders, such as *Pradeshiya Sabhas*, NGOs (involved in water supply and sanitation) and CBOs. Long-term and short-term training courses have been identified to suit the requirements of the project (a list of the proposed Training Courses and Estimated Training Costs are presented in Volume 6 of the feasibility study final report, Annex 6-13).

VIII. GRIEVANCE REDRESS MECHANISM

352. The institutional arrangements established to ensure effective management of the design, construction and subsequent operation of the project infrastructure, include special provisions to enable affected persons to bring to the attention of the project authorities any dissatisfaction they may experience and to ensure that this is dealt with appropriately. The mechanism is shown in Figure 8.

Figure 8: Grievance Redress



353. Grievances of affected persons will first be brought to the attention of the Environmental Officer in the PMCIU or the focal point in the PIU, who will discuss the issues on site with the complainant and other involved parties to achieve an acceptable solution if possible. Grievances that cannot be redressed in this way will be brought to a Grievance Redress Committee (GRC). The GRC will be composed of the Assistant Divisional Secretary (chair),[21] a District representative, an NWSDB representative, the Head of the PMCIU and PIU, a representative of a CBO or local NGO working in the area, a resident of the community, and the Environmental Officer from the PMCIU (ex-officio member). A secretary to the GRC will be appointed to take minutes. The GRC will be given notice of the meeting and will meet to determine the merit of the grievance. If the person who filed the grievance is dissatisfied with the outcome of the process they may refer their case to the appropriate court of law. The grievance redress mechanism will be made aware to all project communities. All minor grievances will be resolved within 7 days from the time of receiving the complaint, whereas the GRC will resolve more complicated grievances within 21 days.

354. As complaints are expected to be infrequent, the GRC will meet only when a grievance is not resolved by the PMCIU Environmental Officer. They will be given notice of the meeting, meet to determine the merit of the grievance, and resolve the grievance within a month of receiving the notice for the meeting, informing the complainant verbally and in writing of the outcome. If the affected persons is not satisfied with the outcome they may refer the case to the appropriate courts of law.

355. The Environmental Officer, will participate in the GRC as an ex-officio member and function as the lowest level receiver of grievances along with the PIU focal point. The Environmental Officer will be responsible to (i) record, register, and sort grievances; (ii) conduct an initial assessment of grievances; (iii) refer grievances to appropriate units or persons; (iii) notify complainants and other affected parties of eligibility, the resolution process, and outcomes; (iv) track, monitor, document and evaluate grievances; and (v) submit annual summary report to PMCIU project director to be submitted to ADB.

IX. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

356. Stakeholders were involved in project planning by means of a number of consultation activities conducted during the feasibility study. The main contacts were as follows:

(i) During data collection for the social studies, every household participating in the household survey was given outline information on the proposed project;
(ii) Specific focus group discussions were held, which addressed a variety of aspects of the project;
(iii) Numerous more structured meetings were held with a wide range of stakeholders;
(iv) A number of presentations were given to specific groups of stakeholders including the farmers served by the Iranamadu irrigation scheme; and
(v) Two public meetings which were advertised in the local newspapers in English and Tamil and attended by a wide range of participants.

[21] If this position is vacant, the divisional secretary functions as the chair of the GRC. The GRC has the right to request *grama niladharis*, the project technical staff, and officers from relevant state or nonstate institutions to attend the meetings and provide information. A complainant has the right to appear in person, to be accompanied by a family member, and/or to request to be represented by a village elder.

357. Information on these meetings is given in Appendix 4 below, and in feasibility study Final Report Volume 1, Annexes 5, 6 and 7 (details of stakeholders met, meetings held and presentations) and Volume 8, Annex 2 (public meetings). The suggestions made by such participants were included in the project design and proposed operation strategies.

358. In order to avoid conflicts with irrigation farmers of the Iranamadu Scheme, public consultation was essential. A public consultation mainly for awareness creation was held with the District Secretary of Kilinochchi, relevant Divisional Secretaries and officers of the Provincial Irrigation Department, local political authorities and representatives of the farmer organizations during the feasibility study and their suggestions were considered for the project design.

359. A draft MOU was presented for comments in the second consultation meeting held with representatives from the NWSDB, Department of Agriculture, Provincial Irrigation Department and other relevant agencies and farmer representatives. The farmer representatives requested more powers for the Committee represented by them to decide the amount of water release during critical periods. At the consultation they were informed that the dam of the Iranamadu Tank will be rehabilitated and raised by 2 feet and water abstraction will be 1250 acre feet per month at a maximum, which would not impact on their present extent of cultivation. It was agreed that further consultations would be held prior to awarding construction contracts if these conditions were to change, and that construction should not begin before obtaining consent of the relevant agencies and farmers.

360. Two major consultation meetings with the public on the proposed project activities were held at Kilinochchi and Jaffna on 17 and 18 February 2006 after being advertised in newspapers. Interested NGOs and civil society representatives were specifically invited. At the consultation all proposed plans were discussed including potential environmental issues. Also re-settlement plans were discussed.

361. The feasibility study final report provides a copy of the proposed MOU between the Irrigation Department and the NWSDB and a copy of the Federation of Farmer's letter of 28 November 2005 outlining their concerns. Details and notes of the meetings held with the general public in Kilinochchi and Jaffna on 17th and 18th February 2006 are given in Annex 4 below, and further information is provided in Annex 2 of Volume 8 of the feasibility study on Resettlement.

362. Recommencement of the stakeholder consultation process during the project review period of 2009-10 was delayed initially because of security concerns and the sensitive political situation at that time. Nevertheless, informal contact was made with key stakeholders during site visits in late 2009 and early 2010, and ADB and NWSDB met with key institutional stakeholders on 18 February 2010 (Jaffna District Secretary, Divisional Secretaries and key officials from government institutions and NGOs in Jaffna) to inform them of the resumption of the project and to discuss any concerns. NWSDB then held an initial meeting with farmers and their representatives in early April 2010, and further contacts will take place as project development proceeds, especially during the detailed design stage..

363. NWSDB will disclose this IEE and the Resettlement Plan to stakeholders by making copies of the summaries available (in English and Tamil) in Urban Council and *Pradeshiya Sabha* offices in the project area. Summaries will also be disclosed to a wider audience on the websites of NWSDB and ADB. Both documents will be reviewed during the detailed design stage and revised if necessary to reflect any changes in the project, site selection or other

matters. If documents are amended, meetings will be held to inform stakeholders of the changes, and the revised documents will be disclosed again.

X. CONCLUSIONS AND RECOMMENDATIONS

364. This draft IEE, prepared in 2005-2006 and revised in 2009-2010 when the project was resumed after the end of the conflict, assesses the potential environmental and social impacts of the proposed Jaffna and Kilinochchi Water Supply and Sanitation Project. The project is a major element of the government's efforts towards social and physical reconstruction in the north of Sri Lanka and will bring much needed basic infrastructure to the Jaffna Peninsula and parts of the adjacent mainland, where municipal services have suffered from two decades of neglect as a result of the conflict.

A. Water Supply

365. There are no perennial rivers in Jaffna; and groundwater, which is currently the main source of domestic and irrigation water, is polluted because of inadequate sanitation and seawater intrusion, and cannot be abstracted at rates required for an expanded service. The nearest suitable source is Iranamadu Tank south of Kilinochchi, and studies during the feasibility study have shown that this could store and provide an additional 50,000 m^3/d if the Full Supply Level was raised by 0.61 m, and if farmers using irrigation water from the tank cultivated other field crops (OFC) in the dry season, instead of a mixture of rice and OFC as of the present. This was agreed in 2006 after extensive discussions between NWSDB, the PID and farmers and their representatives, and the agreements were set out in the MOU. However discussions in 2010 suggested that a change in farming practice would no longer be acceptable so the project has adopted a two stage approach: abstracting 27,000 m^3/d in the first instance (which will not affect farming); and only increasing to 50,000 m^3/d subsequently if the improved tank bund and head-works perform satisfactorily and if the changes in cultivation are successfully introduced. NWSDB will hold further discussions with PID and farmers to revise agreements and prepare a new MOU following design.

