Environmental Assessment

INITIAL ENVIRONMENTAL EXAMINATION

Project No. 49001-002
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FIJI: Urban Water Supply and Wastewater Management Project

Rewa River Water Supply Subproject

Prepared by the Water Authority of Fiji and the Ministry of Finance for the Asian Development Bank

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CURRENCY EQUIVALENTS

(as of August 2016)
Fiji Dollar – (FJD)
FJD 1.00 = USD 0.489
USD = FJD 2.041

ABBREVIATIONS

ADB	Asian Development Bank
CEMP	Construction Environmental Management Plan
COEP	Code of Environmental Practice
CPP	Consultation and Participation Plan
DOE	Department of Environment
DSC	Design and Supervision Consultant
EIA	Environmental Impact Assessment
EMA	Environmental Management Act of 2005
EMP	Environmental Management Plan
EPC	Engineering Procurement Contractor
ESS	Environmental Safeguards Specialist (DSC Team)
GRM	Grievance Redress Mechanism
GSA	Greater Suva Area
HSP	Health and Safety Plan
IEE	Initial Environmental Evaluation
mg/l	milligrams per liter
ML/D	mega (million) liters per day
NRW	Non-Revenue Water
NSS	National Safeguards Specialist (DSC Team)
PPE	Personal Protective Equipment
SPS	Safeguard Policy Statement
SSS	Social Safeguards Specialist (DSC Team)
WAF	Water Authority of Fiji
WMP	Waste Management Plan
WTP	water treatment plant

EXECUTIVE SUMMARY

The proposed Fiji Water Supply and Wastewater management Project (the Project) will assist the Water Authority of Fiji (WAF) and the Government of Fiji efforts to provide safe water and sewerage services to the urban population of the greater Suva area (GSA) where approximately 30% of Fiji's population lives.[1]

The scope of the project will build infrastructure to increase water production by 20% and wastewater treatment by 200% in the GSA. In addition, WAF will be supported to implement a non-revenue water (NRW) program, introduce a water demand and liquid waste trade program, and other efficient management initiatives to improve service delivery. The project will also support government develop and implement policy and regulatory reforms in water and sewerage to make WAF a more sustainable and accountable institution. A capacity development technical assistance was provided to prepare the project.[2]

The project will be funded through a multitranche financing facility (MFF) and hence implemented in two tranches and phases. The first phase will construct the Rewa River Water Supply scheme and implement a non-revenue water reduction (NRW) program only. This is the Initial Environmental Examination (IEE) prepared for the water supply subproject proposed under the Project. The interventions proposed under the Project are located on the Rewa River of Viti Levu Island and the associated Rewa catchment and delta. Based on Fiji government law and ADB's environmental safeguard policy, the proposed Project is categorized as an environmental Category 'B' project considering the most sensitive component. This IEE meets the requirements of Fiji's Environmental Management (EMA) Act 2005 and the Environmental Impact Assessment (EIA) Guidelines 2008; and complies with the ADB's Safeguard Policy Statement (SPS) 2009. The scope of this IEE is limited to the sites of the proposed interventions.

This IEE was initially prepared during the project preparation work which concluded in May 2015. Since that time, the project design consultants have presented their draft final design and this document, therefore, reflects those changes.

The following presents the summary of existing features and proposed interventions of this subproject:

The Project

The subprojects of the Water Supply Project:

- Water Supply consists of an intake of 40 ML/d initially, increasing to 80 ML/d by 2020 on the Rewa River with conventional coagulation, flocculation, filtration and chlorination treatment, storage (3ML) and pumping for 8.5km to a second reservoir at Waitolu and gravity feed for 17.8km to the connection at Nausori and to the reservoir at Raralevu;

[1] World Bank and Fiji Bureau of Statistics. 2011. Republic of Fiji: Poverty Trends, Profiles and Small Area Estimation (Poverty Maps) in Republic of Fiji (2003-2009). World Bank. Washington DC.

[2] The Asian Development Bank (ADB) provided capacity development technical assistance for *Urban Development Planning and Institutional Capacity Building*. TA-8526-FIJ.

- Non-revenue Water Reduction consists of meter replacement, replace old mains and pressure management program

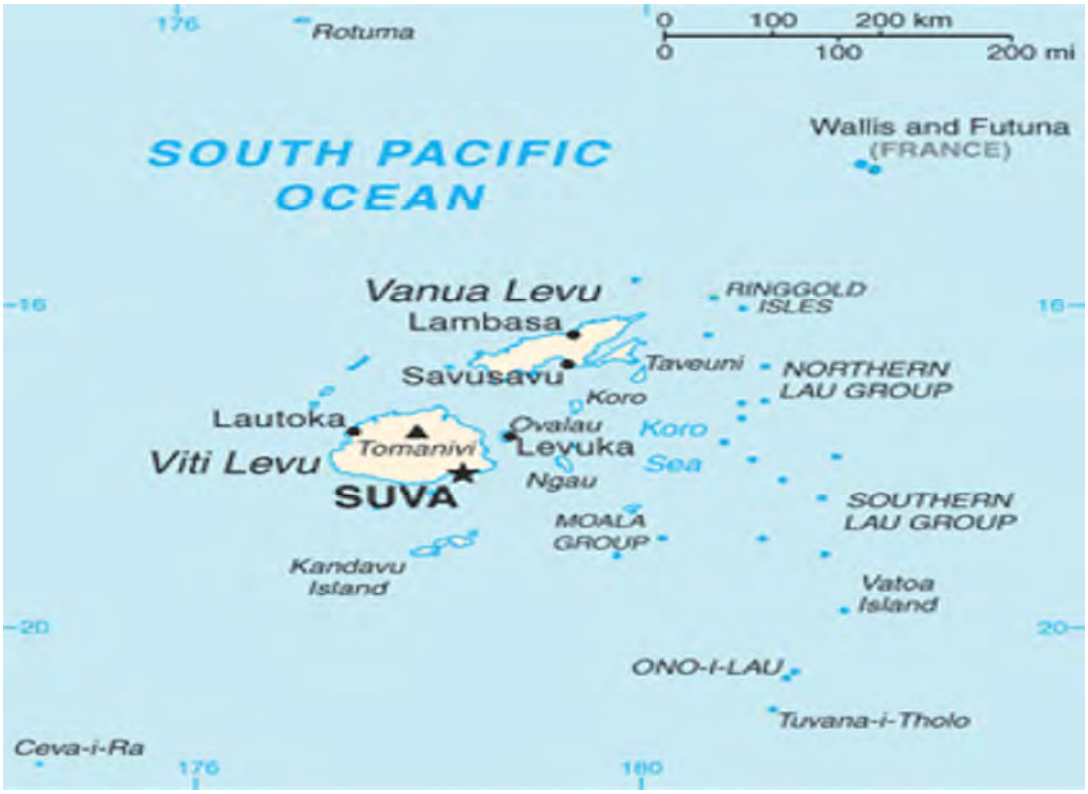
Local communities and stakeholders were involved in the process of preparing the IEE through on-site discussions and with minor environmental impacts, local communities and community leaders support the Project. Details of community issues and project actions are incorporated in the social assessment report. The IEE will be made available at public locations and will be disclosed to a wider audience via the ADB website. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the Project and have the opportunity to participate in its development and implementation and understand that there is a process in place for them to air any grievances or complaints.

Only minor and transient environmental disturbances will be experienced at the project sites during construction and operation, and these can be minimized and managed through proper implementation of the EMP. Due to the limited and manageable nature of impacts, this IEE is adequate to comply with the EMA of Fiji and ADB's SPS and therefore further environmental analysis of the Project is not required. Requisite compliance measures (updating and implementation of EMP and monitoring plan) will be included in the project and bid/tender documents.

A. INTRODUCTION

1. Fiji is located in Melanesia in the South Pacific Ocean about 2,000 km northeast of New Zealand's North Island. Its closest neighbors are Vanuatu to the west, Tonga to the east, and Tuvalu to the north. The country comprises an archipelago of more than 332 islands, of which 110 are permanently inhabited, and more than 500 islets, amounting to a total land area of about 18,300 square kilometers (km^2). The two major islands, Viti Levu and Vanua Levu (Figure 1), account for 87% of the population of almost 860,000. The capital and largest city, Suva, is on Viti Levu. About three-quarters of Fijians live on the coastal plains of Viti Levu, either in Suva—the country's capital—or in smaller urban centers like Nadi or Lautoka.

Figure 1: Location Map



2. With peak day demands estimated to be around 168 ML/d currently, there is a significant shortfall in bulk water supply and WTP capacity which is leading to water shortages or low pressures in vulnerable areas of the water supply system (high level areas, particularly at the extents of the system) during peak dry demand periods. Peak day demands are expected to exceed 200 ML/d within 25-30 years.

3. Based on forecast increases in peak day demands and capacity of the existing Waimanu River and the Waila and Tamavua WTPs, the proposed capacity for the new Rewa River Water Supply Scheme is 40 ML/d for Stage 1 with a duplication of capacity to 80 ML/d for Stage 2.

4. This IEE was prepared during the project preparation work which completed in the month of May 2015. The project is currently at preparation stage through a project

design advance facility, and although there are no major changes in the project design and location of components anticipated, this IEE has been updated after more detailed engineering design in compliance with the ADB's SPS 2009.

5. This document describes the Rewa River Water Supply Scheme, its environmental impacts and mitigation, an environmental management plan, conclusions and recommendations in the following sections: Policy, Legal and Administrative Framework, Description of the Project, Assessment of Alternatives, Description of the Environment (baseline data), Anticipated Environmental and Social Impacts and Mitigation Measures, Consultation and Information Disclosure, Grievance Redress Mechanism, Environmental Management Plan, Summary and Conclusion

6. This IEE study is conducted based on primary data from field surveys (including consultations) and secondary information collected from various sources. During the site visits the specialists had discussions with various stakeholders including MLGHE, town members and local executive powers for their opinions on the Project. The results of the consultations with village/town members and communities as well as an evaluation of the institutional framework have been incorporated into this assessment.

7. Based on the government's EMA and ADB's SPS, the interventions proposed in the project is categorized as category 'B' project based on the most sensitive component. Project categorization is carried out using a Rapid Environmental Assessment (REA) Checklist (Annex A-5). Accordingly this IEE is prepared to meet the requirements of the government as well as ADB's SPS requirements.

B. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

8. Environmental assessment of the proposed project has been carried out in compliance with ADB's SPS and the Fijian government's legislation and requirements.

1. National Level

a) Department of Environment

9. The principal national agency charged with environmental protection is the Department of environment (DOE) under the Ministry of Local Government, Urban Development, Housing and Environment (MLGUDHE). The role of MLGUDHE is to protect the environment and promote sustainable development. The environmental assessment for development projects is also approved by MLGUDHE. It is also the agency required to respond to any complaints from the public about environmental issues.

10. The DOE derives its legal mandate from the Environment Act 2005—Part 2 Administration. DOE promotes the sustainable use and development of Fiji's environment and implements the EIA process. Section 11(1) of the Act outlines the functions of the DOE as follows:

a. to coordinate the formulation and review of National Report;
b. to coordinate the formulation, review and implementation of the National Environment Strategy (including national environmental and resource management policies);
c. to implement and carry out the EIA process;

d. to design and implement policies and programmes on pollution and waste management, abatement an reduction;
e. to formulate, monitor and enforce environmental standards;
f. to coordinate conservation and management of natural resources;
g. to facilitate the establishment of environmental units in Ministries, departments, statutory authorities, local authorities, or facilities;
h. to establish and maintain a register of accredited persons;
i. to provide technical advice on pollution control and abatement measures;
j. to implement treaties and conventions on environmental and resource management to which Fiji is a party;
k. to formulate and review a National Resource Management Plan and the Natural Resources Inventory.

11. The Environment Act requires the establishment of four units: 1) The Environmental impact Assessment Unit; 2) The Resource Management Unit; 3) The Waste Management and Pollution Control Unit; and, 4) Environmental Management Unit.

12. The role of the EIA unit is to examine and process every development proposal which is referred to it by an approving authority, which may come to the attention of the unit as having a significant environment or resource management impact.
Duties of the EIA Unit:

- Carry out site investigations to assess private and public sector development projects
- Review EIA reports and management plans
- Develop EIA procedures with other government stakeholders
- Advise on environment implications of projects
- Raise awareness on EIA
- Develop and maintain EIA reporting system
- Develop a registration system for EIA consultants to uplift the standard of EIA's in Fiji
- Undertake research and provide secretariat support to committees

b) Environmental Management Act 2005

13. The Environmental Management Act 2005 (EMA) was gazetted on 17 March 2005. The Act, or sections of it as determined, came into force at dates appointed by the Minister. The Act sets guidelines and policies for environmental impact assessments, waste management, pollution control and penalties. The Act has seven parts:

Part One: Preliminary, contains definitions, application and purposes ("to apply the principles of sustainable use and development of natural resources; and to identify matters of national importance for the Fiji Islands—a) the preservation of the coastal environment, margins of wetlands, lakes and rivers; b) the protection of outstanding natural landscapes and natural features; c) the protection of areas of significant indigenous vegetation and significant habitat of indigenous fauna; d) the relationship of indigenous Fijians with their ancestral lands, waters, sites, sacred

areas and other treasures; and e) the protection of human life and health.

Part Two: Administration, includes the National Environment Council and its functions/terms/remuneration and meetings, functions/duties and powers of the Department of Environment, creation of the Environmental impact assessment unit, the resource management unit, the waste management and pollution control unit, the Environmental management units and committees, establishment of an Environmental Register, appointment and powers of inspectors, improvement notices and Environmental audits.

Part Three: Environment Reports and Plans, contains establishment of the National State of the Environment Report, the National Environment Strategy, the Natural Resource Inventory and the National Resource Management Plan, access to reports or plans.

Part Four: Environmental Impact Assessment, contains duties of approving authorities, the environmental impact assessment process, contents, review and approval of EIA reports, environmental management and monitoring, proposals subject to an EIA, and public hearings.

Part Five: Waste Management and Pollution Control, includes permits to discharge waste or pollutants, power to issue permits, facilities without permits, power to inspect and issue notices, order to stop work, environmental emergency declaration and appeal.

Part Six: Offenses and Penalties, includes limitation period for offenses, offense of undertaking unauthorized developments, other offenses, pollution offenses, general penalties and other orders, employee protection, defense regarding discharge of waste, civil claims and damages, liability of corporations and directors, matters of bankruptcy, evidence.

Part Seven: Miscellaneous, contains information on institution of proceedings, establishment of an Environmental Trust Fund, establishment of an Environmental Tribunal (for appeals), exemption from liability, power to give directions, power to delegate, rewards, regulations (Minister), guidelines (Director), transitional and savings (contracts, reports, developments).

Schedule 1: Environment and Resource Management Acts (listing)
Schedule 2: Development Proposals—Part 1 approved by EIA Administrator, Part 2 approved by approving authority
Schedule 3: Development Proposals That May Not Require the EIA Process or an EIA Report.

c) Environment Management (Waste Disposal and Recycling) Regulations 2007

14. The purpose of these Regulations is to prevent the pollution of the environment by controlling the discharge of solid waste from facilities, the discharge of liquid wastes, the emission of polluting gases, smoke, steam and dust, and the handling, storage and disposal of wastes and hazardous substances generally.

Part 5 of the Environment Management Act 2005 sets out the framework for waste management and pollution control in the Fiji Islands. It prohibits any commercial or

industrial facility from discharging any waste or pollutant into the environment or handling or storing hazardous materials without a permit and gives the Waste and Pollution Control Administrator power to issue permits.

d) Environmental Management (EIA Process) Regulations 2007

15. There are 5 parts for the regulations.

Part One: Preliminary sets out citation and commencement, definitions and authority for a development proposal.

Part Two: Screening, includes application for screening of a proposal, involvement of the Ministry as a proponent, procedure of the screening application, the screening decision itself and the classification of proposals and the role of the EIA Administrator.