366. The proposed new water supply system will consist of:

(i) Repairing, strengthening and raising the earth bund of Iranamadu Tank by 0.61 m and constructing a new RCC intake near the left bank sluice;
(ii) Repairing the tank head-works (radial gates, RCC stilling basin), adding 3 new radial gates and raising the RCC spillway by 0.61 m;
(iii) A 32.5 km raw water transmission main of 800 mm DI and 600 mm HDPE, buried beside the left bank irrigation canal and in the ROW alongside the A9 highway;
(iv) A raw water sump, 27,000 m^3/d Water Treatment Plant, and high lift pumps at Palai;
(v) A 44 km treated water transmission main of 600 mm DI, buried in the ROW of the A9;
(vi) A 520 km water distribution system of 63-300 mm uPVC, buried alongside local roads, with 2 ground sumps, 17 new overhead tanks and 11 refurbished existing towers.

367. Construction will be quite large in scale, involving: substantial earthworks and concreting at Iranamadu Tank and the WTP site; excavation of over 550 km of trenches, mainly beside roads in a heavily populated urban area; and a major transportation exercise taking waste spoil for disposal and bringing construction materials from quarries on the mainland as there are no

suitable sources on the Jaffna Peninsula. Construction will be conducted over a four-year period, scheduled for 2012-2016, after detailed design in 2011.

368. Despite the scale and duration of the construction process it is not expected to result in major negative impacts. This is because:

(i) Many impacts have been avoided by careful site selection, such as locating pipelines in the ROW of roads and locating the WTP, sumps and overhead tanks on unoccupied and un-used government land, to avoid acquiring private land and relocating people;
(ii) Construction will involve certain basic techniques (excavation, concreting, creation of RCC structures) that are common features of most similar projects, so there are well-developed mitigation measures, with which experienced contractors should be familiar;
(iii) The natural environment in this part of Sri Lanka has been degraded by human use over the centuries (mainly farming and urbanization) and is therefore not especially sensitive (with the exception of certain specific features and areas).

369. It is not possible however to avoid all negative impacts, particularly for a project like this, a major part of which is located in a heavily populated urban area. It is not surprising therefore that most of potential impacts relate to the human environment, such as disturbance by noise, dust, vehicle emissions, visual intrusion, interrupted access, traffic disruption, etc. These will generally be mitigated by measures that are common elements of urban construction. For example, contractors will be required to:

(i) Service and maintain all vehicles and machinery according to manufacturers' specifications and fit up-to-date noise and air pollution reduction equipment;
(ii) Water site roads to reduce dust in dry weather and cover all loose material with tarpaulins when carried on trucks and stored on site;
(iii) Prepare a traffic management plan with relevant municipal authorities, and include: avoiding site deliveries during peak traffic periods; keeping heavy traffic away from narrow roads where possible; routing haul roads away from sensitive locations; etc.

370. Further frequently-used mitigation measures will be adopted to prevent or control impacts on certain other elements of the natural or social environment. For example contractors will be required to prepare and implement:

(i) A Pollution Prevention and Abatement Plan involving safe storage and use of toxic materials including fuels and construction chemicals and effective clean-up of spills;
(ii) A Chance Finds Procedure, which will ensure the recognition, protection, recording and removal (if appropriate) of any historical/archaeological material discovered;
(iii) A Health and Safety Plan to protect workers and the public at and around all worksites, via security, signage, personal protective equipment, training, monitoring, etc.

371. There are certain other impacts that are a result of particular circumstances in the project area, or specific elements of this project; and these will require more custom-designed mitigation. For example, transporting the significant quantities of waste spoil for disposal and

bringing construction materials from south of Kilinochchi could cause significant disturbance of people living along haul routes, and vehicular emission of greenhouse gases could contribute to global warming. Mitigating these impacts will be more complex and could involve:

(i) Identifying the closest suitable sources of all materials to proposed construction sites;
(ii) Using alternative construction materials, e.g., rubble from war-damaged buildings could be suitable as rip-rap, or as an aggregate substitute after crushing;
(iii) Reducing waste by re-use of materials wherever possible (e.g., excavated soil could be suitable for bund raising; demolished concrete may be used as rip-rap or aggregate).

372. Further unusual circumstances arise from the increased presence of the Sri Lankan army in the north of the country after the civil war, and there are now guard posts and gun emplacements near many of the proposed facility sites, including Iranamadu Tank. The army must therefore be included in project consultations as an important stakeholder and all construction work should be discussed with appropriate senior officers and measures agreed to allow construction to proceed without compromising army operations, security or safety.

373. When it is completed and operating the new water supply system should provide major social benefits for the people of Jaffna and served communities on the mainland as it will provide a safe, efficient, and convenient supply of potable water into the houses of over 50% of the population. This will improve personal hygiene, sanitation and public health, and will greatly improve the quality of life of the recipient community, particularly women who will no longer have to spend large proportions of each day searching for water. It will also improve socio-economic status as people will spend less on healthcare and will be away from work less, so their disposable incomes should increase.

374. It will be essential for NWSDB to manage and operate the system effectively, ensuring that all elements are inspected and maintained regularly and repaired and replaced when necessary. This applies particularly to the Iranamadu source and the WTP, but also to the other elements−pipelines, sumps, and overhead tanks. The project will raise the capacity of NWSDB offices and staff in the region by providing training, consultancy support and financial resources throughout the construction period and beyond. This will be extended to other local government agencies with responsibilities in the water supply and related sectors, and to relevant NGOs and CBOs.

375. If these and the various other mitigation measures described in Section 5.4 are provided as set out in the Environmental Management Plan (Table 30) and monitoring is conducted as outlined in Table 31, then there should be no significant negative impacts as a result of construction or operation of the water supply subproject. The long-term impacts of the subproject should therefore be significantly positive, as described above.

B. Sanitation

376. There is no sewerage system in Jaffna and the widespread use of pit latrines, soakaways and malfunctioning septic tanks causes public health risks and pollutes the groundwater on which the peninsula currently depends. The sanitation subproject aims to remedy this situation in the densely populated Jaffna Municipal Council and University areas by collecting and treating sewage from all households and non-industrial premises with water-

operated toilets. The scheme will be designed in 2011 and constructed in 2012-16 in parallel with the water supply system, and will comprise:

(i) House connections and 187 km of 150-525 mm diameter uPVC sewer pipes and pumping mains buried in the ROW alongside roads;
(ii) Pumping stations at various locations to be decided after topographic surveys and hydrological studies in the design stage;
(iii) A Sewage Treatment Plant (STP) on a 4.5 ha site at Kallundai, treating a total equivalent population of 80,000 via an activated sludge treatment plant, with a coastal outfall, the length and location of which will also be determined in the design stage.

377. Although important decisions still have to be made, the same process of careful site selection as applied in the water supply project should provide a similar success in avoiding major resettlement and other environmental and social impacts. In particular:

(i) Pumping stations will be located on unoccupied government-owned land away from inhabited areas wherever possible; and
(ii) Seabed habitats in potential outfall locations will be surveyed to avoid any sensitive sites, and modelling studies will allow design of outfall length and location to achieve maximum dilution and dispersion of STP effluent.

378. As with the water supply scheme, there are certain impacts related to particular aspects of the project or the local environment, which need to be addressed by further action in the pre-construction stage. These relate to the proposed STP site, which has the advantage of a remote location and available space for expansion, but the disadvantages of poor drainage and risks of inundation by rain or sea, and the presence of a Hindu cremation site nearby. The flooding risk will be assessed by studies in the design stage and preventative and remedial measures will be incorporated into the design as necessary.

379. NWSDB will consult the local community and custodians of the cremation site to determine whether it is possible to relocate the facility. If so, NWSDB will acquire an agreed alternative site following procedures set out in the Resettlement Plan, and will provide practical and financial assistance to support the relocation process.

380. The main elements of the sewerage and sanitation system are similar to those of the water supply scheme (pipelines, pumping stations and treatment plant), and construction will involve the same basic techniques (excavation, installation of pipes, creation of RCC structures). The construction process will therefore generate similar impacts, although these should be less extensive as the sanitation system will serve a smaller area, and the work will be more straightforward.