Part Three: EIA Processing, contains the application for EIA processing of a proposal, the processing and scoping of the proposal, a site inspection that includes factors to be taken into account, records of the inspection and samples taken, scoping consultation including the public, preparation of the terms of reference for the EIA along with TOR meetings and contents of the TOR.

Part Four: EIA Study and Report, includes purpose and conduct of the EIA study, preparation of the EIA report, the required contents of the EIA report and the Environmental Management Plan, submission, publication and review of the EIA report, review meetings and decision.

Part Five: Miscellaneous, describes such matters as bonds, inspection, variations of approval, amendments, corporate body identification, discontinuance of application, consultant registration and loss of same, environmental register, information confidentiality, EIA guidelines, notices, forms, fees, moneys recovery and appeals.

e) Environmental Impact Assessment (EIA) Guidelines 2008

16. The guidelines contain initial information on what is an EIA and then the EIA process for Fiji: step 1—screening; step 2—scoping; step 3—the EIA study; step 4—review of the EIA report; step 5—EIA report approval and environment bonds; step 6—appeal system; step 7—compliance and step 8—monitoring. Further information is provided through: flow diagram of the procedure, roles and responsibility of key participants, applicability of the EIA report, conclusion, FAQ, glossary of terms and a reference section. Appendices include: Site inspection form, scoping checklist, typical terms of reference, recommended format of public advertisement and environment bond.

f) National Liquid Waste Management Strategy 2007

17. The strategy contains the scope and objectives of the strategy and reasons for managing liquid waste, i.e. the extent of the problem and attendant consequences, information on Pacific wastewater policy and Fiji country background (current waste management in Fiji including legislation, sewage waste, industrial and commercial wastewater, wastewater from the tourism industry, animal wastewater, marine shipping, urban storm water, leachate from landfill and dump sites and sludge (biosolids)). Appendices include: a strategy for pollution prevention: i) Identifying existing liquid

waste management activities and their effectiveness to determine best technologies and practice; ii) Developing a regulatory framework that effectively encourages adoption of best practice and monitors change; iii) Creating awareness and willingness of people ready to achieve goals; iv) Implementing pilot projects and up-scaling successful ones and v) Developing the human and capital resources required to carry out the needed activities.

g) Endangered and Protected Species Act 2002[3]

18. The Act consists of 8 Parts:

Part One: Preliminary, consists of the short title and interpretation (definitions).

Part Two: Field of Application, contains the Appendices and Schedules of species: Schedule 1 species not listed in Appendix 1 includes Part 1- Fishes (7), Part 2–Birds (11), Part 3—Seabirds (12), Part 4—Reptiles—Gekos (1), Part 5 – skinks (4), Part 6—Mammals (3), Part 7—Flora (42). Schedule 2 indigenous species not listed in Appendices I to III or Schedule I includes Part 1—Fishes (10), Part 2—Birds (Landbirds)(38), Part 3—Reptiles (9), Part 4—Skinks (8), Part 5—Terrestrial Snakes (1), Part 6—Amphibians (1), Part 7—Mammals (1), Part 8—Flora (85).

Part Three: Establishment of the Fiji Islands CITES Management Authority and the Fiji Islands CITES Council

Part Four: Permits includes export permits, import permits, re-export permits, permits for introduction from the sea, power to grant permits, validity of permits, keeping of records, application forms, species bred in captivity.

Part Five: Transit and Transhipment includes transit and transshipment of specimens, prohibited and restricted goods, and exemptions.

Part Six: Registration and Possession contains registration of persons to trade in specimens, registration of captive breeders, etc.

Part Seven: Enforcement includes offenses, offenses by directors, etc., detention of suspects, power of seizure and entry, general penalty, confiscation and forfeitures, reporting of breach.

Part Eight: Miscellaneous, includes donations, appeals, delegation of powers, regulations, transitional and savings.

2. International Level

19. This environmental assessment is carried out in compliance with Safeguard 1 of ADB's SPS so as to ensure that potential adverse environmental impacts are identified, avoided where possible and managed or addressed.

20. As per the SPS the objective of Environmental Safeguards is to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the projects decision-making process. To help achieve the desired outcomes, ADB adopts eleven policy principles for guiding the assessment

[3] A Bill is currently being circulated for comment which updates the lists of species in Schedule 1 and 2.

of projects that trigger environmental risks and impacts. ADB categorizes projects into categories A, B, C, and FI according to the significance of likely impacts.

a) ADB Environmental Safeguards Policy and Procedure

21. For the ADB Safeguard Policy Framework,[4] safeguard policies are generally understood to be operational policies that seek to avoid, minimize, or mitigate adverse environmental and social impacts, including protecting the rights of those likely to be affected or marginalized by the development process. ADB's safeguard policy framework consists of three operational policies on the environment, Indigenous Peoples, and involuntary resettlement. These are accompanied by *Operations Manual* sections on Environmental Considerations in ADB Operations; Involuntary Resettlement; and Indigenous Peoples. ADB's Handbook on Resettlement and Environmental Assessment Guidelines (2003) provide information on good practice approaches to implementing safeguards.

22. An updated ADB document[5] provides guidelines for conducting an environmental assessment. Some of these features include guidance on the environmental assessment process:

- Project screening and categorization
- Scoping for environmental assessment
- Analysis of alternatives
- Project description
- Applicable policy, legal and administrative framework and standards
- Baseline environment
- Impact and risk analysis
    i. type and scope of impact and risks
    ii. impact assessment methods
    iii. impact description
    iv. mitigation measures and residual impacts

- Environmental management plan
    i. actions to be taken to implement the mitigation measures
    ii. monitoring and reporting
    iii. institutional arrangements
    iv. EMP implementation schedule and cost estimates

- Information disclosure, consultation and participation
    i. information disclosure
    ii. meaningful consultation and participation

- Grievance redress
    i. grievance redress principals

23. Occupational and community health and safety—includes impacts on workers and communities involved in both construction and operation.

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[4] *Safeguard Policy Statement*. ADB Policy Paper, June 2009.

[5] *Environment Safeguards, A Good Practice Sourcebook,* Draft Working Document. ADB. December 2012.

24. Biodiversity conservation and sustainable natural resource management—impacts on diversity of living systems, their conservation and whether or not the project is sustainable from a natural resource perspective.

25. Pollution prevention and abatement—efficient use of resources, wastes and hazardous materials analyzed, treated and mitigated, pesticides mitigated and greenhouse gas minimized.

26. Physical cultural resources—protection through environmental assessment and management via screening, consultation, management, chance find and removal.

C. DESCRIPTION OF THE PROJECT

1. Background

27. The overall project will increase the capacity of the Water Authority of Fiji (WAF) to provide safe water and sewerage services to the urban population of the greater Suva area (GSA) where approximately 30% of Fiji's population lives. In this context the water supply subproject will build infrastructure to increase water production by 20% in the GSA. This will be the first stage/tranche project to which this IEE applies. In addition, WAF will be supported to implement a non-revenue water (NRW) program, introduce a water demand program, and other efficient management initiatives to improve service delivery in the second stage/tranche of the project. The overall project will also support government to develop and implement policy and regulatory reforms in water to make WAF a more sustainable and accountable institution. A capacity development technical assistance was provided to prepare the project.[6]

28. This IEE in detail is only for the first major subproject which is the construction of a water intake, 40 mega liter (ML) WTP (designed to be expanded easily to 80ML), and 3ML reservoir on the right bank of the Rewa River above of the confluence with the Waidina River. In addition, a second 10ML reservoir will be constructed 8.46 kilometers from the WTP at the highest elevation (132 meters) on the route to its junction with an existing water supply line 17.74 km from the second reservoir. The pipe will run in road reserve throughout. Currently there are two water intakes drawing from the Waimanu River with WTPs at Tamavua and Waila. Tamavua is designed for 60 ML/day and produces 55ML. Waila is designed for 100 ML/day and 95 ML per day. Both plants run at full capacity precluding necessary preventive maintenance, but several areas within the GSA receive water only intermittently.

29. The subproject impact will ensure that residents of some of Fiji's most densely populated areas have improved access to safe piped water system. The project's impact is aligned with the government's policy to improve delivery of water supply as articulated in the draft National Development Plan 2016-2036. The outcome will be improved access to sustainable water supply.

2. Overall Project Location

30. The Republic of Fiji is a large archipelago with diverse landscapes and climate. More than 300 islands are scattered over 1.3 million square kilometers. Located in

[6] The Asian Development Bank (ADB) provided capacity development technical assistance for *Urban Development Planning and Institutional Capacity Building*. TA-8526-FIJ.

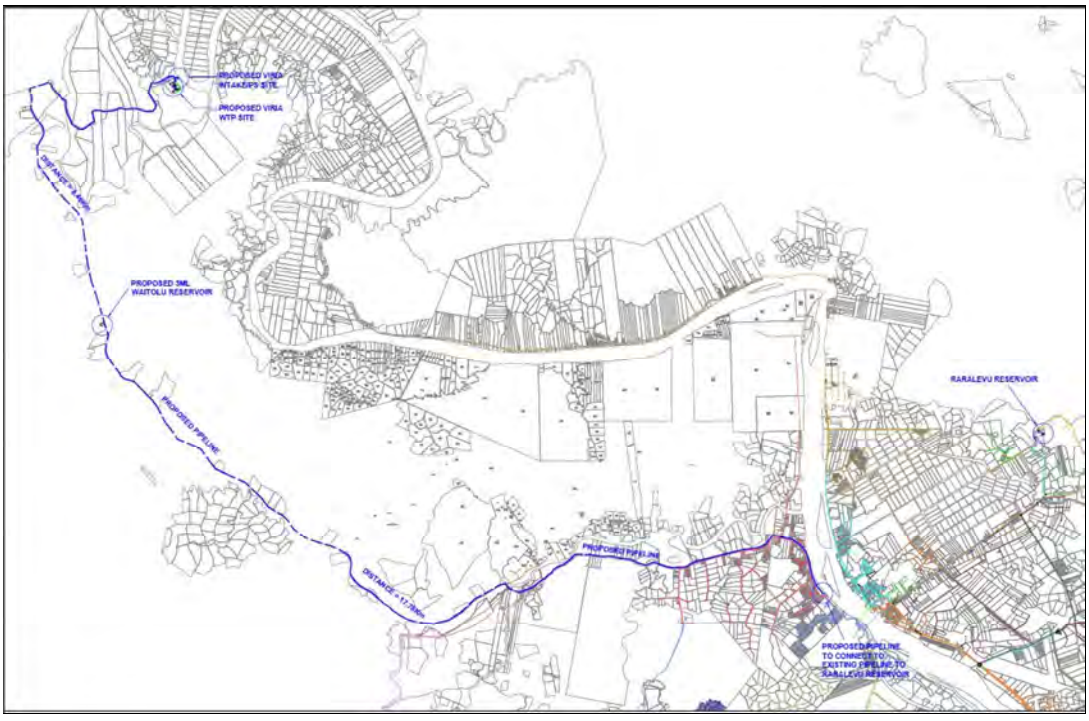
Melanesia in the South Pacific Ocean, it is about 2,000 km northeast of New Zealand's North Island. Its closest neighbors are Vanuatu to the west, Tonga to the east, and Tuvalu to the north. The total land area amounts to about 18,300 square kilometers (km^2). The two major islands, Viti Levu and Vanua Levu (Figure 3.1 below), account for 87% of the population of almost 860,000. The capital and largest city, Suva which also constitutes the GSA, is on Viti Levu. About three-quarters of Fijians live on the coastal plains of Viti Levu, either in Suva—the country's capital—or in smaller urban centers like Nadi or Lautoka.

31. The islands are characterized by diverse ecosystems including significant areas of natural forest, freshwater, coastal and marine life. Since independence in 1970, there have been many positive achievements in the pursuit of environmentally sustainable development. It cannot be denied however that the prevailing national enterprise for economic and social development has disturbed and in some instances destroyed the natural environment. The situation is compounded further by the increasing need to build ecosystem resilience to the growing adverse impacts of climate change and climate variability.

32. The water supply subproject is designed to serve the GSA metropolitan areas, shown below in Figure 2 and 3

Figure 2: Greater Suva Area

Figure 3: Location and Route of the Rewa Water Supply Subproject in the GSA



3. Water Supply Subproject Components

33. This system will be the same as that being used at the Waila and Tamavua water treatment plants for consistency for the operators and for integration into a future link to the Wailoku National Control Centre using either microwave radio, fibre-optic or a combination of both. Further investigations were carried out during the design development to determine the most appropriate communication link.

34. Acquisition of land for the WTP site is required.

35. The WTP site will include a 5ML treated water storage reservoir which will be duplicated at Stage 2 and the treated water pump station. This pump station will be fitted with three pumps for Stage 1 with space for a further three pumps at Stage 2. Key project components of the scheme include:

- a new river intake and pumping station on the Rewa River
- a new Water Treatment Plant including treated water reservoir and pumping station
- a network power supply upgrade
- 26km of DN900 pipeline to connect the WTP to the existing water supply system servicing Nausori and surrounding areas, and
- a 10ML water storage reservoir at Waitolu.

36. These components are further described in the following sections.

a) River Intake and Pump Station

37. Hydrological and hydraulic assessment has been undertaken to determine flood and drought flows and levels associated with the Viria treatment plant and intake structure[7]. Flow, level and rating data were obtained from the Fiji Meteorological Service for the long term flow gauging station on the Rewa River at Navolau which is located 7 km upstream of the water intake but the difference in catchment area is relatively small (52 km) and the long record at Navolau provides unparalleled information on flows in the middle reach of the Rewa River.

38. Flood frequency analysis of the entire Navolau record was undertaken using TIDEDA software; hydraulic modelling for a 2.5 ha area around the Viria intake was completed using Innovyze ICM (Integrated Catchment Modelling) (v5.5) computer software, while the hydraulic profile through the WTP was determined using HADES which is a proprietary modelling tool developed by MWH[8].

39. Developed from the modelling assessment are the design requirements for the intake and the water treatment plant with the minimum water level at RL0.5m and the 1 in 100 year flood level at RL17.0m. The raw water pump intake pipes are to be set with an invert of RL-2.50m to ensure full submergence under all flow conditions.

40. The treatment plant access road and pump header pipe access platform will be constructed above the 100 year flood level at RL17.5m. Full standby power supply via diesel generators is provided in case of regional flooding or HV power transmission loss

[7] MWH (2015) *Rewa River Water Supply Scheme – Preliminary Design Report*. Volume 2 – Section E, Technical Note: *Rewa River Hydrology*. Suva
[8] MWH *loc.cit.*

and permanent WTP operator accommodation facilities are provided to ensure continued operation[9]

41. The estimated average flow for the 1 day duration annual low flow is 50 m^3/s, the water level for this flow is approximately 0.5m above mean sea level (which is approximately 3m of water in the channel at this location, based on the survey data available). The flow frequency analysis of the Navolau recorded flow series estimated the daily average flow during a 20 year ARI drought to be 8.0 m^3/s

42. The river intake and pump station are combined as a single structure. Three pumps will be provided at Stage 1 and a further 3 pumps in Stage 2. The proposed arrangement comprises submersible pumps and piping within inclined installation tubes constructed down the bank into the river on a slope of approximately 1 in 3. Intake screening comprises passive screens within the river with 3mm slotted openings, fixed onto the inlet ends of the pump installation tubes with a back-flush cleaned by a packaged 'air burst' system. This arrangement was considered the most advantageous and cost effective given the large potential variation in water level of the Rewa River.

43. Each pump will have a 350mm nominal inside diameter pipe string inside an outer 500mm draft tube to carry the flow. A maintenance structure will be provided on the river bank for extraction of the pipe spools and pumpsets.