381. Construction impacts that are common to both subprojects will be mitigated in the same way as for the water supply scheme and this will include both commonly-encountered measures and the more specialised actions, both of which are summarized above and presented in detail in Table 30. The coastal outfall is the main structural difference between the schemes, and here different measures will be required to mitigate construction impacts, which include damage of seabed and inhabiting plants and animals, which could be of ecological and fisheries importance. In addition to the seabed surveys mentioned above:

(i) Construction contractors will be required to keep all work within a specified area to prevent unnecessary additional seabed damage; and
(ii) NWSDB will meet fishers' organizations to explain the work in advance and discuss measures taken to minimise impacts on fisheries.

382. When the scheme is operating it will again be important for NWSDB to keep all elements in working order, by conducting regular inspections and maintenance, and repairing pipeline leaks promptly, given the environmental and health risks associated with sewage. This reinforces the need to build capacity in the regional NWSDB and local government offices, via training, consultancy support, finance, etc., and to link this with similar measures provided in relation to the water supply system to avoid duplication and maximize synergy.

383. Disposal of sewage sludge from the operating STP should not be a major issue because stabilized sludge when fully decomposed is safe to handle. Sludge can be a useful resource in agriculture, replacing organic matter and plant nutrients washed out by irrigation water, so NWSDB will include a small composting plant in the STP design to convert the material into a form in which it might be acceptable to farmers. They should also raise farmers' awareness of the benefits of using sludge and demonstrate its safety from a health perspective. Disposal of STP effluent should also not cause negative impacts because treatment will be to legal discharge standards and the outfall length and location should be designed to achieve effective dilution and dispersion.

384. It is expected therefore that all potential negative impacts of constructing and operating the sewerage and sanitation infrastructure will be avoided or reduced to the level of no significance by the identified mitigation measures. Thus, providing the STP and sewerage system continue to function as intended, the long-term impacts of the scheme should be almost entirely positive. It will provide sanitary toilet and sewage disposal facilities for around one third of the population of Jaffna, which should improve their health and environment (including groundwater), and improve their quality of life. Given that a safe water supply and sanitary wastewater disposal are basic human needs, the impact of the two systems together should therefore be highly beneficial.

C. Conclusion

385. As demonstrated in the above account, the principal conclusion from the IEE study is that, if all of the mitigation measures recommended in Sections 5.4 and 6.4 are provided as set out in Table 30, then there should be no significant negative impacts as a result of construction or operation of the water or sanitation subprojects.

386. The overall impact of each subproject should therefore be beneficial in providing much-needed water and sanitation infrastructure and improving the hygiene and health of the recipient population and therefore improving their quality of life and social status. Compared to present conditions where the entire peninsula relies on a limited, diminishing and increasingly polluted groundwater for their daily needs and many people have no alternative to the use of unsanitary pit latrine toilets, the combined impact of the improvements in water supply and sanitation infrastructure will be highly beneficial.

D. Recommendations

387. Achieving the benefits of the project without causing unacceptable social and environmental damage and degradation depends on providing the necessary mitigation. The

main recommendation of the study is therefore that NWSDB should ensure that all mitigation measures identified by this IEE are provided as shown in Table 30 and monitored as set out in Tables 31 32.

388. The second and final recommendation is that this IEE (and the Resettlement Plan) should be reviewed in the detailed design stage and revised if necessary to take into account those elements that have yet to be decided and any other significant changes in the project at that time.

APPENDIX 1: Proposed sites of water supply and sewerage infrastructure – summary description from visits in 2006, 2009 and 2010

Ref No[a]	Proposed Use of Land	Location	Area (ha)	Ownership	Site Description (2006)					Site re-assessment (2009-10)	
					Infra-structure	Agriculture	Livestock	Community use	Trees	Date(s) visited	Comments
Water Supply: Phase I Stage 1											
01	Intake	Iranamadu	0.05	State	No	No	No	No	0	29 Dec 2009; 4 Mar 2010	As of 2006, except that surrounding area is currently occupied by Sri Lankan Army camp
03	Treatment Plant	Maruthankerny Junction	4.00	LRC	No	No	No	No	6	29 Dec 2009; 4 Mar 2010	As of 2006; army camp now located at edge of site; mines and UXO not yet cleared
04	Tower	Palai	0.05	*Pradeshiya Sabha*	No	No	No	No	0	29 Dec 2009; 4 Mar 2010	As of 2006; army post now at site entrance and District Secretary advised the ownership of the land
05	Tower	Puttur	0.05	State	No	No	No	No	0	29 Dec 2009; 5 Mar 2010	As of 2006; ownership should be checked as owner may be *Pradeshiya Sabha*
06	Tower	Kodikamam	0.05	*Pradeshiya Sabha*	No	No	No	No	0	29 Dec 2009; 4 Mar 2010	As of 2006; site is located on unused land in a public market that is occupied daily
07	Tower	Karaveddy	0.05	NWSDB - State (existing tower)	n/a	n/a	n/a	n/a	n/a	11 Feb 2010; 5 Mar 10	Proposed refurbishment of existing tower on state-owned land
08	Tower	Meesalai	0.50	NWSDB - State	No	No	No	No	0	1 Jan 2010 4 Mar 2010	Vacant land with some abandoned buildings owned by NWSDB
09	Tower	Navatkuli	0.05	State	No	No	No	No	0	9 Feb 2010; 4 Mar 2010	Sites proposed in 2006 no longer available. New site is unused and unoccupied
10	Tower 1	Main Street Jaffna	0.05	JMC - State (existing tower)	n/a	n/a	n/a	n/a	n/a	31 Dec 2009; 4 Mar 2010	Site proposed in 2006 is no longer available. Now proposed to refurbish existing tower
11	Tower 1 (Alternative site)	Racca Road Jaffna	0.05	State	No	No	No	Yes	0	11 Feb 2010; 4 Mar 2010	Site proposed in 2006 is no longer available. Tower on new site can be built without affecting public well or community center
12	Tower 2	Old park, Jaffna	0.05	State	No	No	No	No	1	31 Dec 2009; 4 Mar 2010	As of 2006; un-used state land controlled by District Secretary
13	Tower 3	University ground, Nallur	0.05	University of Jaffna - State	No	No	No	No	0	11 Feb 2010; 4 Mar 2010	Site proposed in 2006 is no longer available. Tower on new site can be built without affecting nearby playground
14	Tower	Kondavil	0.05	State	No	No	No	No	2	31 Dec 2009; 4 Mar 2010	As of 2006; new tower can be built without affecting small JMC water intakes on site
15	Sump and	Kaddudai	0.3	Private or State						4 Mar 2010	Site proposed in 2006 is not available. There