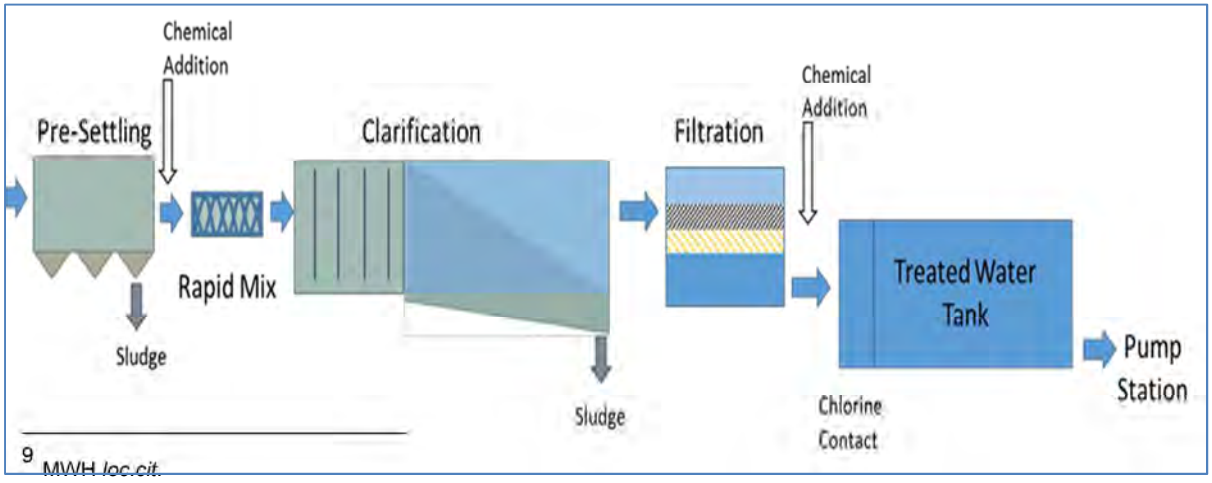
44. Access will be provided by the construction of a fill embankment to RL17.50m on the river bank to provide access to the pump header pipes and automatic control valves during a 1 in 100year flood event. This platform will extend from the edge of the Viria road and will be approximately 1,500 m^2 in plan.

45. Acquisition of land for the intake, pump station and water treatment plant site is required.

b) Water Treatment Plant

46. The overall Water Treatment Process selected for the Rewa River source is summarized in figure 4 below.

Figure 4: Water Treatment Plant Process



9 MWH *loc.cit.*

47. The treatment plant will be sized for 40ML/d initially and able to be duplicated to 80ML/d. The pre-settling tank and rapid mix coagulation will be sized for the ultimate capacity. The balance of the process units will initially be sized for 40ML/d.

48. The raw water pumps lift the water up to the pre-settling tank which has a top water level of RL27.88m. The flow through the treatment plant is by gravity with the top water level in the Treated Water Tank being RL22.00m and the minimum operating water level being RL17.00m.

49. Chemicals used in the process in their stored quantity (for 90 days) at the plant:

- polymer – 100 bags, 25 kg each
- chlorine gas – 12 drums, 1000 kg each
- $NaC0_3$ (soda ash) – 2400 bags, 25 kg each
- $AlS0_4$ – 4500 bags, 25 kg each
- $Na_2(SiF_6)$ fluoride – 400 bags, 25 kg each

50. A supervisory control and data acquisition system (SCADA) will be provided which will enable automated operation of the treatment plant and associated raw and treated water pumping stations.

c) Sludge Management and Disposal

51. Filter backwash wastewater and clarifier residuals are to be treated by settlement, drying and disposal to landfill. It is proposed that three sludge lagoons each 1000m^2 in area will be provided to cater for the residuals with space provided for a future fourth lagoon if required.

52. The intended operating regime is that the lagoons will have a filling cycle, a drying cycle and a cleaning cycle. Supernatant from the lagoons will be returned to the river via the main drain. The Government of Fiji Environmental Management (Waste Disposal & Recycling) Regulations 2007 sets faecal coliform limits at 400 and 200 no. per 100ml and TSS limits of 60 and 40 mg/l for General Ecological Zones and Sensitive Ecological Zones respectively. Discharges will need to comply with these requirements unless a special permit is obtained.

d) Network Power Supply Upgrade

53. For the Rewa River WTP, the FEA have advised that the existing 33kV Transmission system will need to be extended and a new Viria Zone substation constructed. A site immediately adjacent to the WTP has been identified as a suitable location for the Viria substation. An 11kV supply and step down transformer to low voltage would be located at the WTP and would be provided and owned by FEA.

54. Standby power supply will be provided using diesel generator sets with sufficient fuel storage capacity for up to 48 hours continuous operation at full load.

e) Pipeline

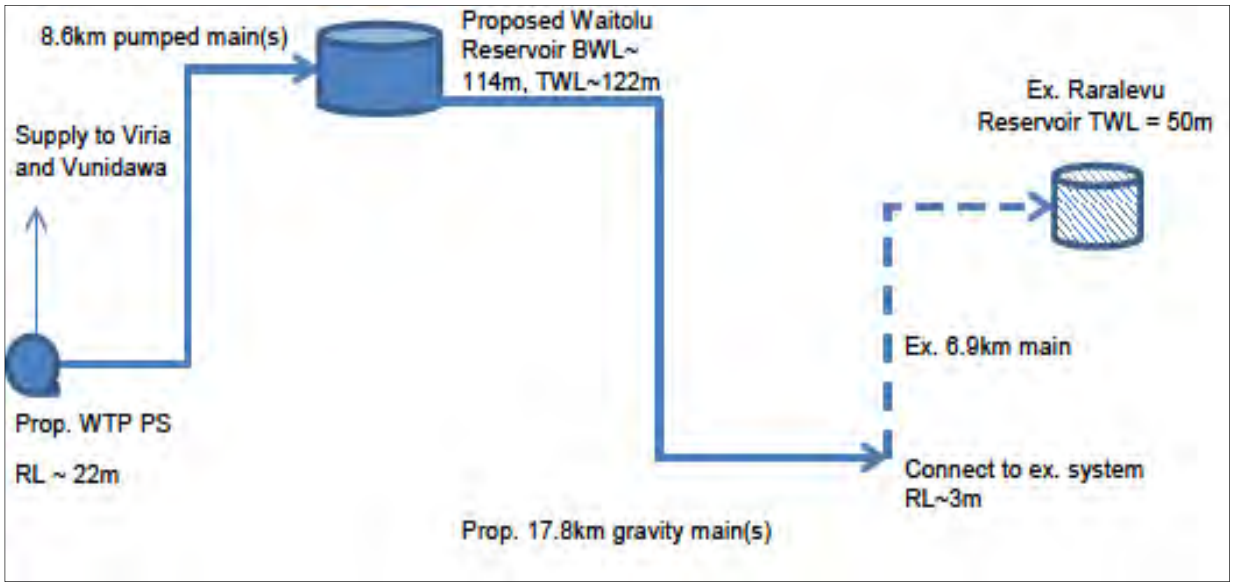
55. The treated water pipeline for the Rewa Water Supply Scheme comprises the

following:

- a 8.6km long pumped pipeline from the water treatment plant (WTP) on Viria Road to Waitolu Reservoir.
- a 17.8km long gravity pipeline from Waitolu Reservoir along Sawani-Serea and Princes Road to the existing Raralevu Supply main, which feeds the existing Raralevu Reservoir.

56. A 900mm diameter welded steel pipe is recommended following an assessment of alternative materials and diameters.

Figure 5: A schematic of the network is shown below.



e) Waitolu Reservoir

57. The proposed location for the Waitolu storage reservoir is at the high point along the main supply pipeline which is approximately 11.4km along the Sawani-Serea Road from Prince's Road. The site is cleared of all original forest vegetation and comprises a secondary habitat of mostly alien vegetation. There are no buildings on the site which is constrained with the land falling away dramatically to the west and south.

58. The storage reservoir could be constructed in reinforced concrete, welded steel plate or light weight prefabricated steel on a reinforced concrete base. Due to the difficult site configuration a rectangular rather than a circular tank configuration will be more efficient. Ground investigations show that the underlying rock profile falls away towards the north-west and that the surface material has insufficient bearing capacity to support the storage reservoirs. Piling of the reservoir foundations will therefore be required with pile depths ranging from around 6 metres to 20 metres.

4. Implementation Arrangement and Schedule

59. Existing and newly established institutions will support project implementation. The government through the Ministry of Finance (MOF) will be the executing agency (EA) of the project. The implementing agency (IA) will be the Water Authority of Fiji

(WAF). WAF has key hands-on expertise and will nominate counterpart staff with adequate capacity in water engineering systems, planning, finance, environment, and social areas to form the Project Management Unit (PMU). An international team comprising a lead water specialist, field engineer, safeguards specialist, and financial expert will be established as the Project Management Consultants (PMC) to support the PMU, EA and IA. During project implementation a project steering committee chaired by the MOF will supervise project implementation.

60. It is envisaged that the project will be implemented between January 2016 and December 2023.

D. DESCRIPTION OF THE ENVIRONMENT (BASELINE DATA)

1. Land Resources and Biodiversity

61. While over 60% of Fiji's total land area is suited to some form of agricultural activity, only 29% is appropriate for arable farming. The current expansion of commercial and residential use into land previously engaged in agricultural activity is indicative of the pressure of demand on arable land. The nature of land utilization practices, whether for agriculture, forestry or mining activities, has also increased risks associated with high soil erosion, river and stream contamination, sedimentation, pollution and flooding in low lying coastal and coral reef areas. In some instances this has led to the irreversible loss of biodiversity. As is true of most isolated islands in the Pacific, the terrestrial flora and fauna of Fiji demonstrate a high degree of endemism—over half (56%) of Fiji's 1,594 known plant species are entirely endemic. Fiji currently has 48 terrestrial protected areas covering 488 km^2 or 2.7% of the nation's land area. These sites are formally protected whereas a combined 129 terrestrial, marine and mangrove sites with potential biodiversity importance currently face formal conservation management challenges.[10]

62. The Rewa catchment is located on the windward side of Viti Levu and enjoys high rainfall for much of the year. The forest ecosystem supports high biodiversity of flora and fauna which in turn provides local communities with abundant natural resources.

63. Biodiversity of freshwater fauna is high in Fiji. There are 96 recorded species of Fijian freshwater and brackish fish. Four (4%) of these are endemic. Freshwater fish are an important food source for communities living on the banks of the Rewa River (and tributaries) as well as some commercial significance such as *Tilapia*. Available data suggest that between 20–35 percent of freshwater fishes in Fiji are vulnerable, endangered or extinct, mostly because of habitat destruction and degradation[11].

a) Freshwater Fishes.

64. The freshwater fish fauna of Fiji is relatively well known (Jenkins 2014) and Fiji's freshwater fishes have recently been recognized (Boseto, 2006, Abell et. al. 2008, Jenkins et. al. 2010) for their diversity and international importance in terms of endemic

[10] Department of Environment. 2007. *Implementation Framework 2010–2014 for the National Biodiversity Strategy and Action Plan 2007*. Fiji.

[11] *A Preliminary Investigation of Priority Ichthyofaunal Areas for Assessing Representation in Fiji's Forest Reserve Network*. A.P. Jenkins Technical Report. Wetlands International-Oceania and Wildlife Conservation Society-South Pacific, Suva, Fiji. 2003.

species per unit land area. While many of the unique species are small, colourful gobies, Fiji also has a distinctive freshwater pipefish fauna (Jenkins & Mailautoka, 2010) and also possesses the largest archipelagic endemic freshwater fish in the Pacific Islands. Currently 166 species (47 families) have been recorded from tidal reaches upwards with 156 (43 families) indigenous to Fiji. 10 species (4 families) have established invasive or non-indigenous populations in the wild although at least 15 non-indigenous species have been introduced. At least 13 species (4 families) (8.3%) are considered species endemic to the Fijian archipelago (Jenkins, 2009).

65. Almost all Fiji's fish fauna (98%) are of marine ancestry and have evolved unique life history patterns adapted to the temporal impermanence of island waterways. High island, tropical aquatic systems such as Fiji exhibit an unusually high degree of faunal connectivity (Jenkins et. al 2010). The major consequence of this is that fish species must cross a number of habitats throughout their life history and are likely to be disproportionately affected by deleterious environmental conditions due to the greater probability of encountering an obstacle to free passage (Eikaas and McIntosh, 2006). Larvae and post-larvae of diadromous fishes are particularly vulnerable during their downstream and upstream migrations. Obstacles preventing their safe passage upstream may be man-made (e.g. dams; Greathouse et al., 2006), consequences of non-native fish introductions (e.g. predation by invasives; Canonico et al., 2005), and/or consequences of degraded water quality (e.g. reduced ability to feed; Rowe and Dean, 1998). Although physical obstacles would less impede species with unique climbing abilities, such as many gobies and eels, many appear sensitive to degraded water quality conditions. In Fiji, primary threatening processes to this freshwater fauna are deforestation, mining, gravel extraction, building of obstacles to passage (eg. dams, hanging culverts) and introduction of exotic species.

66. While important ecologically, freshwater fishes also play an important socio-cultural role particularly in the lives of inland villages. Fresh fish often contributes greater than 75% of the fish consumption of both rural and urban areas of the Pacific with the remainder comprised of canned fish (Bell et. al 2009). For many Fijian inland communities, freshwater fishes not only comprise a major part of the diet but also have important cultural totemic values.

b) Marine and Coastal Resources.

67. Fiji has an estimated 1, 129 km of coastline within some 1.3 million km^2 of ocean area inside its Exclusive Economic Zone. Offshore fisheries in this context make a significant contribution to the Fijian economy but there are concerns about the number of vessels operating, the sustainability of the catch effort, and the potential impacts both upon pelagic fisheries resources and near shore coral reefs. Major threats identified to Fiji's coastal resources are the increasing rates of coastal activities such as land reclamation, coral extraction, river dredging, compounded by unregulated residential and tourism development. Fiji has the third largest mangrove area (38,000 ha) in the Pacific but coastal area and wetlands reclamation have caused significant loss of mangrove areas and littoral forest, especially around heavily industrialized areas, towns and cities. Coastal pollution from land-based activities and waste is also a major threat through increased siltation from reclamation, solid waste dump sites, eutrophication and groundwater seepage. Fiji's reef systems are directly affected with its reefs and near-atolls spanning over 10,000 km^2. In this context, the reefs health is vital to the large proportion of the populace dependent on subsistence or small scale commercial fishing

as well as the growing tourism industry. Marine reserves have been established with environmental management plans but there is a clear lack of commitment for implementation due to lack of resources, lack of skilled manpower and unclear institutional arrangements.

68. For the purposes of this water supply subproject, we will focus attention on the Rewa watershed and catchment, the Rewa River and associated delta.

c) Rewa Watershed[12]

69. The Rewa River is the widest river in Fiji, and its watershed is the largest watershed in Fiji, covering an area of 3,092 km^2, which is about 1/3 of the total area of Viti Levu. The Rewa River originates in the largest peak in Fiji (Tomaniivi) in Ra Province, is fed by two large tributaries, the Wainibuka and the Wainimala, in the upper reaches, while the smaller tributaries such as the Waidina and the Waimanu contribute to the flow in the lower reaches of the Rewa River. The watershed spans five provinces, namely Ra, Namosi, Naitasiri, Tailevu and Rewa. These provinces are connected by tributaries of the Rewa River, but each is noted for very different land- use patterns, resource usage and contribution to the national economy.

70. In Namosi Province, where the Waidina River originates, the government-endorsed exploratory work for what is potentially the biggest copper mine project for Fiji is currently being assessed in an EIA study and process. In Tailevu Province, where one of the major tributaries (Wainimala River) originates, the country's main pastoral and dairy farms are located. Also, in the last several years, the construction of the Kings Highway along the northern parts of Viti Levu has been a major activity in the Tailevu Province. In Naitasiri Province, the country's largest hydropower plant is located in the upper reaches of the Wailoa River, which drains into the Waidina River. Logging of forests in the upper reaches of the Rewa River and intensive agriculture in the lower reaches of the rivers are having significant effects on the water quality in the Rewa River. The culmination of these activities in the Rewa watershed often impinges most grievously on the communities, the businesses and the villagers occupying the lower Rewa and the delta areas during periods of heavy rain and associated flooding. The high rainfall and the physical attributes of the terrain in the Rewa watershed exacerbate the devastating effects of flooding in the Rewa Delta.

71. This watershed receives high rainfall of 2,500–4000 mm annually, one of the highest for Fiji. The Rewa watershed also has the highest runoff coefficient (0.6–0.9) when compared to Nadi and Ba catchments (0.4–0.6), computed from annual rainfall and annual discharge figures[13]. The very steep terrain is another contributing factor to erosion: as much as 70% of the Rewa drainage basin has slopes of >18°[14]

72. The Rewa watershed recorded the highest soil loss in comparison with the other watersheds in Fiji, namely Ba, Sigatoka and Nadi. Studies of soil within the Rewa

[12] *The Need for an Integrated Approach to Understanding and Managing Coastal Change in River Delta Areas, The Case of the Rewa River*. Ulukalesi Bale Tamata, James Comley, Lanieta Tokalauvere. Journal of Pacific Studies, Vol.2 pp 11–24. 2012.

[13] *The Study of Washed Management and Flood Control for the Four Major Viti Levu Rivers of the Republic of Fiji Islands*. Final Report. JICA. 1998.

[14] *An Assessment o fSoil Erosion in Fiji*. A Report Prepared for the Fiji National Environment Management Project. R.J. Morrison. Department of Environment. 1992.

watershed showed that the soil has a high erosive index of 1500–2000[15]. These are factors contributing to the severe soil loss and floods for which the Rewa River and delta have, historically, been renowned.

d) Freshwater Clam (Kai)

73. The freshwater clam (*Batissa violacea*) called in Fijian kai ni wai dranu, is an important food item for many families in the Rewa, Tailevu and Suva areas. It is the largest single domestic fishery in Fiji, producing approximately 1,300 metric tons annually[16]. The current value of the fishery is estimated to be around FJD$1million.
The clam provides a source of protein on a subsistence basis but it is also the basis of a substantial commercial fishery operated mainly by Fijian women.

74. According to market research by the Department of Fisheries (2011), a drop in the production of kai has been recorded over the past decade, including a significant reduction in kai sizes at the markets. Although overfishing is suspected as the major cause of this decline, extreme events such as flooding has been found to play a part in declining kai numbers in the Rewa River. Strong flows and heavy sedimentation during the flood bury or displace the kai from their original habitat. Over time as river hydrology and dynamics return to normal kai re-establish themselves in suitable habitat. The Department of Fisheries recorded a major drop in production between 1992 and 1993, which coincided with the extreme flood event during Cyclone Kina.

e) Terrestrial Vertebrates

75. Birds are the most conspicuous form of vertebrate wildlife in Fiji and Viti Levu has the largest terrestrial avifauna of any of the Fijian islands with 47 species. The importance of native forest to Fiji's terrestrial avifauna is well documented[17] and it is particularly important to the more significant endemic forms, such that the majority of them are unable to survive outside of forested habitats. None of Fiji's rarer or threatened species are expected to be resident in the disturbed, secondary habitats found at the project sites. In contrast, all of Viti Levu's rarest forest birds have been recorded and are likely to be resident in parts of the forested upper catchment of the Rewa river.

76. Fiji's only native mammals are five species of bat, three of which are found on Viti Levu. These comprise two large flying fox species and one small cave-dwelling insectivorous—none of these are endemic. No caves will be disturbed by the project works and the flying foxes are widespread on the island and will not be affected.

77. There are 32 species of terrestrial reptile or amphibian recorded in Fiji of which 40% are endemic. 25 of these have been recorded from Viti Levu but several have been lost and the majority of terrestrial forms occur at very low densities because of predation by the introduced mongoose and feral cats. As with the birds the majority of endemic forms are forest-dwelling species and would not occur in the disturbed, secondary and cleared habitats occurring at the project site.

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[15] *Country Report of Fiji*. S.T. Willat and L. Limalevu. IBSRAM Document. 1994.
[16] Richards, R. 1994. Fiji Resource Profiles. Research Co-ordination Unit, Forum Fisheries Agency & Fiji Fisheries Division, Ministry of Agriculture, Fisheries and Forest. FFA Report No. 94/4: pp 140–144.
[17] Fiji – State of Birds 2013. *A guide for conservationists, policymakers and communities*. D.Watling, NatureFiji-MareqetiViti, Suva 2013.

f) Coastal Environment

78. Oceanic activity in and around the Rewa coastal zone is characterized by predominantly south-easterly swells throughout the year, though during the period between July and December there are significant easterly swells. Tides are generally diurnal and sea surface temperatures have an annual average of between 24 and 31 degrees C. The annual mean tidal range is 1.1m with a range of neap tides of 0.9m and spring tides of 1.3m. Strong tidal currents occur three hours before and after low and high tides in coastal lagoons, such as Laucala Bay. The amount of water entering lagoons over reef areas and through passages is dependent on tidal heights.

g) Rewa Delta

79. The Rewa delta hosts the largest and most diverse area of mangrove forest in Fiji, with approximately 5,130 ha of mangrove[18] and over 1,000 ha of predominantly freshwater swamp including the largest peat swamp in Fiji, the Bonatoa Swamp (~800 ha) [19]. The Rewa river water supply sub-project intake is approximately 45 km from the mouth of the Rewa river, of which the final 9 km are associated with mangrove and freshwater wetland communities of the delta.

80. Seven obligate mangrove species are recognized throughout Fiji's mangroves, including the distinctive hybrid *Rhizophora* x *selala*. The relative distribution, associations and their stature varies greatly in different parts of Fiji, but the Rewa delta is regarded as having the most diverse and productive mangrove associations. Six distinct mangrove vegetation zones have been described in the Rewa Delta, of which the largest in area and impressive in stature is the 'basin forest' which is overwhelmingly dominated by large '**dogo**' *Bruguiera gymnorrhiza*[20]. Outside of the mangrove, most of the native wetland plant species also occur in dry land habitats, and the majority of the plant species are recent introductions[21].

81. The mangroves play an important role in supporting fish populations in both the delta proper and greater Suva area. More than 60% of the commercially important fish species in Fiji are associated with mangroves at some stage in their life cycles. In places where extensive reclamation of mangroves has taken place, there has been an associated decrease in fish production.

82. The Rewa delta environment is a relatively dynamic setting in which rapid deposition of transported sediments can lead to changes in mangrove species dynamics. There are also sites of active coastal progradation, with mangrove colonization of seaward shoals, and with replacement of mangroves to landward by freshwater vegetation types, which is clearly evident in the Rewa delta. Two on-going anthropogenic activities in the delta are having major impacts on the site's hydrology and vegetation, these are dredging with unmanaged spoil disposal in the mangrove, and the widespread construction of flood levees and roads.

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[18] Watling, R. 1986a. A mangrove management plan for Fiji. Phase 1: Zonation requirements and a plan for the mangroves of the Ba, Labasa, and Rewa Deltas. Technical report, The Mangrove Management Committee, Fiji. A joint project of the Fiji Government and the South Pacific Commission. 67pp.

[19] Ash J & W. Ash (1984) Freshwater wetland vegetation of Viti Levu, Fiji, *New Zealand Journal of Botany*, 22:3, 377-391, DOI: 10.1080/0028825X.1984.10425269.

[20] Watling *loc.cit*.

[21] Ash & Ash *loc.cit*.

2. Rewa River

83. The Rewa River is the principal river in the Rewa watershed, the largest watershed in Fiji, 2920 km^2 [22]. The river is formed by the convergence of the Wainibuka and Wainimala Rivers and fed b two other tributaries—Waidina and Waimanu. These four rivers drain the Eastern, wetter side of Viti Levu. The lower reaches of the Rewa River are influenced by tide—about a meter rise and fall at Nausori [23] As a future source of drinking water for the public, there were a number of concerns that had to be dealt with first concerning the river.

84. There are three studies that provide background relevant to the water supply subproject, particularly with regard to placement of the intake on the Rewa River. First is the study carried out in 2000 as a Masters Thesis by a student at the University of the South Pacific. Second is the Study of water quality in the Waisoi, Waidina and Rewa rivers in 1995 by Placer Exploration Limited. Third is the survey conducted in 2015 of the Rewa River by the National Water Quality Laboratory of the Water Authority of Fiji. Details of these and other studies on the Rewa may be found in Appendix A-5 Rewa River Studies.

a) Riverbed slope

85. The riverbed slope is important in estimating the eventual reach of the salt water, not only for high and low tides and seasons of high and low flow, but also for estimating the consequences of climate change—the rise in sea level, and the lower lows and higher highs of river flow.

86. The rough change in elevation from Lokia Landing, taken to be mouth of the river, but is actually 3 or 4 km upstream, to Kasavu suggests a straight-line slope angle of 0.01 percent. From Kasavu to Viria is slightly higher, but the difference is small.

87. This is a gradual slope overall, however there are changes in the bottom profile across the width, complicated by dredging and partial rock shelving.

b) Chemical Constituents

88. The sample analysis consists of an average of three separate sampling periods of water quality at the Viria planned intake site on the Rewa River.

89. Values appear typical of Ca-HCO_3 river waters and do not appear to present a problem for treatment during normal ranges of river flow. However, during periods of high flow, sediment values will be high and perhaps other values, such as coliforms.

c) Heavy Metals/Pesticides

90. Sample analysis was provided by the laboratory at the University of the South Pacific. There appear to be only trace amounts of organochlorines, low to trace amounts of organophosphorus pesticides.

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[22] *Hydrology of Rewa and a Watershed*. FAO Report to the Fiji Ministry of Primary Industries. Hasan, M.R. 1986.

[23] *Nutrient Transport via Sedimentary Process in the Rewa Catchment, Fiji*. Togamana C. MSc Thesis, University of the South Pacific. 1995.

91. Heavy metals appear in sediment, water column and mussel tissue, with metals associated with exploratory copper mining——Cd, Cu, Pb, Zn predominating.

3. Climate Change

92. Climate change and its effects on both the planned water supply system on the Rewa River as well as the upgraded wastewater treatment at Kinoya are important factors in planning for these projects. Having some idea of the likely scenarios will help in developing adaptive mechanisms.

93. There are three studies that were used in assessing climate change for the water supply and wastewater upgrade project. Details of these studies may be found in Appendix A-6, Climate Studies.

a) The First Study is the one by DBR[24]. The following information is taken directly from this report.

94. Summary of climate change threats to the Rewa River watershed, based on baseline information plus projections:

1. More frequent high intensity lower catchment flood events;
2. More frequent upper and mid-catchment flash flood events;
3. Storm surge increasing in frequency and magnitude;
4. Large scale extreme flooding (flash flooding, intensive rainfall, storm surge, king tide combined);
5. More frequent drought—saline intrusion, hydropower outages.

95. The following saline projections are based on i) existing saline intrusion, ii) existing drought impact, and iii) sea level projection of a 40cm rise by 2030:

- Saline water is projected to intrude into mid-catchment river system
- By 2030 with 0.4m sea level rise salinity intrusion will extend to Lokia
- By 2060 with 0.8m sea level rise salinity intrusion will extend to Burebasanga
- By 2100 with 1.2m sea level rise saline intrusion will extend into Waimanu

96. Coastal flooding of flat lands during storms

- By 2030 will reach Lakena
- By 2060 will reach Vareta
- By 2100 will reach Kasavu
-

b) The Second Study information is taken from Climate Change Hazard Report TA 8526 Fiji Final 160115, a consultant's report by Rosa Perez, November 2014.

97. The report has this to say about climate change projections in summary:

[24] Strengthening the Capacity of Developing Member Countries to Respond to Climate Change, Fji. National Report. DBR Pty, Ltd. TA 7394 –REG, July 2012

" … future temperature projections indicate that warming will continue with more hot days and warm nights. Temperature increase will be in the range from 1.4 to 2.6 C by 2100. Rainfall patterns are projected to decrease in dry season and to increase in wet season. The projected occurrence of extreme daily rainfall though, has a very high uncertainty due to conflicting results of different models used.[25] By the end of this century projections suggest decreasing numbers of tropical cyclones but a possible shift towards more intense categories. Sea level around Fiji has risen and will continue to rise throughout this century. In the absence of downscaled projections in the GSA, these projections at the national level may be used as indicative of what are expected at the GSA."

c) The Third Study[26] focused on location of water supply intake options on the Rewa River. Presented are results of modeling the intrusion of salt water into the Rewa River, which was a consideration in the feasibility study.

98. Previous studies of water supply schemes on the Rewa River have identified the extent of saline intrusion as a key issue that could influence intake site selection. Those studies reported that saline water (at very low concentrations) has been detected at Navuso, approximately 20km upstream of the river mouth.

99. The conclusion from this assessment and detailed modeling is that under extreme low conditions, there is still sufficient flow in the Rewa River to minimize the risk of saline water being drawn into the planned intakes between sites at 33, 29 and 26 km above the river mouth.

100. The study conclusions are given below, ver batum:

"1. The location of the proposed intake at chainage 28km is supported by the results of salinity modeling.
2. Despite the fact that bed levels in the Rewa River are below sea level, there appears little likelihood of salinity extending up to the proposed intake site for current tidal ranges.
3. The model supports an assumption made that the system is well mixed. That is, there is little indication of any strong variation in salinity with depth. This implies that there is no salt wedge effect, and hence it appears unlikely that higher concentrations of salt will occur for intake locations located close to the river bed.
4. The following factors will cause salinity concentrations to increase within the Rewa River:a lowering of the river bed through dredging; consistent periods of very low flow; a rise in sea level.
5. On the basis of some of the unsupported anecdotal evidence obtained, it is possible that the model may slightly underestimate salinity concentrations at upstream locations. However, the modeled upstream extent does support

[25] More details are found in Volume 2 of the Australian Bureau of Meteorology and CSIRO, 2011: Climate Change in the Pacific: Scientific Assessment and New Research 20 The number of days with extreme 24-hrs rainfall (defined as 200mm/day) is projected to decrease according to the Fiji Second National communications to UNFCC; while the Pacific Climate Change Program (PCCP) indicates increases in frequency. PCCP is a cooperative study effort of Australian Bureau of meteorology, Commonwealth Scientific and Industrial Research Organization (CSIRO) and Fiji Meteorological Service.

[26] Suva-Nausori Water Supply and Sewerage Project, Vol. 1 – Feasibility Study Report. TA 3055 FIJ.

evidence nominating the detection of saline water at the junction of the Waimanu River.

6. *If all factors nominated in Items 4 and 5 were to coincide, it would seem likely that salinity in the Rewa River will exceed ta threshold of 0.500ppt up to a chainage of at least 20km, and probably of the order of 23km.*
7. *Salinity concentrations vary significantly with the state of the tide. The location of the threshold concentration would appear to move up and down the river by as much as 5km in response to tidal variations. Hence, even if salinity levels exceeded the potable water threshold at the location of the intake during high tide, it is likely that water could be still extracted at other times."*

4. Sustainability in Fiji

101. Ensuring environmental sustainability is the seventh MDG, which provides a framework for integrating the principles of Sustainable Development into national policies, with the focus on ensuring availability of safe drinking water, improving sanitation, and reducing other social ills such as poverty and unemployment.

102. The Environmental Management Act (EMA) 2005 provides the legislative framework for the sustainable development of land and water resource management. However, there have been a number of constraints in implementing the EMA such as inadequate resourcing of the Department of Environment, outdated subsequent legislations and regulations, the absence of accredited laboratories, and poor coordination among agencies.

103. Achieving sustainable development, while overcoming environmental challenges such as deforestation, land degradation, logging of watersheds, over-exploitation of terrestrial and aquatic biological resources, improper waste management and pollution control, impact of climate change, and the attitude of people in terms of the unsustainable use of their resources, is a central challenge of this plan.

5. Social Dimensions

104. The Project—Principal concerns are those for upstream water quality impacts on drinking water—health aspects from both biological and chemical contaminants. Mitigate with monitoring and watershed management (longer term).

105. A small village is approximately 2km upstream with others further away that will affect the raw water quality. Routine monitoring of raw water will be required.

106. Most importantly, however, will be the existing and potential future developments in the Rewa watershed, namely, farming, mining, timber and other development. Coordination of development plans in the watershed must be carefully coordinated.

6. Human and Economic Development

a) Population.