Ref No[a]	Proposed Use of Land	Location	Area (ha)	Ownership	Site Description (2006)					Site re-assessment (2009-10)	
					Infra-structure	Agriculture	Livestock	Community use	Trees	Date(s) visited	Comments
	Tower			(2 alternatives)							are two alternatives: (i) Land with a house under temporary occupancy, which the owner is keen to sell; (ii) Unused government land nearby, surrounded by about 50 houses
17	Tower	Vaddukoddai	0.05	NWSDB - State (existing tower)	n/a	n/a	n/a	n/a	n/a	31 Dec 2009; 5 Mar 2010	Proposed refurbishment of existing tower on state-owned land
18	Tower	Araly North	0.05	Prad Sab - State (existing tower)	n/a	n/a	n/a	n/a	n/a	11 Feb 2010	Proposed refurbishment of existing tower on state-owned land
19	Tower	Araly South	0.05	NWSDB- State (existing tower)	n/a	n/a	n/a	n/a	n/a	11 Feb 2010; 5 Mar 2010	Proposed refurbishment of existing tower on state-owned land
20	Tower	Moolai	0.05	State	No	No	No	No	0	31 Dec 2009; 5 Mar 2010	An abandoned housing scheme is on part of the site but there is enough room for a tower
21	Tower	Karinagar	0.05	State	No	No	No	No	5	31 Dec 2009; 5 Mar 2010	As of 2006; unused state-owned land
Total			**5.6**								
Water Supply: Priority Works											
01	Tower	Karainagar East	0.05	Prad Sab - State (existing tower)	n/a	n/a	n/a	n/a	n/a	31 Dec 2009	Proposed refurbishment of existing tower on state-owned land
02	Tower	Karainagar North	0.05	NWSDB - State (existing tower)	n/a	n/a	n/a	n/a	n/a	31 Dec 2009	Proposed refurbishment of existing tower on state-owned land
03	Tower	Karainagar West	0.05	NWSDB - State (existing tower)	n/a	n/a	n/a	n/a	n/a	31 Dec 2009	Proposed refurbishment of existing tower on state-owned land
05	Tower	Kayts	0.05	NWSDB - State (existing tower)	n/a	n/a	n/a	n/a	n/a	12 Jan 2010; 5 Mar 2010	Proposed refurbishment of existing tower on state-owned land
06	Sump	Araliturai	0.05	State	No	No	No	No	0	31 Dec 2009; 5 Mar 2010	Site is marshy & was inundated when visited so designs must include adequate drainage
07	Tower	Velanai	0.05	NWSDB - State (existing tower)	n/a	n/a	n/a	n/a	n/a	31 Dec 2009; 5 Mar 2010	As of 2006: site of an existing tower that supplies 53 connections. Land is overgrown and contains some abandoned buildings
08	Tower	Velanai	0.05	*Pradeshiya Sabha*	No	No	No	No	0	31 Dec 2009; 5 Mar 2010	
09	Tower	Pungudutivu	0.05	Kovil - Private	No	No	No	No	0	31 Dec 2009; 5 Mar 2010	Kovil (Hindu temple) is willing to donate land that is free of occupants and structures
10	Tower	Mandaitivu	0.05	NWSDB - State	No	No	No	No	5	31 Dec 2009;	Contains facilities of existing water scheme

Ref No[a]	Proposed Use of Land	Location	Area (ha)	Ownership	Site Description (2006)					Site re-assessment (2009-10)	
					Infra-structure	Agriculture	Livestock	Community use	Trees	Date(s) visited	Comments
										5 Mar 2010	with enough free space for new tower
18	Tower	Nainativu	0.05	NWSDB - State (existing tower)	n/a	n/a	n/a	n/a	n/a	12 Jan 2010	Proposed refurbishment of existing tower on state-owned land
20	Tower	Analaitivu	0.05	Kovil - Private	No	No	No	No	3	12 Jan 2010	Kovil is willing to donate land. 3 sites being considered. Option 3 (away from kovil) is most suitable
22	Tower	Eluvaitivu	0.05	Private (Church or Fisheries Community Soc)	No	No	No	No	0	12 Jan 2010	2 potential sites - within church premises or on playground owned by fishery community society. Both owners willing to donate land
23	Office Building	Jaffna	0.1	NWSDB - State	No	No	No	No	1	4 Mar 2010	Unused land with public buildings nearby
Total			**0.7**								
Sewerage and Sanitation											
01	Treatment Plant	Kallundai	4.5	State	No	No	No	No	0	31 Dec 2009; 4 Mar 2010	Site is swampy, so designs must include adequate drainage and flood protection. Hindu cremation site nearby would have to be moved with community agreement
02	Pump Stations	Jaffna – several sites needed	0.5	State	No	No	No	No	0		Locations not yet identified
Total			**5.0**								

[a] Site reference numbers are those used in the Feasibility Study Final Report (Volume 8, Table 2.1).

APPENDIX 2: Description of proposed sites of key infrastructure facilities

Site: Sanitation 1		Date: 31Dec 2009	
1. Project component		Proposed Sewage Treatment Plant	
2. Location name		Kallundai	
3. District Secretary division		Valikamam South East/Jaffna District	
4. Local authority		Valikamam South East *Pradeshiya Sabha*	
5. Site access		Jaffna – Karainagar road (B74)	
6. Site photographs			
			
Plate1: Entrance to cremation site		Plate 2: Cremation site (proposed STP behind)	

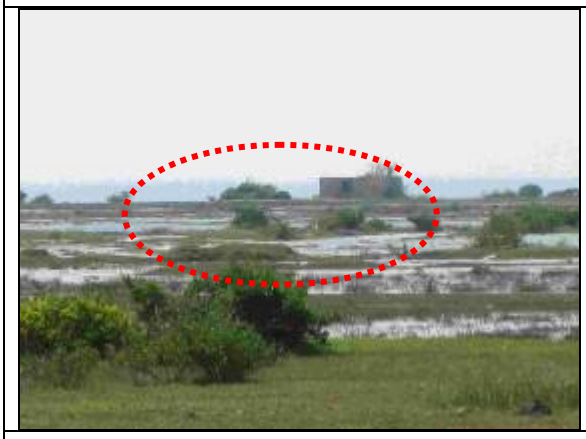



Plate 3: Close view of the location		Plate 4: Access trail towards the proposed site	
7. Occupancy	Free of occupants	8. Area of land	4.5 ha
9. Land use	Marshy and swamp area – no human usage, but Hindu cremation site nearby		
10. Description of environment			
The site is about 5 km from Jaffna town, just outside Jaffna Municipal Council boundary, along the Jaffna–Karainagar road (B74). It is in a swampy area adjacent to the lagoon and was mostly covered with standing water when visited in December 2009 following recent rain. The site is reached from the entrance of Anaikotti Hindu crematorium (Plate 1) and is a further 500 m towards the lagoon. The area is free of human activity except for the cremation site and some fishing along the nearby lagoon and beach, and there are fishing camps and boats on the coast. During the monsoon season, the access road is not suitable for vehicles so this would need to be improved as part of the project. The cremation site would also need to be moved with the agreement of the local community and the sewage treatment plant site design must provide adequate flood protection and drainage measures.			
11. Land ownership	State land under control of Divisional Secretariat, Valikamam South East		

Site Ref No: 15	Date: 04 Mar 2010
1. Project component	Proposed sump and tower
2. Location name	Kaddudai
3. District Secretary division	Valikamam South West/Jaffna District
4. Local authority	Valikamam South West *Pradeshiya Sabha*
5. Site access	Jaffna – Karainagar (via Manipai) road (B73); Junction near 6km post
6. Site photographs	
	
Plate1: Entrance to the land	Plate 2: Existing building
	
Plate 3: Present land use	Plate 4: Surrounding coconut cultivation

7. Occupancy	One house occupied by a family
8. Land use	Home garden surrounded by a main road and homesteads, shops etc..

9. Description of environment

The site is accessible along the Jaffna–Karainagar road (B73) to the Kaddudai junction near the 6 km post located near the main road. The site belongs to two persons and National Water Supply and Drainage Board has begun negotiations for the land acquisition. There is a house on the land that is currently occupied by relatives of one of the owners and according to National Water Supply and Drainage Board the family is planning to relocate shortly. The garden comprises a well-managed coconut and palmyrah plantation and the surrounding land is mainly occupied by homesteads with coconut, palmyrah and other common trees, plus a few shops.

10. Ownership	Private land owned by Mr. S. Sivagurunathan and Mar. S. Sivananda
11. Land extent (ha)	0.3

Site Ref No: 15 (Alternative site)		Date: 11 Feb 2010	
1. Project component		Proposed sump and tower	
2. Location name		Kaddudai	
3. District Secretary division		Valikamam South West/Jaffna District	
4. Local authority		Valikamam South West *Pradeshiya Sabha*	
5. Site access		Jaffna – Karainagar (via Manipai) road (B73); Junction near 6km post; Kaddudai – Navali road	
6. Site photographs			
			
Plate1: Proposed land		Plate 2: Another view of proposed land	
			
Plate 3: Temporary water tank and foundation		Plate 4: Well and kovil at boundaries of land	
7. Occupancy	Free of occupants		
8. Land use	Empty land with a temporary water supply tank; surrounded by a housing scheme, homesteads, two public wells and a kovil		
9. Description of environment			
The site is accessible along Jaffna–Karainagar road (B73) to the Kaddudai junction near the 6 km post and then along Kaddudai–Navali road. The land is surrounded by around 50 houses built in 1981 funded by the National Housing Development Authority. There are 2 public wells used for washing purposes and a kovil located near the boundaries of the land. The site contains a newly installed temporary water tank and the foundations (approx. 2 x 2 m) for a permanent tank. This is a National Water Supply and Drainage Board project supplying water from the Chunnakam intakes through a newly laid pipe line. There are also several temporary roads across the land used by residents because the land is not fenced.			
10. Ownership	State land under control of Divisional Secretariat, Valikamam South West		
11. Land extent (ha)	0.05	12. Villager interviewed	V. Rajeswari