107. National Population—The 2007 Population Census[27], indicates that Fiji's total population in 2007 was about 837,000, including 425,000 in the urban sector. Fiji's urbanization rate, driven largely by rural to urban migration, increased from about 46% in 1996 to 51% in 2007. During the 1996–2007 intercensual period the increase in population was only about 62,000 persons corresponding to an average annual growth rate of about 0.7%. In this period, the rural population decreased by about 0.1% per year, while the urban population grew at about 1.5% per year. Given the continuation of present trends, the total population of Fiji is forecast to reach the 1 million mark by 2030, with 61% urbanization. (Source: 2007 Census)

108. Greater Suva Area—The Greater Suva Area[28] (GSA) comprises Suva City, Lami, Nasinu and Nausori Towns and their adjacent peri-urban areas. The peri-urban areas are defined by the Bureau of Statistics following each census based on five main criteria, namely: (a) urban attributes (commerce, industry, administration services, and utility services); (b) economic activity; (c) population size; (d) association and continuity with the adjoining city/town centre, and; (e) population density. The term "urban" includes both the city/town areas and the peri-urban areas.The 2007 Census indicates that urban population growth in the GSA was about 1.3% p.a.[29]

109. Squatter Settlements in GSA—The 2007 Census did not record the number of squatter households, but the land tenure data collected by the census provides a guideline. Land tenure data in Table 2-2 indicate that 84% of households in the GSA have secure tenure, in the form of freehold (31%), leased state land (26%), leased TLTB land (19%), and proclaimed village land (9%). The remaining 7,724 households (16% of total households) are deemed to be mainly squatter households, with estimated population about 42,500 (based on 5.5 persons/household). The Census data also indicates that 30,200 squatters (71%) resided within city/town boundaries and a further 12,300 (29%) within the peri-urban areas in 2007.

110. The population projections show that the overall GSA population is expected to grow from 241,300 in 2007 to about 293,600 in 2020. Over the same period the squatter population is forecast to grow from about 40,500 in 2007 to 52,000 by 2020 if no informal settlement upgrading is carried out.

a) Economy

111. Fiji, endowed with forest, mineral, and fish resources, is one of the most developed and connected of the Pacific island economies. Earnings from the tourism industry, with an estimated 692,630 tourists visiting in 2014, and remittances from Fijian's working abroad are the country's largest foreign exchange earners. Fiji's sugar remains a significant industry and a major export. The sugar industry reforms since 2010

[27] Fiji Population Census 2007. Fiji Bureau of Statistics. The official results of the 2007 population census have not yet been released. The census figures quoted in this report are preliminary.
[28] This is the Greater Suva Area as defined by the Fiji Bureau of statistics.
[29] Population growth rates quoted in this report are compound average annual growth rates (AAGR) unless noted otherwise.

have improved productivity and returns, but the industry faces the complete withdrawal of European Union preferential prices by 2017. Fiji's trade imbalance continues to widen with increased imports and sluggish performance of domestic exports. The return to parliamentary democracy and successful elections in September 2014 have boosted investor confidence. Private sector investment in 2014 reached 15% of GDP, compared to 13% in 2013.

- Real GDP growth rate (2014): 4.1%
- Exports: 51.6%. Imports: 69.1%
- GDP composition: agriculture – 12.7%, industry – 18.2%, services – 69.1%
- Agriculture products: sugarcane, coconuts, cassava, rice, sweet potatoes, bananas, cattle, pigs, horses, goats, fish
- Industries: tourism, sugar, clothing, copra, gold, silver, lumber, small cottage industries

7. Occupational Health and Safety

112. There are laws, regulations and amendments pertaining to health and safety in the workplace in Fiji. Additionally, the Water Authority of Fiji (WAF) has an extensive Health and Safety Policy based on the Act (Health and Safety at Work Act of 1996), although it could probably use a little more support.

113. The Ministry of Employment, Productivity and Industrial Relations administers the Act through three principal activities:

- Training accreditation, Chemical and Hygiene
- Risk Engineering and Capital Projects
- Field Operations

114. Of particular importance for WAF during project construction are aspects of:
- Worker sanitation—safe provision and maintenance of facilities
- Worker health—assurance of health of individuals through certification
- Worker safety—provision of protective equipment and clothing
- Community health and safety—through awareness, signage and lighting

115. And during project operation:
- Worker health—assurance of health of individuals through certification
- Worker safety—provision of protective equipment, clothing and first aid training

E. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

1. Component 1: Water Supply Project: Rewa Intake, Treatment Plant and Reservoir.

116. **Proposed name of new site:** Viria. Largely rural area. The design contractor has recommended the use of draft tube intakes containing piping and pumps minimizing excavation and civil construction aspects of both the intake system and pump station. The draft tube is to be buried in the river bank and covered with rock beaching to protect pipe and against bank erosion during major flooding

1.1 Design and Pre-construction Impacts

a) Impacts on Physical Resources

117. Physical impacts in the design and pre-construction stage relate to the consideration of climate change and natural hazard impacts, impacts on topography, geology and soils impacts as well as impacts that may arise through the course of the project due to inadequate inclusion of mitigation measures in contract documents and capacity enhancement/training of contractors at the outset of the project.

118. Impacts associated with inadequate inclusion of mitigation measures in contract documents and lack of understanding of environmental issues can be addressed through proper inclusion of the EMP into tender documents and training of contractors in the requirements of the EMP, as well as ensuring the EMP is updated as necessary following the detailed design phase. Mitigation measures include:

- Obtain lease and development consent for earthworks/structures within a river/stream as specified in the Crown Lands Act and Town and Country Planning Act
- EMP and any conditions of the EIA, development consent and lease are included in EPC tender documents and mitigation measures appropriately budgeted for.
- Specify in tender documentation that the contractor shall engage appropriately qualified and experienced staff to take responsibility for the environmental management and safety issues at the working level and to monitor the effectiveness and review mitigation measures as the project proceeds.
- EPC contractor to submit construction environmental management plan (CEMP) based on contract EMP for approval by DSC (i.e., site clearance, site drainage, waste and materials management, traffic, noise and dust management etc.).

(i) Climate Change/Natural Hazard Impacts

119. The subproject areas are located within a catchment that has periodic flooding of the watercourses. The most significant climate change consideration is an increase in the frequency of extreme flood events in the future.

120. The structures will need to accommodate stronger and faster water flows, particularly for the intake structure. Proper drainage for storm runoff must be designed for the plant and access areas. Mitigation measures include:

- Design criteria in respect of peak flood size and levels to be established based on available climate change modelling data. In the absence of such data, design criteria to be demonstrably conservative.
- The proposed works will be designed in accordance with the design criteria so as to mitigate the future potential impact of climate change.
- The plant must be designed above the 100 year flood level and intake must be designed to protect against strong current
-

(ii) Topography, geology and soils

121. There are no significant earthworks that would impact on the existing topography, geology and soils of the subproject sites. The following environmental table extracted from the geotech survey presents the results of their survey.

6.3 Environmental

A desktop due-diligence study was conducted prior to the geotechnical site investigations to verify the presence of acid sulphate soil within the proposed development. The outcomes of the desktop study are detailed in the factual report and summarised below:

- There are 6 soil types present within the proposed development and are inclusive of Sawakasa, Narewa, Wainibuka, Lobau, Nasou, and Sote.
- 80% of the pipeline layout environment has agricultural pristine on it and therefore possibility of the presence of acid sulphate is minimal to none.

Table 6-2: Environmental Assessment Summary

Site	Soil Type	Limitations	Acid Sulphate threat
River intake and Water treatment plant site	Lobau	Slope, acid, very severe erosion risk and nutrient deficient	None - provided that the climatic conditions on the area is maintained and there is no salt water intrusion in the river.
Reservoir	Lobau and Sote	Sloping, erosion, acid and nutrient deficient	None – provided vegetation is maintained and careful and selective cutting of trees is considered prior to any works
Populated area 1 (BH8 to BH11)	Lobau and Wainibuka	Clayey, slow subsoil permeability and rarely flooding	Risk of contaminating soil with petroleum and hydrocarbons from industrial developments. However, may not pose a direct impact on the pipeline. Location of sediment ponds should be confirmed in relation to the proposed pipeline alignment.
Populated area 2 (BH2 to BH5)	Wainibuka, Sawakasa, and Narewa	Clayey, slow subsoil permeability and flooding, gilgai nutrient deficiency	Low – as present soil does not have acidic characteristics and the surrounding land use

Based on our desktop study, we do not consider that there will be any adverse impact on the structures founded on or within the existing ground. However, prior to construction works detail environmental investigation within the proposed development is recommended.

122. Mitigation measure includes:

- Prior to construction works detail environmental investigation within the proposed development is recommended
-

i) Scour/erosion

123. Structures within a watercourse have the potential to cause scour/erosion by altering the current flows. This is particularly the case around the intake which slows the current flow on the upstream side and accelerate it on the downstream side (causing scour). The Rewa River where the subproject is located has a low to medium but steady flow and medium current speeds when not in flood and so the expected impacts of the structure during these periods is considered to be minimal. During flood conditions, the current speeds increase and correspondingly the scour potential. However, mitigation measures are proposed as follows:

- Maximize the design for bank stabilization of the Rewa on both sides of the intake

- Design structures to allow appropriate overtopping in flood

a) Impacts on Ecological Resources

124. The main ecological impacts that would arise from the design and pre-construction phase relate to designs that would require significant vegetation clearance, such as new road alignments through unmodified areas and treatment plant access roads. The terrestrial ecology in the vicinity of the subproject is somewhat modified already through introduced, and often invasive, flora (such as the African Tulip Tree) and fauna (such as mongoose) as well as the agricultural crops and existing road and scattered houses. Although there is no specific information or studies of the ecology of the site, there were not any species or habitats of significance (i.e. critical or natural) observed during field inspection that may be impacted. There are no recorded protected sites in the project area.

125. The first 4km of the proposed pipeline route runs along Viria Road, which is the only access road to Viria Village and several properties/farms. It is also a bus route. Viria Road is a single lane road and in some sections has steep slopes on either side. The pipeline will need to be installed in the centreline of the road to minimise the risk of slope failure during and after construction. The installation of the pipeline would likely require closure of Viria Road, due to the size of equipment and extent of trenching required.

126. A temporary road of 3.8 km in length and 8-10 m wide is one option being considered as an alterantive for traffic during the construction period of approximately 1 month. Construction of temporary passing points, and covering the open trench with road plates to enable traffic to pass at regular intervals are some other possible options.

127. The temporary road passes through the properties of four farmers, and much of it is on existing tracks. Elsewhere, new sections of track will need to be prepared. These will pass through grazing land, and cleared land reverting to secondary bush and woodland. These habitats are of no conservation significance

128. Impacts include land disturbance and inconvenience to the landowners/farmers, while the track may not be passable to all vehicles in bad weather. Rehabilitation of the track to the satisfaction of the property owners will be required after its use.

129. Preliminary examination of the planned intake site and literature on the Rewa River would suggest that no particular aquatic organisms would be harmed. Mitigating measures incorporated into the design include the use of proprietary Johnson screens (or equivalent) are proposed which should minimise impact on aquatic life around the intake, and a maximum intake velocity of 0.15m/s to protect against fish and other aquatic organism intake have been adopted.

130. Adjust alignment of access roads to minimize need for removing large trees. Minimize the width of the vegetation clearance corridor for the temporary road if the road is implemented.

131. Mark the boundary of vegetation clearance corridors with high visibility tape to ensure construction workers are aware of clearance boundaries.

b) Impacts on Socio-economic Resources

(i) Loss of high value land through land acquisition.

132. There is potential for the loss of valuable agricultural land through construction of the intake, treatment plant and reservoir works if good land is taken and unproductive land is returned post-works. The requirement for land, especially land that is considered high value due to the economic returns it offers the landowner, can have an impact on the economic prosperity of locals. However, if only small parcels of land are required, the impacts will be minor.

133. The impacts of land acquisition can be mitigated as follows:

- Design temporary road (if necessary) and access road realignments to take into account the value of land and to minimize the area required.
- No physical displacement of people, either on an individual household basis or through the acquisition of public properties such as schools, churches or other community centers should occur.
- Stockpiles and construction camps to be located on lower value land or public land.
- Loss of land is to be compensated through measures outlined in project resettlement plan (RP).

1.2. Construction Impacts

a) Impacts on Physical Resources

i) Climate change and greenhouse gas emissions.

134. There will be greenhouse gas emissions from construction vehicles, although this will be temporary and is not expected to be a significant contributor to overall greenhouse gases.

135. Fiji has emission and air quality standards which are provided in Schedule 5 (Part B), Part 4 of the Environmental Management Regulations 2007. This regulation indicates that “a point source of an air polluting substance should not, in isolation or combination with any other source of that substance, cause a concentration of that substance in the ambient air to exceed the emission standards set out.”

136. Since the impact on air quality is likely to be minimal and associated with construction stage only and machinery will be maintained and serviced regularly to minimize emissions, the standards are not expected to be exceeded. To mitigate any undue emissions, all construction vehicles will be required to successfully pass an LTA Certificate of Roadworthiness.

ii) Water quality

137. There is potential for an increased suspended sediment load in the Rewa River during construction from runoff from surrounding earthworks. There is also the potential for oils and hydrocarbons from machinery to impact on water quality during construction. Significant sediment loads or contaminants from spills, for example, could be carried downstream to eventually discharge into the Rewa River. The main potential sources of discharge are any excavation works on slopes above the watercourse, fill works, spills of hydrocarbons, sediment disturbance during piling and from runoff from spoil disposal or stockpile areas.

138. It is noted that potential impacts on water quality are temporary and relate to the construction phase only. These impacts are expected to be no more significant than the periodic flood conditions, when the level of suspended sediment in rivers naturally increases.

139. Earthworks as part of the subproject will have roughly equal cut to fill and so it is not expected that there will be excess materials or spoil to dispose of following construction works. Earthworks are also not significant and therefore it is not considered necessary to have a spoil management plan. Water quality impacts of the proposed works can be mitigated as follows:

- Schedule excavation activities in the drier months (Jun - Oct)
- Minimize the width of vegetation clearance corridor for any access and/or temporary roadway that is implemented
- Immediately re-vegetate and/or stabilize exposed surfaces and stockpiles of excavated material
- Implement effective construction site drainage such that runoff is directed to sediment traps before discharge to water course
- Locate stockpiles away from watercourses
- Install cut-off drains above excavated areas on steep slopes to reduce erosion
- Works in and around river to ensure there is no blockage of the waterway at anytime
- Minimize any machinery movements within the Rewa River
- No machinery refueling to occur within 20 m of watercourses
- Install river bank protection measures (gabion baskets etc.) at the intake structure
- As far as possible ensure cut to fill balance.

- Effective construction supervision to ensure the above measures are implemented.

iii) Riverbed extraction.

140. The construction materials for the water treatment plant will be small quantities required for concrete aggregates. Materials are likely to be sourced from the Rewa River which can accommodate small takes much better than smaller tributaries. Gravel quarries may also be utilized.

141. The river has been used for a long time as the source of road aggregate. We are aware, through consultation with DOE, that there are a number of unauthorized gravel extraction activities occurring in Fiji rivers. There is no information on what has been extracted or what is a sustainable extraction rate or the impacts of extraction.

142. In the absence of a suitable alternative for construction materials the extraction of river gravels will need to minimize the potential for any adverse effects. In this respect, existing gravel supplies will be used where possible to minimize the requirement for extraction.

143. If riverbed extraction is required the contractor will be required to prepare an aggregate extraction plan and ensure that a gravel extraction permit is obtained, issued by the Ministry of Lands and Mineral Resources either to a supplier or directly to the contractor for the extraction of materials. The gravel extraction plan should be incorporated as part of a CEMP to be developed by the contractor prior to works and that will be based on the EIA and EMP and the existing COEP. The CEMP must be approved by both WAF (Environment Department) and DOE. Extraction will not commence until Ministry of Lands and Mineral Resources has issued the permit. The following mitigation measures are proposed:

- Investigate viable alternatives to river gravel
- Prepare a gravel extraction plan, including determining volumes required and incorporate as part of a wider construction EMP (CEMP).
- Riverbed gravel extraction permit obtained if required.
- No gravel extraction from the active river channel.
- Extraction spread out over a number of different extraction locations.

iv) Waste storage and disposal.