Site Ref No: 03	Date 29 Dec 2009
1. Project component	Water treatment plant
2. Location name	Maruthankerny junction
3.Assistant Government Agents / District Secretary Division	Pachchilipalai/ Kilinochchi District
4. Local Authority	Pachchilipalai *Pradeshiya Sabha*
5. Site access	A9 road; near Maruthankerni junction
6. Site photographs	

Plate 1: Proposed location

Plate 2: Tharmankarni road (off A9) at boundary

Plate 3: Adjacent lands

Plate 4: Army camp in front of the land

7. Occupancy	Free of occupants and structures
8. Land use	Un-used scrub land
9. Description of environment	

The proposed land is located adjacent to the A9 road, between the 276 and 277 km posts, near the Maruthankerni junction. A by-road towards Tharmankarni village marks the northern boundary of the land. An Army camp (HQA COY 7VIR) is currently located in front of the proposed site.
The area is covered by naturally growing shrubs and there is no dense vegetation. There are however some Palmyra palm, coconut and other mature trees scattered in the vicinity.
The area has not been cleared at the time of the visits and a mine/unexploded ordinance clearance certificate must be obtained from the District Secretary, Kilinochchi before any field work may commence.

10. Land ownership	Land Reform Commission
11. Land extent (ha)	4
12.Officers consulted	District Secretary, Kilinochchi; Divisional Secretary, Pachchilipalai

APPENDIX 3: Current Sri Lanka Effluent Discharge Standards (CEA 2004)

Wastewater Quality Standards for Discharge to Water Bodies

No	Parameter	Unit, Type of limit	Tolerance Limit Values		
			Discharged into Inland Waters		Discharged into Coastal Waters
			Sensitive Waters (CLASS II Waters)	General Waters (CLASS III Waters)	
01	pH at Ambient Temperature	-	6.0-8.5	6.0 – 9.0	5.5 – 9.0
02	Temperature	^{o}C, max.	N+4	N+7	N+8
03	Total Suspended Solids	mg/l, max.	20	50	150
04	Biochemical Oxygen Demand (BOD_5 at 20^{o}C or BOD_3 at 30^{o}C)	mg/l, max.	30	50	100
05	Chemical Oxygen Demand (COD)	mg/l, max.	150	250	250
06	Color	Wavelength Range 400 – 499 nm (Yellow range) 500 – 599 nm (Red range) 600 – 750 nm (Blue range)	Maximum spectral absorption coefficient 7 m^{-1} 5 m^{-1} 3 m^{-1} (to be rounded up to the nearest 0.1 m^{-1})	Maximum spectral absorption coefficient 7 m^{-1} 5 m^{-1} 3 m^{-1} (to be rounded up to the nearest 0.1 m-1)	Unobjectionable
07	Odor	-	Unobjectionable	Unobjectionable	Unobjectionable
08	Dissolved Phosphates (as P)	mg/l, max.	5.0	5	-
09	Total Kjeldahl Ntrogen	mg/l, max.	100	150	-
10	Free Ammonia (as N)	mg/l, max.	10	-	-
11	Ammonical Nitrogen (as N)	mg/l, max.	50	50	50
12	Cyanide (as CN)	mg/l, max.	0.1	0.2	0.2
13	Total Residual Chlorine	mg/l, max.	0.2	1.0	1.0
14	Chlorides (as Cl)	mg/l, max.	1000	-	-
15	Fluorides (as F)	mg/l, max.	2.0	10	15
16	Sulfide (as H_2S)	mg/l, max.	1.0	2.0	5.0
17	Arsenic (as As)	mg/l, max.	0.1	0.2	0.2
18	Cadmium (as Cd)	mg/l, max.	0.1	0.2	2.0
19	Chromium, total (as Cr)	mg/l, max.	0.5	2.0	2.0
20	Chromium, Hexavalent (as Cr^{6+})	mg/l, max.	0.1	0.1	1.0
21	Copper (as Cu)	mg/l, max.	0.5	2.0	3.0
22	Iron (as Fe)	mg/l, max.	3.0	3.5	-
23	Lead (as Pb)	mg/l, max.	0.1	0.5	1.0
24	Mercury (as Hg)	mg/l, max.	0.0005	0.005	0.01
25	Nickel (as Ni)	mg/l, max.	0.5	2.0	5.0
26	Selenium (as Se)	mg/l, max.	0.05	0.1	0.1
27	Zinc (as Zn)	mg/l, max.	2.0	3.0	5.0
28	Pesticides	mg/l, max.	0.005	0.05	50
29	Detergents/surfactants	mg/l, max.	5	15	-
30	Phenolic compounds (as C_6H_5OH)	mg/l, max.	0.5	1.0	5.0
31	Oil and grease	mg/l, max.	10	10	20
32	Faecal coliforms	MPN/100 ml, max.	40	40	60

Quality Guidelines for Wastewater Discharge into Public Sewers

No	SUBSTANCES (Determinants)	Unit, Type of limit	Tolerance limit values
01	pH at Ambient Temperature	-	5.5 - 10.0
02	Temperature	^{o}C, max.	45
03	Total Suspended Solids	mg/l, max.	500
04	Biochemical Oxygen demand (BOD_3 at 30^{o}C)	mg/l, max.	350
05	Chemical Oxygen demand (COD)	mg/l, max.	850
06	Total Kjeldahl Nitrogen	mg/l, max.	500
07	Free Ammonia (as N)	mg/l, max.	50
08	Ammonical Nitrogen (as N)	mg/l, max.	200
09	Cyanide (as CN)	mg/l, max.	5.0
10	Total Residual Chlorine	mg/l, max.	3.0
11	Chlorides (as Cl)	mg/l, max.	900
12	Fluorides (as F)	mg/l, max.	20
13	Sulfide (as H_2S)	mg/l, max.	5.0
14	Sulfates (as SO_4)	mg/l, max.	1250
15	Arsenic (as As)	mg/l, max.	5.0
16	Cadmium (as Cd)	mg/l, max.	2.0
17	Chromium, total (as Cr)	mg/l, max.	5.0
18	Copper (as Cu)	mg/l, max.	3.0
19	Lead (as Pb)	mg/l, max.	5.0
20	Mercury (as Hg)	mg/l, max.	0.005
21	Nickel (as Ni)	mg/l, max.	5.0
22	Selenium (as Se)	mg/l, max.	1.0
23	Zinc (as Zn)	mg/l, max.	5.0
24	Pesticides	mg/l, max.	0.2
25	Detergents/Surfactants	mg/l, max.	50
26	Phenolic Compounds (as C_6H_5OH)	mg/l, max.	5.0
27	Oil and grease	mg/l, max.	50

In addition the following condition should also be met:

(i) discharge of high viscosity material should be prohibited;
(ii) calcium carbide sludge should not be discharged;
(iii) substances producing inflammable vapours should be absent; and
(iv) zero radioactive compounds.

APPENDIX 4: Details of Consultations held During Project Preparation

A. Rationale

1. The main objective of consultation and grievance redress participation is to involve stakeholders in the decision-making process, to keep all affected people informed of resettlement and compensation options and to provide a mechanism through which they can raise any concerns so that they may be addressed in project design and implementation.

2. Identification of the primary and secondary stakeholders is the first step. People affected, beneficiaries and the National Water Supply and Drainage Board (NWSDB), as the implementing agency, are the primary stakeholders. Members of Parliament, *Pradeshiya Sabhas* and Local Authorities, officials of district and divisional secretariats and local authorities in the area are secondary stakeholders. NGOs operating in the area will also be in this category.

3. Stakeholder consultation was conducted during the initial period of project preparation in 2006 and then continued when the project recommenced in 2009-2010. Consultation covered both environmental and social issues, as described below.