144. During construction waste will be generated by construction workers (general and sanitary waste, packaging and containers—plastic and metal).

145. The impacts of waste storage and disposal will be mitigated as follows:

- Prepare and implement a Waste Management Plan (WMP) as part of CEMP before construction to cover all aspects of waste storage disposal and accidental spills. The WMP is to be approved in writing by both the DOE and the WAF Environmental Manager one month prior to starting works. Contractor to implement the WMP provisions.
- Segregation of wastes shall be observed.

- Facilities for washing and toilets shall be provided on site and routinely maintained
- Recyclables shall be recovered and either reused in or sold to recyclers.
- Residual wastes shall be disposed of in disposal sites approved by local authorities and not located within 500m of the river.
- Construction offices and facilities shall be provided with garbage bins
- Burning of construction and domestic wastes shall be prohibited.
- Disposal of solid wastes into drainage ditches and public areas shall be prohibited.
- All general solid waste will be collected and removed from the work areas and disposed in local waste disposal sites as identified by the waste management plan.

v) Hazardous substances.

146. The use and storage of hazardous substances during construction can impact on physical soil and water resources if they accidentally spill or leak into the environment and if hazardous materials are not properly disposed.

147. Hazardous substances that will be stored as part of the construction of the subprojects will be machinery fuels and oil. Hazardous waste in the form of used batteries, fuel drums and oily wastes may require disposal as part of the construction works. To mitigate the impacts of hazardous substance use the contractor will be required to implement the following:

- Hydrocarbons and toxic material will be stored in adequately protected sites consistent with international best practices to prevent soil and water contamination.
- All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities to combat emergency situations.
- Segregate hazardous wastes (oily wastes, used batteries, fuel drums) and ensure that storage, transport and disposal shall not cause pollution and shall be undertaken consistent with international best practice.
- Ensure all storage containers are in good condition with proper labeling.
- Regularly check containers for leakage and undertake necessary repair or replacement.
- Store hazardous materials above possible flood level (although it is noted construction works are to occur during dry season when floods are less likely).
- Discharge of oil contaminated water shall be prohibited.
- Used oil and other toxic and hazardous materials shall be disposed of off-site at a facility authorized by permit.
- Ensure availability of spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored.
- Spillage, if any, will be immediately cleared with utmost caution to leave no traces.
- No refueling of vehicles within 20m of a watercourse.

b) Impacts on Ecosystem Resources

i) Aquatic ecology.

148. The construction of new structures has the potential to impact on aquatic ecology through decreased water quality, disturbance to river bed sediments and vibration from piling. Although there is information on the aquatic ecology in the vicinity of the proposed works, it is likely to have no species of significance (e.g. native, endangered or rare) or critical or natural habitats that may be impacted by the subproject. Consultation with local village people has confirmed that the types of fish species caught are representative of a modified environment (i.e. introduced fish species such as Tilapia).
Water quality impacts and appropriate mitigation measures has been discussed under physical resources above. It is considered that with mitigation in the form of erosion and sediment runoff control, appropriate hazardous substances storage and disposal, minimization of vegetation clearance, and refueling of machinery at least 20m from the Rewa River, the water quality will not be significantly degraded and aquatic ecology impacts minor.

149. Piling causes vibration which may impact on aquatic species that cannot move away from the noise source. Species that inhabit the riverbed sediments are also directly affected from piling. However, the intake structure will only require a small number of piles and there are no records of any critical or natural species or habitats that would be at risk.

ii) Terrestrial ecology.

150. Terrestrial ecology may be impacted during construction through noise, dust and vibration. During construction noise and vibration may impact on fauna but will be limited to those species that can't move away from the disturbance. Given the works will be temporary, there are not likely to be any endangered or rare species, and most species will be able to move away from the source of the disturbance, it is not considered that there will be significant adverse impacts on fauna. However, to limit the impacts the following will be undertaken:

- Construction machinery will be maintained to a good standard and shall be equipped with muffler silencers. Machinery must be tested and operating sound must not exceed 85 db.
- All construction vehicles must pass LTA inspection and show results (Certificate of Roadworthiness).
- Limit the use of machinery that causes vibrational impacts as far as practicable.

151. Dust from construction vehicles and exposed soil can impact on adjacent vegetation health and function. The dust will not be chemically active (such as highly alkaline limestone a highly acidic dust) and so impacts are limited to physical impacts such as leaf surface abrasion or blocking of the plants' stomata and a reduction in photosynthetic abilities. However, the subproject is in an area where dust is already occurring from road surfaces (Viria road) as it is currently unsealed and the volume of construction traffic is not expected to significantly increase the dust loading vegetation currently receives. Should the temporary road (3.8 km x 10-12m) be used, there will be dust on the farm, but only for the short term. Dust impacts on vegetation will therefore

be minor. Should dust be a problem in the judgment of the WAF Environmental Director, roadways will be sprayed with water or used oil.

c) Impacts on Socio-economic Resources

i) Construction camp, site offices and works yards/compounds.

152. A construction camp will not be required as the workforce is small to medium in size, depending upon the phase of the project and can be accommodated for the short period of the works in existing lodgings. There will be the need to identify and use (temporary basis) work sites and/or compound for storage of materials and equipment. The presence of camps, site offices and works yards/compounds within a rural community such as the subproject can cause an adverse impact through the increased disturbance, noise and waste generated by camps and work sites, especially if the sites are located close to village areas and houses. The temporary sites/compounds can also be the cause of conflict, especially if many workers are brought in from outside of the local area. The impacts can be mitigated by:

- Locating the site office, facilities and storage site/compound in an area agreed with the local community in association with the Turaga-ni-Koro (elected administrative head of each village) and having the facilities approved by WAF's environment manager/DSC. The sites should be in accordance with the protocols established in the CPP and GRM.
- Providing potable water, clean water for showers, hygienic sanitation facilities/toilets with sufficient water supply, worker canteen/rest area and first aid facilities onsite.
- Separate toilets shall be provided for male and female workers.
- Hiring and training as many local workers as possible for construction.
- Installing adequate toilet facilities and prohibiting open defecation. The use of toilets will be encouraged by keeping toilet facilities clean at all times.
- 30 All waste materials shall be removed and disposed to disposal sites approved by local authorities.
- At the completion of the works contractor's facilities area, sites and storage compound area shall be rehabilitated to the satisfaction of the land owner, and the area cleaned up to the satisfaction of WAF's environment manager/ Turaga-ni-Koro after use.

ii) Worker health and safety

153. A number of activities, plants and products can give rise to health and safety impacts for workers during the construction phase. Most of these impacts can be managed and/or mitigated. The potential impacts are (i) contamination of local water supplies by potential contaminants such as sediments, fuel products and lubricants (ii) air pollution from exhaust fumes and dust giving rise to respiratory conditions; (iii) risk of accidents at work sites; and (iv) spread of communicable diseases.

154. To avoid these impacts contractors will observe general health and safety requirements and as a minimum must be compliant with the Labour Act of 1978 and the Safety at Work Act of 1996.

155. The contractor will provide personal protective equipment (PPE) to construction workers suitable for civil work such as safety boots, helmets, gloves, high visibility vests, protective clothes, goggles, and ear protection at no cost to the workers. The contractor will also prepare a health and safety plan (HSP) instructing workers in health and safety matters. This plan is to be approved in writing by WAF's environment manager/DSC one month prior to starting works. All workers will receive training from the contractor on the HSP as well as general environmental, safety and environmental hygiene. Mitigation measures are proposed as follows:

- Contractor to prepare a Health and Safety Plan (HSP) instructing workers in health and safety matters. The HSP is to be approved in writing by WAF's environment manager/DSC one month prior to starting works. Contractor to implement HSP provisions.
- Before construction commences the contractor will conduct training for all workers on environment, safety and hygiene. The contractor will instruct workers in health and safety matters as required by good engineering practice and provide first aid facilities.
- Workers shall be provided (before they start work) with appropriate PPE suitable for civil work such as safety boots, helmets, gloves, protective clothes, goggles, and ear protection at no cost to the workers. Site agents/foremen will follow up to see that the safety equipment is used and not sold on.
- Fencing shall be installed on all areas of excavation greater than 1m deep and at sides of temporary works.
- Provision of potable water supply in all work locations.

iii) Community health and safety

156. Construction will involve a number of truck movements within and around the subprojects sites, including large equipment transporters and general construction traffic (workers transport, etc.). Most construction traffic will utilize existing roads and crossings as haulage routes. The increase in vehicle movements has the potential to place people using the area at risk, particularly children. This risk can be avoided by ensuring specific measures are undertaken to protect the users including using traffic control such as stop/go men to control and regulate the movement of people through construction areas and timing the works to avoid the periods when people are most frequently using the crossing, such as the start and finish of the work/school day.

157. The presence of a construction crew at the location for extended periods can increase the risk of spread of communicable diseases, including HIV, to the local community. Mitigation measures are proposed including the following:
Provide a temporary access across the watercourse to facilitate safe access during construction.

- Timing of large scale construction works to occur outside of frequent use, such as the start and finish of the work/school day.
- Include in HSP the use of barriers (e.g., temporary fence). These shall be installed at construction areas to deter pedestrian access except at designated crossing points.
- The general public/local residents shall not be allowed in high-risk areas
- Provide warning signs at periphery of site warning public not to enter

- Traffic control measures during construction shall be provided and included in the CEMP. Traffic control shall include the use of stop/go men/women and strict imposition of speed limits through the site.
- Implementation of communicable diseases (incl. STIs and HIV) awareness and prevention measures.

iv) Noise

158. The construction activities can lead to an increase in noise levels for users of the road or nearby residences. The nearest house is adjacent to the planned treatment plant, next to the temporary access road and the nearest school is approximately 1 ½ km from the planned treatment plant.. The potential adverse impact of noise during construction can be mitigated as follows:

- Construction equipment and vehicles will be maintained to a good standard and shall be provided with muffler silencers. As before, Certification of Roadworthiness is required as well as the limit of 85 db on noise emission is required and will be monitored by WAF's environmental manager/DSC.
- No construction works between the hours of 1900 and 0700 every day.
- Monitor and investigate complaints; propose alternative mitigation measures.

v) Dust

159. Dust from the movement of construction vehicles can cause a nuisance for neighboring property owners in regards to residences and crops. Dust is likely to already be a nuisance to road users and residents of Viria Road in the vicinity of the proposed works as the road is currently unsealed. The potential for additional dust generation during construction (from machinery movements and earthworks) can be mitigated by:

- Using of a water cart in dry conditions.
- Limiting the area of soils exposed through earthworks that may be the source of dust.

vi) Disruption to existing road users

160. During construction works existing structures may have to be closed off to the public. This could cause a disruption to road users and may impact on the livelihood of those that depend on the road for access to work, school, markets, etc. However, disruption to road users will be avoided through the provision of alternative access during construction (by constructing a temporary structure alongside the structure being replaced) and traffic management in accordance with a construction environment management plan developed for the works.

161. Construction works in the area have the potential to impact on the normal lives of locals but this can also be minimized by arranging public consultation prior to construction works commencing to advise affected communities of the scope and scheduling of the subproject and to raise awareness within the communities of the likely phasing of events that will occur within their boundaries.

162. The disruption to users of the road will be minor provided the following mitigation measures are undertaken:

- Provide an alternative through the use of temporary structures (see the planned temporary access road described above).
- Communication to the public through public consultation and notice boards regarding the scope and schedule of construction as well as certain construction activities causing disruptions and access restrictions.

vii) Sites of significance

163. Construction works can cause an impact on sites of significance such as cultural or historic sites, particularly where earthworks are required. Although the Museum of Fiji has no records of sites of cultural or historic significance within the area where earthworks and vegetation clearance is to occur for the construction of the Rewa River intake and water treatment plant, it is possible that unidentified sites may be uncovered during construction.

164. To avoid impacts on sites of significance, a discovery protocol is to be put in place and contractors educated on its use. The discovery protocol will direct what actions are to be taken in the event of uncovering a site of potential significance. This will avoid any impact on the site and provide information on appropriate measures to be taken to preserve the site. The protocol will be worked out by the Safeguards Specialist for the PMU and implemented by the Construction Contractor.

1.3. Operation Impacts

a) Impacts on Physical Resources

i) Greenhouse gas emissions

165. Once constructed, the subprojects will not significantly increase vehicle emissions that contribute to greenhouse gases. Vehicular traffic may increase slightly in the short term with WAF vehicles coming and going and in the longer term with an increase in Viria area residents due to provision of piped water.

ii) Water quality

166. Ongoing (post construction) impacts on water quality will have the potential for a negative addition to the quality of the Rewa River, due to the planned release of supernatant from the process sludge lagoons to the river. The risk is the release of untreated micro-organisms and chemicals from the water treatment process. This impact can be mitigated by characterizing the waste water, proposing a treatment scheme designed to release the supernatant at an acceptable level and obtaining a discharge permit from the Department of Environment.

iii) Water quantity

167. The withdrawal of water from the Rewa River leaves less for use downstream users, the mangroves of the Rewa delta and aquatic biodiversity. However, less than 1 km downstream of the intake is the confluence of the Waidina river and further downstream the Waimanu river joins the Rewa. Together these rivers contribute approximately 30% of the flow reaching the Rewa delta .

168. Hydraulic modeling of the impact of the Viria intake during low flows at the site show:

- For the 20 year ARI drought with a flow of 8.0 m^3/s, the withdrawal of 40 ML/d would take out 5.8 percent of the flow and 80 ML/d would take out 11.6 percent.
- For the 1 day duration annual low flow of 50 m^3/s, the withdrawal of 40 ML/d would take out 0.92 percent of the flow and 80 ML/d would take out 1.82 percent

b) Impacts on Ecological Resources

169. Impacts on terrestrial flora and fauna are generally expected to be minor, however, with restoration of some cleared areas, landscaping around the treatment plant, pumping station and storage reservoir, restoration of any disposal areas and other vegetative recovery strategies may serve to provide new small habitats for fauna.

170. Impacts to aquatic fauna due to operation of the intake are expected to be minimal as proprietary Johnson Screens (or equivalent) are proposed which should minimise impact on aquatic life around the intake. In addition, a maximum intake velocity of 0.15m/s is proposed to protect against fish intake[30].

c) Impacts on Socio-economic Resources

i) Community health and safety

171. Upon completion the water treatment plant will be a significant benefit to local residents around the plant and to thousands of other households in the GSA providing access to safe drinking water.

ii) Noise

172. Noise from vehicles operating the water treatment plant and later on, additional residents in the area will contribute slightly to the noise factor, but the contribution is negligible.

iii) Dust

173. Additional traffic, small in scale, as discussed above, will slightly raise more dust, but mainly concentrated along the roadside.

iv) Disruption to users

174. There are no known withdrawals for commercial irrigation, however there is a **kai** (freshwater mussel) fishery downstream in the Rewa and fishing occurs in the lower Rewa and Laucala Bay. Minimum flow withdrawals (refer para 164 above) are not great, and are more than replaced by Waidina and Waimanu flows. During minimum flows it is considered that extraction at the Viria WTP will not produce additional stress on downstream fishing or aquatic ecology.

[30] MWH 2015 *Rewa Water Supply Scheme – Preliminary Design Report.* Suva

2. Component 2: Water Supply Project: Pipeline from water treatment plant to connection with present system at Nausori Bridge

NOTE: system mains are designed for eventually handling 80 ML/d, i.e. pipe i.d. 900mm.

Distance from treatment plant to Waitolu Reservoir: 8.6km
Distance from Waitolu Reservoir to Raralevu Reservoir line connection: 17.8km

Total distance: 26.4km. Largely rural areas.