B. Stakeholder Consultation in 2005-06

4. During the initial project preparation stage, a number of meetings and discussions were held with stakeholders to involve them in decisions on matters directly affecting them, and to keep them informed of the details from the planning stage of the project. A number of public meetings and presentations to various stakeholders were held in Jaffna, Valvettithurai and Kilinochchi as well as in Colombo and Trincomalee. Details are shown in the table.

Table A4.1: List of Stakeholder Meetings and Presentations

Date	Attendees	Location	Principal Topic
25/04/05	All stakeholders	Jaffna Library auditorium	Inception Report & kick-off meeting
07/07/05	CAARP Project Coordination Committee	Trincomalee	Progress report
17/07/05	PDS – Kilinochchi ID – Kilinochchi Farmers organisation representatives	Kilinochchi	The use of Iranamadu Tank for drinking water supplies for Jaffna
27/07/05	MUDWS NWSDB Ministry of RRR Irrigation Department Water Resources Board	Ratmalana	Interim Report
20/09/05	PDS – Kilinochchi ID – Kilinochchi NEIAP NWSDB	Kilinochchi	Iranamadu hydrology and Jaffna Peninsula ground water modelling
14/10/05	CAARP Project Coordination Committee	Trincomalee	Progress report
22/10/05	NSGD Association with SCISL	Valvettithurai	Presentation on water issues at exhibition on Socio-Economic Development achievements in Vadamaradchchi
14/11/05	Farmers organisation representatives Irrigation Department – Kilinochchi	Kilinochchi	The use of Iranamadu Tank for drinking water supplies for Jaffna & MOU.
30/11/05	CAARP Project Coordination Committee	Trincomalee	Progress report

20/01/06	MUDWS NWSDB Chief Secretary NEP ADB	Ratmalana	Draft Final Report
17/02/06	General public NGO Government Officers	Kilinochchi	Details of proposed project.
18/02/06	General public NGO Government Officers	Jaffna Library auditorium	Details of proposed project.
10/02/10	All Divisional Secretaries, Jaffna District Government Officers NWSDB and ADB	Jaffna	Resumption of the project, its present status and new program
03/04/10	NWSDB, PID Farmers and their representatives from downstream Iranamadu area	Kilinochchi	Resumption of project and revised program for design & construction Proposed improvements to Iranamadu Tank and abstraction
Mid-April 2010	All stakeholders	Jaffna and Kilinochchi	Resumption of project, new program; environmental and social impacts and benefits

ADB = Asian Development Bank, CAARP = Conflict Affected Areas Rehabilitation Project, MOU = memorandum of understanding, MUDWS = Ministry of Urban Development and Water Supply, NEIAP = North East Irrigated Agriculture Project, NEP = North East Province, NGO = nongovernmental organization, NWSDB = National Water Supply and Drainage Board, PDS = Planning and Development Secretariat, PID = Project Information Document, RRR = Relief, Rehabilitation and Reconstruction, WRB = .Water Resource Board.

5. Of particular note were the meetings and presentations held with the farmers organizations in Kilinochchi on 17 July and 14 November 2005, and the meetings on 17 and 18 February 2006 in Kilinochchi and Jaffna. The latter meetings were advertised in the local press in both Tamil and English (and were presented in Tamil and English). The general public, NGOs and government officials were invited to attend. Details are provided towards the end of this Appendix. In each case the details of the proposed project were presented and environmental impacts and the impacts on the residents of the area were highlighted. Specifically, the process of pipe-laying in the towns was explained in detail.

5. During and at the conclusion to the presentations the audience raised issues that were of concern and interest to them and which were answered by the project team. No resettlement issues were raised in Jaffna and in particular no concerns were voiced over the possible inconvenience that residents may experience during the pipe-laying operations. The view was expressed by the government agent that any inconvenience suffered during pipe-laying was the contribution of the public to the project, equivalent to the contribution (in labor or cash) that people involved in community water supplies were generally expected to provide.

6. In Kilinochchi members of the farmers' organization accepted that water would be provided from Iranamadu Tank for the Jaffna water supplies, but reiterated their proviso that rehabilitation works should be implemented prior to taking water from the tank. Information about the possibility of direct purchase of private lands was given by the manager of premises of the NWSDB.

7. The meetings were informed that copies of the consultant's feasibility study reports including: Volume 8: Social and Resettlement Assessment and Volume 7: Environmental Assessment will be placed in the offices of the NWSDB. An advertisement, in Tamil and English, will be placed in the local press inviting interested parties to inspect them.

C. Stakeholder Consultation in 2009-10

8. When the project recommenced in late 2009, resumption of stakeholder consultation was a key priority, to inform people that the project was going ahead after the three-year delay, to bring those returning to the project area into the consultation process, and to identify any new issues that may have arisen because of changes in circumstances since 2006. However, such contacts were inevitably delayed in the early period because of security concerns and the sensitive political situation in the country in the aftermath of the civil war and the presidential and parliamentary elections.

9. However, preliminary contacts were made with stakeholders during site visits conducted in late 2009-10 (see Appendix 1) and a meeting and presentation with the main institutional stakeholders was held on 10 February 2010 (see Table A4.1 and Section F below). The first meeting with primary stakeholders was held on 3 April 2010, when NWSDB and the PID met with farmers from the Iranamadu area and their representatives to discuss the proposed improvements to the tank and resulting increased water abstraction, and to reaffirm farmers' agreement with the proposals. A further meeting with a broader range of stakeholders is planned for mid-April 2010, and others will be held as project development proceeds further.

D. Discussions on Land Acquisition

10. Discussions on land acquisition, compensation and related matters were held with a variety of government officials, both in 2005-06 and 2010. Details of the meetings are summarized in the table below and the main findings were as follows:

11. Other than the private lands, NWSDB should apply for long term leases of the identified state lands. The Land Commissioner indicated that the present practice is to grant long-term leases of the state lands required for NWSDB projects. The term of the lease is thirty years and the leases will be on a renewable basis on completion of the term. The availability of state lands and vesting arrangements were discussed with the Jaffna District Secretary and the Divisional Secretary, Pachchilaipallai. Those are the officers who report to the Land Commissioner that the particular lands are available and can be leased for the purpose indicated by NWSDB. With regard to the LRC land, the procedure was discussed with the Director (Land Ceiling) of the LRC Head Office, Colombo.

12. Discussions were also held with the affected persons identified in 2005-06 and with the proposed donors of land, when details of the project were outlined to them and the need for land-take explained as well as the various procedures concerning land acquisition and donation.

Table A4-2: Discussions with Government Officials

No	Name of the officer	Position	Date	Points Discussed
1	Mr. K. Ganesh	District Secretary , Jaffna	19 Sep 2005	Availability of state lands and acquisition of private lands for the project and resettlement issue
2	Mr. S. Sivasiri	Divisional Secretary, Pachchilaipallai Division	16 Sep 2005	-do-
3	Mrs. Coole	Executive Engineer, RDA, Jaffna	19 Sep 2005	Availability of A9 road for laying the pipe line
4	Mr. Mohan	Deputy Director, A9 Road Project, Vavuniya	6 Sep 2005	-do-
5	Mrs. A. Hewasilian	Director, Land Ceiling, RC, Colombo	23 Sep 2005	Acquisition of LRC lands
6	Mr. S. J. Pathirana	Land Commissioner, Colombo	23 Sep 2005	Vesting of State lands

7	Mr. R. Gunaratna	Additional Land Commissioner, Colombo	23 Sep 2005	-do-
8	Mr. A.G. Gunaratna	Manager, Premises, NWSDB, Ratmalana	6 Sep 2005	Direct Purchase of Land by NWSDB
9	Mr. K. Ganesh	District Secretary, Jaffna	13 Jan 2010	Confirming availability of state-owned lands
10	Mr. Jayaseelan	Divisional Secretary, Karainagar Division	10 Feb 2010	-do-
11	Mr. D. Goonewardene	DGM (North) NWSDB	06 Mar 2010	Findings from re-assessment of sites; revised project program

A9 = Kandy to Jaffna Highway, LRC = Land Reform Commission, NWSDB = National Water Supply and Drainage Board.

E. Records from key Consultation Meetings

13. The following pages contain formal records from key consultation meetings held in 2006 and 2010. These include:

- Newspaper advertisements;
- Records of discussions at key meetings (points raised and answers given); and
- Attendance lists.

14. In due course his will be supplemented with equivalent details from further meetings held in 2010.

News Paper Advertisements

உதயன்

Public Consultation meeting on ADB assisted Jaffna Water Supply and Sanitation Feasibility Study

Under the chairmanship of Mr.K.Ganesh, Government Agent, Jaffna the above mentioned meeting will be held on 18th Feb. 2006 at 10.00 a.m. The venue is Jaffna Public library Auditorium. The General Public, NGOs and Government Officials in Jaffna District are cordially invited to participate in the meeting.

Eng.T.Barathithasan,
Manager (Northern Region),
National Water Supply and Drainage Board.

Andrew Scott,
Team leader
SMEC consultant,
Colombo.

ஆசிய அபிவிருத்தி வங்கி அனுசரணையுடன் மேற்கொள்ளப்படும்
யாழ். குடாநாட்டிற்கான குடிநீர் வழங்கல் மற்றும்
சுகாதார நிர்ணயத்திற்கான சாத்தியக்கூறு ஆய்வின் கலந்துரையாடல்

அரச அதிபர், யாழ்ப்பாணம் திரு.கே.கணேஷ் தலைமையில் நடைபெறும் மேற்படி விடயம் சம்பந்தமான கலந்துரையாடலில் பொதுமக்கள், அரசசார்பற்ற நிறுவனங்கள், அரசாங்க உத்தியோகத்தர்களைப் பங்குபற்றுமாறு அன்புடன் அழைக்கின்றோம். இக்கலந்துரையாடல் எதிர்வரும் 18.02.2006ஆம் திகதியன்று முற்பகல்10 மணிக்கு யாழ்.பொதுநூலக கேட்போர் கூடத்தில் நடைபெறும்.

எந்திரி.தி.பாதிதாசன்
முகாமையாளர் (வடபிராந்தியம்)
தேசிய நீர் வழங்கல்,
வடிகாலமைப்புச் சபை.

அன்ரு ஸ்கொட்,
குழுத்தலைவர்,
SMEC ஆலோசகர்கள்.
கொழும்பு.

15.02.2006

Public Consultation meeting on ADB assisted Jaffna water Supply and Sanitation Feasibility Study

Under the chairmanship of Mr.T.Rasanayagam Government Agent, Kilinochchi the above mentioned meeting will be held on 17 th Feb 2006 at 9.30 am. The venue is Kachcheri conference hall in kilinochchi. The General public, NGOs and Government officials in kilinochchi District are cordially invited to participate in the meeting.

Eng.T.Barathithasan
Assistent General Managar (Northern Region),
National water Supply and Drainage Board,
Kilinochchi.

Andrew Scott,
Team leader,
SMEC consultant,
Colombo.

ஆசிய அபிவிருத்தி வங்கி அனுசரணையுடன் மேற் கொள்ளப்படும் யாழ்.குடாநாட்டிற்கான குடிநீர் வழங்கல் மற்றும் சுகாதாரத் திட்டங்களுக்கான சாத்தியக் கூற்று ஆய்வின் கலந்துரையாடல்.

கிளிநொச்சி அரசாங்க அதிபர் தி.இராசநாயகம் தலைமையில் நடைபெறும் மேற்படி விடயம் சம்பந்தமான கலந்துரையாடலில் பொதுமக்கள், அரச சார்பற்ற நிறுவனங்கள், அரசாங்க உத்தியோகத்தர்களைப் பங்குபற்றுமாறு அன்புடன் அழைக்கின்றோம். இக்கலந்துரையாடல் எதிவரும் 17.02.2006 திகதி அன்று காலை 9.30 மணிக்கு கிளிநொச்சி கச்சேரி மாநாட்டு மண்டபத்தில் நடைபெறும்.

எந்திரி.தி.பாதிதாசன்.
உதவி பொதுமுகாமையாளர்
(வடபிராந்தியம்).
தேசிய நீர் வழங்கல்,
வடிகாலமைப்புச் சபை.

அன்ரு ஸ்கொட்,
குழுத்தலைவர்,
SMECஆலோசகர்கள்,
கொழும்பு.

புதினம்

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- Age not less 22 y

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செய்யாத

தே.ரூபன்

Record of Discussions at Key Meetings

15. Presentations were given in both Tamil and English. A full description of the design process, design parameters, alternative water sources, proposed strategy and recommendations for water supplies, sewerage system, sewage treatment and disposal, institutional strengthening etc. were presented. Issues relating to potential environmental and social impacts of the water, sewerage and sewage treatment were put forward. In particular the recommended pipeline construction process and effects in Jaffna and other built-up areas was explained.

Kilinochchi, 17th February 2006

16. Farmers' representatives wanted the rehabilitation of the Iranamadu Irrigation Scheme to be completed, institutional and capacity building, research into the identification of suitable Other Food Crops and marketing to be implemented before water is released for Jaffna water supplies. Concerns were raised that the population in Jaffna would increase prompting increased water demands, which could reduce the water available for cultivation.

17. NGOs raised the issue of what were appropriate sanitation options. The relative merits and acceptability of compost latrines were debated. One delegate reported that over a million had been constructed in China and in India. However it was claimed that the cultural/ sociological conditions were different in China and Sri Lanka and that compost latrines would not be acceptable to the people in Jaffna District. It was emphasized that the recommendation applied to the karstic limestone areas and that a pilot scheme should be implemented to assess the acceptability of such a technology before full implementation. It was also emphasized that sanitation methods were site specific.

18. On the need to raise the full supply level in the Iranamadu Tank, the Irrigation Department did not confirm the previously expressed view that this was un-necessary.

19. The possibility of using desalination as a method of water supply was raised. However the NWSDB considered that the operational costs were excessive.

20. One attendee proposed that water and sewerage connections should be done concurrently with the construction of the mains, a view that was well supported.

21. No concerns were raised concerning environmental issues or on the potential impact of pipe-laying activities.

Jaffna, 18th February 2006

22. The same arguments concerning the use of composting toilets were aired. One delegate informed the meeting that a pilot scheme for 50 toilets was being implemented in the District and that two advantages were that there was no pollution of the ground water and that there was no need for water for flushing.

23. The capacity of the different water sources were raised by different delegates. Concern of the security of water from Iranamadu was expressed including the risk of illegal tappings. It was observed that the irrigation Department had a programme to rehabilitate the salt water exclusion bunds and this, together with other measures would enhance the availability and quality of groundwater in the Peninsula.

24. The possible sources of water to meet future demands were raised. It was confirmed that a further study on the water resources in the north-eastern region was being recommended. It was suggested that the possibility of using Mahaweli water should be included in the TORs for the study.

25. The provision of a sewerage system in Jaffna was endorsed as an appropriate method to tackle ground water pollution in the area. In addition it was proposed that improvements to the surface water drainage system should also be provided.

26. The recommended pipeline construction process and effects were explained in detail as this would affect Jaffna particularly. The provision of the sewage treatment works and the likely alternative locations of the sea outfall were also specifically explained. No concerns were raised concerning environmental issues or on the potential impact of pipe-laying activities.

27. The RDA emphasized that there should be close co-ordination over pipe-laying generally so that it can be incorporated into the road construction in the project area.

28. The importance of managing the water resources was raised. A water resources committee under the chairmanship of the Government Agent was proposed, which would manage, protect and control abstraction of the groundwater.

29. It was proposed that agricultural extension work should be enhanced to enable and educate farmers to adopt new water conserving technologies and crops, to expand the use of compost and to produce organic foods.

30. Appreciation of the Jaffna Water Supply and Sanitation feasibility study was voiced by attendees.

Jaffna, 10th February 2010

31. The meeting was held in the District Secretariat of Jaffna and was chaired by the District Secretary. The focus group for the presentation was all the Divisional Secretaries along with the key officials from governmental institutions and NGOs in Jaffna District. A presentation was delivered in English, outlining the need for the project, followed by a description of the design process, design parameters, main components of the proposed water supply and sewerage systems etc.. The provision of the sewage treatment works and the sitting of the sewage treatment plant were also specifically explained. The present status of the project was described by the ADB mission leader.