175. Construction Activities include:

- Trenching and laying of pipeline along approach road for approximately 5 km from reservoir at treatment plant to Sawani-Serea Road at bridge across Waidina River (Option 1 suspend pipe over river; Option 2 attach pipe to bridge; Option 3 horizontal drilling or trenchless pipelaying under the Waidina River). Option 1 is currently favored.
- Trenching and laying of pipeline along Sewani-Serea Road and across Waimanu River (Same 3 Options, same favorite). Note: this segment would include construction of Waitolu Reservoir at elevation 132m involving an access road and removal of trees and vegetation in a roughly 40m x 40m area.
- Trenching and laying of pipeline along Princess Road to Raralevu line connection at Nausori Bridge on the Rewa River.
- Planned position of pipeline for Viria road is along the centerline and for the rest of the route, along the edge of the sealed roadway (berm 2 – 5 m wide and trench for 900mm pipe is 1.5 m wide), i.e., along the road right-of-way.
- Impacts largely concern sediment control from trenching and the crossing of 7 rivers:
  1. Waidina – pipeline supported by pile systems with pipe bridge and walkway for maintenance
  2. Waimanu – pipeline supported by pile systems with pipe bridge and walkway for maintenance
  3. Savu bridge – ch 6,200. 5 m span support on either side with piles or concrete supports
  4. Waidrauso bridge – ch 9,350. 16.8 m span supported on either side with piles or concrete supports
  5. Vuniniudrovu bridge – ch 13,900. 25 m span supported by a pipe bridge with one or more intermediate supports
  6. Sarava bridge – ch 15,200. 28.5 m span supported by a pipe bridge with one or more intermediate supports
  7. Waila bridge – 17,700. 18.75 m span supported with piles or concrete supports on either side

2.1 Design and Pre-construction impacts

a) Impacts on Rewa River Flows

176. The Rewa river water intake at Viria will draw water from a sub-catchment of 2012 km^2, while the entire Rewa river catchment is approximately 30% greater at 3,092 km^2, as such there is a significant proportion of the catchment flow to

downstream users and the mangroves of the Rewa delta which is unaffected by the project. Hydraulic modelling estimates are that the extraction (at stage 2 maximum capacity of 80 ML/d) will withdraw less than 2% of the annual average low flow of 50 m^3/s. This would increase to 11.6% in a 20 year ARI drought flow of 8.0m^3/s.

b) Impacts on Physical Resources

177. Physical impacts in the design and pre-construction stage relate to the consideration of climate change and natural hazard impacts, impacts on topography, geology and soils impacts as well as impacts that may arise through the course of the project due to inadequate inclusion of mitigation measures in contract documents and capacity enhancement/training of contractors at the outset of the project.

178. Impacts associated with inadequate inclusion of mitigation measures in contract documents and lack of understanding of environmental issues can be addressed through proper inclusion of the EMP into tender documents and training of contractors in the requirements of the EMP, as well as ensuring the EMP is updated as necessary following the detailed design phase.

179. Mitigation measures include:

- Obtain lease and development consent for earthworks/structures within a river/stream as specified in the Crown Lands Act and Town and Country Planning Act
- EMP and any conditions of the EIA, development consent and lease are included in EPC tender documents and mitigation measures appropriately budgeted for.
- Specify in tender documentation that the contractor shall engage appropriately qualified and experienced staff to take responsibility for the environmental management and safety issues at the working level and to monitor the effectiveness and review mitigation measures as the project proceeds.
- EPC contractor to submit construction environmental management plan (CEMP) based on contract EMP for approval by DSC (i.e., site clearance, site drainage, waste and materials management, traffic, noise and dust management etc.).

i) Climate Change/Natural Hazard Impacts.

180. The subproject areas are located within a catchment that has periodic flooding of the watercourses. Indeed, the condition of the two major rivers crossed can be significant during severe flood events. One of the significant climate change considerations is an increase in the frequency of extreme flood events in the future. Another is seismic activity. Numerous fault lines exist in Viti Levu.

181. The structures will need to accommodate stronger and faster water flows when crossing the rivers and creeks, which could be achieved by increasing the height of the water crossings to accommodate increased flood discharges and by having a single section of pipe that will allow for debris movement during flood (and minimize blockage risk).

182. Mitigation measures include:

- Design criteria in respect of peak flood size and levels to be established based on available climate change modeling data. In the absence of such data, design criteria to be demonstrably conservative.
- The proposed works will be designed in accordance with the design criteria so as to mitigate the future potential impact of climate change.
- Design criteria for entire pipeline should include evaluation of proximate fault lines

- For seismicity the proposed site alignment is designed for 1/500 year EQ event (magnitude 7.5). Adopting 50% of max peak ground acceleration (0.31) as 0.16g—some deformation may be accepted for some structures.
- Screening of soil was conducted and low risk of liquefaction, but should be confirmed in final design.

183. The geotechnical study, "Geotechnical Design Recommendations" found no major geotechnical issues that would require WAF to reconsider the proposed pipeline route.

ii) Scour/erosion

184. Structures within a watercourse have the potential to cause scour/erosion by altering the current flows. This is particularly the case around piers and piles which slow the current flow on the upstream side and accelerate it on the downstream side (causing scour). The creeks where the subproject is located have a low flow and slow current speeds when not in flood and so the expected impacts of the structures during these periods is considered to be minimal. During flood conditions, the current speeds increase and correspondingly the scour potential. However, mitigation measures are proposed as follows:

- Minimize the number of piles in bridge design
- Design structures to allow continued flow of water through or appropriate overtopping in flood.

185. For river bank stability of the Waidina and Waimanu, there appear to be no serious land slide hazard on the banks, but the possibility of erosion/scouring over steep areas of the banks. To mitigate this:

- Design bank reinforcement at crossing point with gabions and other techniques
- Slope stability of the Rewa intake site, further detailed advise from a hydrological consultant would be required with respect to scouring depth and rate, inundation and rapid fluctuation of groundwater and surface water runoff, so that with treatment the slope instability risk can be reduced from moderate to low

b) Impacts on Ecological Resources

186. The main ecological impacts that would arise from the design and pre-construction phase relate to designs that would require significant vegetation clearance, such as new pipe alignments through unmodified areas. The terrestrial ecology in the vicinity of the subproject is rural at most points, but modified at others through introduced, and often invasive, flora (such as the African Tulip Tree) and fauna (such as mongoose) as well as the agricultural crops and existing road, crossings and villages.

Although there is no specific information or studies of the ecology of the sites, there were not any species or habitats of significance (i.e. critical or natural) observed during field inspection that may be impacted. There are no recorded protected sites in the project area.

- Adjust alignment of access road to Waitolu to minimize need for removing large trees.
- Minimize the width of the vegetation clearance corridor for the access road to Waitolu reservoir and bridge and culvert crossings.
- Mark the boundary of vegetation clearance corridors with high visibility tape to ensure construction workers are aware of clearance boundaries.
- Ensure that pipe support structures are not designed for placement in watercourses with special aquatic species habitat through consultation with local residents and fisheries specialists

c) Impacts on Socio-economic Resources

i) Loss of high value land through land acquisition

187. There is potential for the loss of valuable agricultural land through realignment of roads if good land is taken and unproductive land is returned post-works. The requirement for land, especially land that is considered high value due to the economic returns it offers the landowner, can have an impact on the economic prosperity of locals. However, if only small parcels of land are required, the impacts will be minor.
Most of the pipeline route is roadside with no land acquisition involved, however for the Waitolu reservoir and attendant access road land will need to be purchased, albeit small parcel. The planned area for Waitolu is 40m x 40m.

188. The impacts of land acquisition can be mitigated as follows:

- Design road realignments to take into account the value of land and to minimize the area required.
- No physical displacement of people, either on an individual household basis or through the acquisition of public properties such as schools, churches or other community centers should occur.
- Stockpiles and construction camps to be located on lower value land or public land.
- Loss of land is to be compensated through measures outlined in LARP.

3. Construction Impacts

189. **Note**: the following methodology will be used:
- Stream crossing outside wet season
- Construction of the temporary road first, then Viria road pipeline
- Traffic management
- FEA coordination regarding upgrades
- Open trenching
- Ground material mostly fill/topsoil, residual clay, alluvial silty clay, sand and gravel with limited areas where bedrock may be encountered)

a) Impacts on Physical Resources

i) Climate change and greenhouse gas emissions

190. There will be greenhouse gas emissions from construction vehicles, although this will be temporary and is not expected to be a significant contributor to overall greenhouse gases. Lesser emissions will emit from portable pumps and generators.

191. Fiji has emission and air quality standards which are provided in Schedule 5 (Part B), Part 4 of the Environmental Management Regulations 2007. This regulation indicates that "a point source of an air polluting substance should not, in isolation or combination with any other source of that substance, cause a concentration of that substance in the ambient air to exceed the emission standards set out."

192. Since the impact on air quality is likely to be minimal and associated with construction stage only and machinery will be maintained and serviced regularly to minimize emissions, the standards are not expected to be exceeded.

ii) Water quality

193. There is potential for an increased suspended sediment load in the watercourses during construction works that are within the bed of the creek and river or from runoff from surrounding earthworks. There is also the potential for oils and hydrocarbons from machinery to impact on water quality during construction.

194. Significant sediment loads or contaminants from spills, for example, could be carried downstream to eventually discharge into the Rewa River via gullies, creeks and smaller rivers. The main potential sources of discharge are any excavation works on slopes above the watercourse, fill works and machinery movements within a stream bed, spills of hydrocarbons adjacent to watercourses, sediment disturbance during piling and from runoff from spoil disposal or stockpile areas.

195. It is noted that potential impacts on water quality are temporary and relate to the construction phase only. These impacts are expected to be no more significant than the periodic flood conditions, when the level of suspended sediment in rivers naturally increases.

196. In excavation, a "digging bucket" fitted to an hydraulic excavator with ripping type assistance may be used, along with an hydraulic rock hammers for bedrock in pipe trenching may also be used.

197. Earthworks as part of the subprojects will have roughly equal cut to fill and so it is not expected that there will be excess materials or spoil to dispose of following construction works. Earthworks are also not significant and therefore it is not considered necessary to have a spoil management plan. Water quality impacts proposed works can be mitigated as follows:

- Schedule excavation activities in the drier months (Jun–Oct)
- Minimize the width of vegetation clearance corridor for the pipeline, where necessary

- Immediately re-vegetate and/or stabilize exposed surfaces and stockpiles of excavated material
- Implement effective construction site drainage such that runoff is directed to sediment traps before discharge to water course
- For the hydraulic machinery a sediment management plan will be implemented
- To prevent sheet or gulley erosion, permanent flat batters (< 1V in 2H) to prevent erosion required along with vegetation
- Pumping of groundwater and rainwater at trench sites to be monitored and controlled
- Groundwater to be controlled also by retaining walls to be designed to be fully drained and induce complete and permanent drainage of the ground behind the walls
- Locate stockpiles away from watercourses
- Install cut-off drains above excavated areas on steep slopes to reduce erosion
- Works in and around river to ensure there is no blockage of the waterway at anytime
- Minimize any machinery movements within creek beds
- No machinery refueling to occur within 20 m of watercourses
- Install river bank protection measures (gabion baskets etc.) at piling and concrete abutments
- As far as possible ensure cut to fill balance.
- Effective construction supervision to ensure the above measures are implemented.

iii) Riverbed extraction

198. The construction materials for the upgrading of crossings will be small quantities required for concrete aggregates. Mostly concrete would be used on the pipeline for the foundation for Waitolu reservoir (and perhaps the reservoir itself) and concrete support structures for pipes crossing waterways.

199. The river has been used for a long time as the source of road aggregate. We are aware, through consultation with DOE, that there may be a number of unauthorized gravel extraction activities occurring in the Rewa River. There is no information on what has been extracted or what is a sustainable extraction rate or the impacts of extraction.

200. In the absence of a suitable alternative for construction materials the extraction of river gravels will need to minimize the potential for any adverse effects. In this respect, existing gravel supplies will be used where possible to minimize the requirement for extraction.

201. If riverbed extraction is required the contractor will be required to prepare an aggregate extraction plan and ensure that a gravel extraction permit is obtained, issued by the Ministry of Lands and Mineral Resources either to a supplier or directly to the contractor for the extraction of materials. The gravel extraction plan should be incorporated as part of a CEMP to be developed by the contractor prior to works and that will be based on the IEE and EMP and the existing COEP. Extraction will not

commence until Ministry of Lands and Mineral Resources has issued the permit. The following mitigation measures are proposed:

- Investigate viable alternatives to river gravel
- Prepare a gravel extraction plan, including determining volumes required and incorporate as part of a wider construction EMP (CEMP).
- Riverbed gravel extraction permit obtained if required.
- No gravel extraction from the active river channel.
- Extraction spread out over a number of different extraction locations.

iv) Waste storage and disposal

202. During construction waste will be generated by construction workers (general waste and packaging). The impacts of solid waste storage and disposal will be mitigated as follows:

- Prepare and implement a Waste Management Plan (WMP) as part of CEMP before construction to cover all aspects of waste storage disposal and accidental spills. The WMP is to be approved in writing by WAF's environment manager/DSC one month prior to starting works. Contractor to implement the WMP provisions.
- Segregation of wastes shall be observed.
- Recyclables shall be recovered and either reused in other construction or sold to recyclers.
- Residual wastes shall be disposed of in disposal sites approved by local authorities and not located within 500m of rivers or streams.
- Construction offices and facilities shall be provided with garbage bins
- Burning of construction and domestic wastes shall be prohibited.
- Disposal of solid wastes into drainage ditches and public areas shall be prohibited.
- All general solid waste will be collected and removed from the work areas and disposed in local waste disposal sites as identified by the waste management plan.

203. **Hazardous substances.** The use and storage of hazardous substances during construction can impact on physical soil and water resources if they accidentally spill or leak into the environment and if hazardous materials are not properly disposed of.

204. Hazardous substances that will be stored as part of the construction of the subprojects will be machinery fuels and oil. Hazardous waste in the form of used batteries, fuel drums and oily wastes may require disposal as part of the construction works. To mitigate the impacts of hazardous substance use the contractor will be required to implement the following:

- Hydrocarbons and toxic material will be stored in adequately protected sites consistent with international best practices to prevent soil and water contamination.
- All areas intended for storage of hazardous materials will be quarantined and provided with adequate facilities to combat emergency situations.

- Segregate hazardous wastes (oily wastes, used batteries, fuel drums) and ensure that storage, transport and disposal shall not cause pollution and shall be undertaken consistent with international best practice.
- Ensure all storage containers are in good condition with proper labeling.
- Regularly check containers for leakage and undertake necessary repair or replacement.
- Store hazardous materials above possible flood level (although it is noted construction works are to occur during dry season when floods are less likely).
- Discharge of oil contaminated water shall be prohibited.
- Used oil and other toxic and hazardous materials shall be disposed of off-site at a facility authorized by permit.
- Ensure availability of spill clean-up materials (e.g., absorbent pads, etc.) specifically designed for petroleum products and other hazardous substances where such materials are being stored.
- Spillage, if any, will be immediately cleared with utmost caution to leave no traces.
- No refueling of vehicles within 20m of a watercourse.

b) Impacts on Ecological Resources

i) Aquatic ecology

205. The construction of new structures has the potential to impact on aquatic ecology through decreased water quality, disturbance to river/creek bed sediments and vibration from piling.

206. Although there is no technical information on the aquatic ecology in the vicinity of the proposed works, it is likely to be typical of modified areas and have no species of significance (e.g. native, endangered or rare) or critical or natural habitats that may be impacted by the subprojects. Consultation with local village people has confirmed that the types of fish species caught are representative of a modified environment (i.e. introduced fish species such as Tilapia).

207. Water quality impacts and appropriate mitigation measures has been discussed under physical resources above. It is considered that with mitigation in the form of erosion and sediment runoff control, appropriate hazardous substances storage and disposal, minimization of vegetation clearance, and refueling of machinery at least 20m from watercourses, the water quality will not be significantly degraded and aquatic ecology impacts minor.