32. Provision of a reliable drinking water system was considered as one of the priority areas in the development of Jaffna. In general, the concentration of Calcium in water is high in the area, which tends to cause serious health issues such as kidney problems. The high concentrations of Nitrates in ground water were also mentioned, and according to the representative from the University of Jaffna, records have revealed that the levels are as high as 22 mg/l, compared to WHO standards of 10 mg/l. High usage of chemicals and fertilizers in agriculture is considered as one of the main cause of groundwater pollution.

33. The Regional Director of Health Services, Jaffna, emphasized the increase of cases of water borne diseases such as Typhoid fever and Hepatitis B in the recent past in the district and highlighted its interconnection with the issue of groundwater pollution due to the prevailing condition of the sanitary systems adopted. The provision of a sewerage system in Jaffna was endorsed as an appropriate method to tackle groundwater pollution in the area.

34. No concerns were raised by the participants concerning environmental or resettlement issues or any potential impacts related to the proposed water supply and sewage works.

Attendance Record

The discussion on Saturday, 18th February 2006 was held at the Jaffna Public Library Auditorium, at 9.30 a.m. and the attendees were as follows:

1.	M.Nanthagopalan	-	District Secretary, Vellanai
2.	Mrs. P.H	-	Engineer, RDA Jaffna
3.	K.Maheshwaran	-	ADP, District Secretary Office, Jaffna
4.	K.Thevasorupan	-	Development Coordinator, District Secretary Office, Nallur
5.	V.Subashini	-	Division Environmental Officer, District Secretary Office, Chankana
6.	K.Arumukham	-	Secretary, UC Chavakadeli
7.	A.Vijayakumari	-	Investigation Officer, RACLGS Office
8.	T.Mahadevan	-	Food & Drugs Inspector, DPDH Office

9.	S.Rajendra	-	SPHI (D), DPDH Office
10.	N.Suganthan	-	TO, Point Pedro *Pradeshiya Sabha*
11.	K.Kumaraswamy	-	OIC, WRB
12.	V.Arulchelvam	-	TO, Point Pedro UC
13.	K.Selvarasa	-	Point Pedro UC
14.	P.Sivalingam	-	Reg. Commissioner Jaffna, NEPC
15.	P.Vignawa	-	President, NGV Group
16.	Guillernw Gareia	-	IFRC, Water/Sanitation
17.	Stetoinos Galontris	-	IFRC, Health
18.	R.Balandra	-	Engineer, Ceywater
19.	C.K.U.Swagnsnam	-	Municipal Commissioner Jaffna Municipal Council
20.	V.S.Sivaprakasam	-	Technical Officer, Jaffna Municipal Council
21.	T.Bavathi	-	RM (North), NWS&DB
22.	S.Sivakumar	-	SA
23.	K.Pathmanathan	-	
24.	S.Ruthiralingam	-	Consultant, REACON
25.	S.Thanabalasingam	-	Librarian, Jaffna Public Library
26.	K.Kajanthirakumar	-	Trainee, PHI, Health Department
27.	R.Jegathasan	-	Trainee, PHI, Health Department.
28.	J.Jeyachristo	-	Trainee, PHI, Health Department
29.	G.Anutharsan	-	Trainee, PHI, Health Department
30.	A.J.Ronald	-	Trainee, PHI, Health Department
31.	S.Uthayapala	-	Trainee, PHI, Health Department
32.	M.Prabakaran	-	Trainee, PHI, Health Department
33.	S.Ravivarma	-	Trainee, PHI, Health Department
34.	V.Thurarahan	-	Trainee, PHI, Health Department
35.	T.D.Thavashirojan	-	Trainee, PHI, Health Department
36.	A.Rathan	-	Trainee, PHI, Health Department
37.	G.Jegatheesan	-	Trainee, PHI, Health Department
38.	K.Venugoban	-	Trainee, PHI, Health Department
39.	K.Shrimohanan	-	Assistant Government Agent, Kayts/Karainagar
40.	K.Karunanithy	-	IE (Jaffna) Irrigation Dept.
41.	T.Ranganathan	-	Office Aide Project Office
42.	S. Vishnu Kumar	-	Watcher, Project Office
43.	A.C. Vinotharaj	-	DDI, Irrigation
44.	K. Ganesh	-	Government Agent, Jaffna, Kachcheri
45.	J.Thilliampalavanan	-	Secretary, Karainagar
46.	K. Sivalingam	-	Rtd. DDPNEP, Consultant, J.D.S.D.F.
47.	M. Sinnathurai	-	Consultant, WatSan, JDDSSU
48.	K. Sivakumaran	-	Coordinator, Care International, Jaffna
49.	T. Sivanandan	-	S.T.A., ACAD's Office
50.	Y. Thayaparan		Asst. Project Officer, UNICEF
51.	K. Sivaganesan	-	APM- WatSan, ACE
52.	K. Ramachandran	-	T.O. , V.S.P.S., Chunnakam
53.	N. Kohuladas	-	Project Officer, FORUT, Jaffna
54.	T. Suthakaran	-	D.E. (J/K), NWSDB
55.	K. Ajanthan	-	PHI (Trainee), Health Department
56.	Y. Sivayogarajan	-	F.O.- WatSan, ITDG
57.	S. Gunabavan	-	PHI (Trainee), Health Department
58.	P. Thalirrajah	-	PHI (Trainee), Health Department
59.	K. Sivanesan	-	Rtd. Acct, R.C. and D.
60.	R. Ramanan	-	PHI (Trainee), Health Department
61.	S. Chandramohan	-	PHI (Trainee), Health Department
62.	T. Suganthan	-	PHI (Trainee), Health Department
63.	S. Rubathas	-	PHI (Trainee), Health Department
64.	S.N. Premkumar	-	PHI (Trainee), Health Department
65.	T. Kiruban	-	PHI (Trainee), Health Department

66. R.G. Vijayaratnam	-	Env. Coordinator, Care International, Jaffna
67. S. Anderson	-	Development Coordinator, Assistant Government Agent Office, Kayts
68. K. Selvakumar	-	Senior Engineer, NWSDB
69. R. Gunaratnam	-	OIC, NWSDB
70. K. Narayanaswamy	-	
71. Y. Sakinthan	-	PHI (Trainee), Health Department
72. M. Anusuthanan	-	PHI (Trainee), Health Department
73. V. Nantharuban	-	PHI (Trainee), Health Department
74. S. Puveenthran	-	PHI (Trainee), RTC
75. G. Mathanakumar	-	PHI (Trainee), RTC
76. S. Thavethan	-	PHI (Trainee), RTC
77. V. Pirabaharan		PHI (Trainee), RTC
78. M. Rajamenakan	-	PHI (Trainee), RTC
79. N. Thivasuthan	-	PHI (Trainee), RTC
80. R. Sotheesh	-	PHI (Trainee), RTC
81. S. S. Ganeshalingam	-	Lab II, Water Supply, Chunnakam
82. N. Perinpanathan	-	Lab II, NWSDB, Jaffna
83. T. Balathas	-	T.O., Vadamaradchy South- West P.S.
84. R. Thananchiyan	-	PHI (Trainee), RTC
85. T. Sureshkumar	-	PHI (Trainee), RTC
86. S. Sabaratnam		NWSDB, Velanai
87. K. Christopher	-	Public, 2 Beach Road, Jaffna
88. S. Ratnasothy	-	Office Manager, JWSS Feasibility Study
89. T. Kajenthiran	-	PHI (Trainee), RTC
90. M. Vasanthan. Croos	-	PHI (Trainee), RTC
91. Dr. s. G. Sivagurunathan	-	Sr. Lecturer, University of Jaffna
92. A. Dhatparananthan	-	
93. M. Thiyagaraj	-	Accountant, NWSDB, Jaffna
94. M. Suntharanayagam	-	E.A., NWSDB, Jaffna
95. S. Jadenthirethevan		
96. A. Paramanathan	-	Eng. Assistant, NWSDB, Jaffna