208. Piling causes vibration which may impact on aquatic species that cannot move away from the noise source. Species that inhabit the riverbed sediments are also directly affected from piling. However, the new pipeline will be single span, reducing the number of piles required and there are no records of any critical or natural species or habitats that would be at risk.

ii) Terrestrial ecology

209. Terrestrial ecology may be impacted during construction through noise, dust and vibration.

210. During construction noise and vibration may impact on fauna but will be limited to those species that can't move away from the disturbance. Given the works will be temporary, there are not likely to be any endangered or rare species, and most species will be able to move away from the source of the disturbance, it is not considered that there will be significant adverse impacts on fauna. However, to limit the impacts the following will be undertaken:

- Construction machinery will be maintained to a good standard and shall be equipped with muffler silencers.
- Limit the use of machinery that causes vibrational impacts as far as practicable.

211. Dust from construction vehicles and exposed soil can impact on adjacent vegetation health and function. The dust will not be chemically active (such as highly alkaline limestone a highly acidic dust) and so impacts are limited to physical impacts such as leaf surface abrasion or blocking of the plants' stomata and a reduction in photosynthetic abilities. However, part of the subproject is in an area where dust is already occurring from road surfaces (Viria road) as it is currently unsealed and the volume of construction traffic is not expected to significantly increase the dust loading vegetation currently receives. Dust impacts on vegetation will therefore be minor and no mitigation is necessary.

c) Impacts on Socio-economic Resources

i) Construction camp, site offices and works yards/compounds

212. A construction camp may not be required as the workforce could be small and accommodated for the short period of the works in existing lodgings. There will be the need to identify and use (temporary basis) work sites or compound for storage of materials and equipment. The presence of camps, site offices and works yards/compounds within a rural community such as the subproject can cause an adverse impact through the increased disturbance, noise and waste generated by camps and work sites, especially if the sites are located close to village areas and houses. The temporary sites/compounds can also be the cause of conflict, especially if many workers are brought in from outside of the local area. The impacts can be mitigated by:

- Locating the site office, facilities and storage site/compound in an area agreed with the local community in association with the Turaga-ni-Koro (elected administrative head of each village) and having the facilities approved by WAF's environment manager/DSC. The sites should be in accordance with the protocols established in the CPP and GRM.
- Providing potable water, clean water for showers, hygienic sanitation facilities/toilets with sufficient water supply, worker canteen/rest area and first aid facilities onsite.
- Separate toilets shall be provided for male and female workers.
- Hiring and training as many local workers as possible for construction.
- Installing adequate toilet facilities and prohibiting open defecation. The use of toilets will be encouraged by keeping toilet facilities clean at all times.

- All waste materials shall be removed and disposed to disposal sites approved by local authorities.
- At the completion of the works contractor's facilities area, sites and storage compound area shall be rehabilitated to the satisfaction of the land owner where relevant, and the area cleaned up to the satisfaction of WAF's environment manager/ Turaga-ni-Koro after use.

ii) Worker health and safety

213. A number of activities, plant and products can give rise to health and safety impacts for workers during the construction phase. Most of these impacts can be managed and/or mitigated. The potential impacts are (i) contamination of local water supplies by potential contaminants such as sediments, fuel products and lubricants (ii) air pollution from exhaust fumes and dust giving rise to respiratory conditions; (iii) risk of accidents at work sites; and (iv) spread of communicable diseases.

214. To avoid these impacts contractors will observe general health and safety requirements and as a minimum must be compliant with the Labour Act of 1978 and the Safety at Work Act of 1996.

215. The contractor will provide personal protective equipment (PPE) to construction workers suitable for civil work such as safety boots, helmets, gloves, high visibility vests, protective clothes, goggles, and ear protection at no cost to the workers. The contractor will also prepare a health and safety plan (HSP) instructing workers in health and safety matters. This plan is to be approved in writing by WAF's environment manager/DSC one month prior to starting works. All workers will receive training from the contractor on the HSP as well as general environmental, safety and environmental hygiene.

216. Mitigation measures are proposed as follows:

- Contractor to prepare a Health and Safety Plan (HSP) instructing workers in health and safety matters. The HSP is to be approved in writing by WAF's environment manager/DSC one month prior to starting works. Contractor to implement HSP provisions.
- Before construction commences the contractor will conduct training for all workers on environment, safety and hygiene. The contractor will instruct workers in health and safety matters as required by good engineering practice and provide first aid facilities.
- Workers shall be provided (before they start work) with appropriate PPE suitable for civil work such as safety boots, helmets, gloves, protective clothes, goggles, and ear protection at no cost to the workers. Site agents/foremen will follow up to see that the safety equipment is used and not sold on.
- Fencing shall be installed on all areas of excavation greater than 1m deep and at sides of temporary works.
- Provision of potable water supply in all work locations.

iii) Community health and safety

217. Construction will involve a number of truck movements within and around the subprojects sites, including large equipment transporters and general construction traffic (workers transport, etc.). Most construction traffic will utilize existing roads as haulage routes. The increase in vehicle movements has the potential to place people using the area at risk, particularly children. This risk can be avoided by ensuring specific measures are undertaken to protect the users including using traffic control such as stop/go men to control and regulate the movement of people through construction areas and timing the works to avoid the periods when people are most frequently using the crossing, such as the start and finish of the work/school day. The provision of a temporary structure will also provide safe access through the area during construction works.

218. The presence of a construction crew at the location for extended periods can increase the risk of spread of communicable diseases, including HIV, to the local community. Mitigation measures are proposed including the following:

- Provide a temporary access across the watercourse to facilitate safe access during construction.
- Timing of large scale construction works to occur outside of frequent use, such as the start and finish of the work/school day.
- Include in HSP the use of barriers (e.g., temporary fence). These shall be installed at construction areas to deter pedestrian access except at designated crossing points.
- The general public/local residents shall not be allowed in high-risk areas
- Provide warning signs at periphery of site warning public not to enter
- Traffic control measures during construction shall be provided and included in the CEMP. Traffic control shall include the use of stop/go men/women and strict imposition of speed limits through the site.
- Implementation of communicable diseases (incl. STIs and HIV) awareness and prevention measures.

iv) Noise

219. The construction activities can lead to an increase in noise levels for users of the road or nearby residences. The nearest house is adjacent to the planned treatment plant, next to the temporary access road and the nearest school is approximately 1 ½ km from the planned treatment plant. The potential adverse impact of noise during construction can be mitigated as follows:

- Construction equipment and vehicles will be maintained to a good standard and shall be provided with muffler silencers. As before, Certification of Roadworthiness is required as well as the limit of 85 db on noise emission is required and will be monitored by WAF's environmental manager/DSC.
- No construction works between the hours of 1900 and 0700 every day.
- Monitor and investigate complaints; propose alternative mitigation measures.

v) Dust

220. Dust from the movement of construction vehicles can cause a nuisance for neighboring property owners in regards to residences and crops. Dust is likely to already be a nuisance to road users and residents of Viria road in the vicinity of the proposed works as the roads are currently unsealed. The rest of the pipeline route is next to a sealed roadway. The potential for additional dust generation during construction (from machinery movements and earthworks) can be mitigated by:

- Using of a water cart in dry conditions.
- Limiting the area of soils exposed through earthworks that may be the source of dust

vi) Disruption to existing users

221. The water supply pipeline essentially follows road ways. During construction works existing structures may have to be closed off to the public. This could cause a disruption to road users and may impact on the livelihood of those that depend on the road for access to work, school, markets, etc. However, disruption to road users will be avoided through the provision of alternative access during construction (either by utilizing the existing road while a pipeline is built or by constructing a temporary structure alongside the structure being built, such as the temporary road for Viria road) and traffic management in accordance with a construction environment management plan (CEMP) developed for the works.

222. Construction works in the area have the potential to impact on the normal lives of locals but this can also be minimized by arranging public consultation prior to construction works commencing to advise affected communities of the scope and scheduling of the subproject and to raise awareness within the communities of the likely phasing of events that will occur within their boundaries.

223. The disruption to users of the road will be minor provided the following mitigation measures are undertaken:

- Avoid closure of the road, particularly at high use times. Provide an alternative way through the use of temporary structures.
- Communication to the public through public consultation and notice boards regarding the scope and schedule of construction as well as certain construction activities causing disruptions and access restrictions.

vii) Sites of significance

224. Construction works can cause an impact on sites of significance such as cultural or historic sites, particularly where earthworks are required. Although the Museum of Fiji has no records of sites of cultural or historic significance within the area where earthworks and vegetation clearance is to occur for the water treatment plant, reservoirs and pipeline route, it is possible that unidentified sites may be uncovered during construction.

225. To avoid impacts on sites of significance, a discovery protocol is to be put in place and contractors educated on its use. The discovery protocol will direct what

actions are to be taken in the event of uncovering a site of potential significance. This will avoid any impact on the site and provide information on appropriate measures to be taken to preserve the site. The protocol will be worked out by the Safeguards Specialist for the PMU and implemented by the Construction Contractor.

4. Operation Impacts

a) Impacts on Physical Resources

i) Greenhouse gas emissions

226. Once constructed, the subproject will not affect vehicle emissions that contribute to greenhouse gases.

227. Repair and emergency vehicles may generate emissions, however this is relatively insignificant.

ii) Water quality

228. Ongoing (post construction) impacts on water quality will be relatively insignificant during periods of normal stream flow. In cases of flood water, scouring and erosion of the embankment can occur around piles and concrete supports, however with properly designed and built bank support this should not be a concern.

229. During periods of extreme storms and cyclonic flooding, rivers and creeks carry large volumes of water moving at high rate of speed and carrying large objects. Pipeline spans crossing these streams are placed downstream of the bridge, so that the bridge will stop most large floating objects before they can strike the pipeline. The pipeline would only be at risk when the bridge fails or when the floodwaters overtop the bridge. Little can be done to mitigate storms.

b) Impacts on Ecological Resources

230. It is unlikely that there would be an impact on terrestrial resources, during the normal operation of a buried pipeline, other than the recovery of cleared vegetation during trenching.

231. There would be virtually no impact on aquatic organisms during normal operation of the pipeline. Any harm to aquatic organisms during periods of high flow and flooding would not be due to the pipeline.
No mitigation is necessary.

c) Impacts on Socio-economic Resources

i) Community health and safety

232. Upon completion the pipeline will provide large benefits to the Viria area communities and to the residents of the GSA in providing access to safe and clean drinking water. No mitigating needed.

ii) Noise

233. Essentially no noise is emitted from operating pipelines. No mitigation needed.

iii) Dust

234. Essentially no dust is generated from operating pipelines. No mitigation needed.

iv) Disruption to users

235. There is no disruption to users during a normally operating pipeline. During periods of service failure, the issues are solved through emergency repair by WAF. Future problems can be minimized through routine and effective maintenance.

F. ASSESSMENT OF ALTERNATIVES

(Note: Sections on economics below are taken from the Economic Analysis in the Main Report)

1. Water supply

236. In the case of economic analysis, it is assumed that under the **"with project"** scenario

- progress will be made both in relation to reducing NRW and in relation to reducing average domestic consumption through demand management.
- It is assumed that non-revenue water (NRW) will be reduced progressively to an average of 27 percent by 2033 (with NRW for new connections at 20 percent),
- that demand management will reduce average domestic consumption to 180 litres per capita per day (lpcd) by 2033,
- and that 100 percent coverage of the population will be achieved by 2033.

237. Therefore, the demand projections support the planned augmentation of water production capacity by 30 megalitres per day (ML/d).

238. In the case of the **"without project"** scenario

- assume that there will be no additional investment in capacity augmentation, NRW reduction, or demand management over the project period.
- Given that water production is currently running continuously at 100 percent capacity with no redundancy for maintenance,

239. Therefore, this scenario concludes that production capacity would decline by 30 percent over the period to 2033.

2. Least Cost Analysis of Project Options

240. The least cost analysis is undertaken on the basis of a comparison of the present value of economic costs (both capital costs, and costs of operation and maintenance), of technically viable project options.

Water supply

241. The project options considered in the least cost analysis are:

Option 1: Establishment of a new raw water intake and water treatment plant with initial capacity of 40 ML/day (expandable to 80 ML/day) on the Rewa River at Viria.

Option 2: Establishment of a new raw water intake on the Rewa River at Viria, with the development of additional water treatment capacity (40 ML/day expandable to 80 ML/day) at the existing Waila water treatment plant.

242. A number of other locations have been considered for a raw water source on the Rewa River, but dismissed on technical grounds due to the level of risk from salinity intrusion and/or contamination from potential mining development. See Site Selection below.

243. The major difference between the options is that Option 1 involves pumping treated water to connect with the existing network, while Option 2 involves pumping raw water a similar distance for treatment at Waila. Costs associated with pumping raw water are higher than those for treated water. Option 1 has the additional benefit of providing potential to connect unserved villages in the vicinity of the water treatment plant and along the pipeline from the treatment plant to its connection with the existing network.

244. Option 1 is found to be the least cost option.

3. Site Selection

245. A suitable site for safe, reliable and sustainable production of public drinking water was sought along the Rewa River. It wasn't until the third site[31] was chosen that an acceptable site that could be agreed upon and realistically developed in an economically and timely fashion.

a) Delaidamanu/Naimasini.

246. This site, located at roughly 41.4km up river from the mouth, had an intake site located at a settlement Naimasini. The site was on a bluff about 20 to 25m straight down. The bluff would not be subject to flooding at that height, however, the geology of the site had not been investigated. A suitable area was found next to the intake site for the water treatment plant. The plan included water pumped from the Rewa, treated and stored at Naimasini and piped along Baulevu Road to a storage reservoir at Logani and on to the existing and possibly expanded storage at Raralevu. The issue was an access road that would have to be constructed, perhaps 2 to 3km in length. This road would at least partly if not fully cross i-Taukei land, whereas the intake and treatment plant were said to be on Crown Land. Given the delay in sorting the land issues and decisions regarding responsibility for the road and the short planning time ruled this site out.

[31] There could have been other proposed sites, however only three were physically investigated by the TA8526 Consulting Team of Urban Solutions.

Additionally this site was downstream from the confluence with the Waidina River, which receives waste from the Namosi Joint Venture.

b) Natoaika/Nakini.

247. This site, located at roughly 38.2km up river from the mouth, had an intake in the flood plane. The water would then be piped across Baulevu Road, which has several bridges, and across a small stream and up to the treatment plant and storage. An access road of approximately 100 to 150m would have to be constructed to the treatment plant from Baulevu Road and another of about 50m down to the intake. The water would be distributed in the same fashion as Delaidamanu/Naimasini. The issues again were land ownership with multiple owners, only one of whom was in Fiji. Again time and sorting would not allow the Team to move forward with the site and again, its location is downstream from the confluence with the Waidina River.

4. Viria

248. This site is actually about 500 to 600m upstream from the confluence of the Rewa River with the Waidina River at approximately 50km upstream from the river mouth. The site has an 18m bluff with presumably solid rock for construction and the site continues to rise up to approximately 58m where the treatment plant and storage would be located. This site is on the western side of the Rewa River, whereas the other two sites were on the eastern side. This site has a good unpaved road to the site without bridges and after the turn-off at the Nagali bridge across the Waidina, with 200m of track to be improved. The site is actually 1 to 1 and 1/2 km downstream from the village of Viria. The major change would be in the routing of the pipeline and location of perhaps another pumping station and/or storage reservoir. WAF will have to decide about Logani and servicing that area. At the moment the pipe will join the existing one crossing the Rewa River at Nausori. The principal advantage of this site, other than better protection from flooding and erosion, is the elimination of the risk from the potential mining emissions from Namosi into the Waidina River and the anticipated effects of climate change (salinity intrusion).

G. CONSULTATION AND INFORMATION DISCLOSURE

249. Consultation in accordance with the Stakeholder Consultation Strategy (SCS) developed as part of the project was undertaken during the preparation of this IEE. Potentially affected parties and key interest groups were identified and consulted in the early stages of the IEE. These parties are listed below.

250. The water supply subproject was discussed at these meetings and questions were targeted at identifying any particular values and uses of the sites and to gain an understanding of the surrounding land uses and economic and social environment. It also allowed the project team to gain information on any particular issues or concerns for the IEE to specifically address.

251. Community consultations were undertaken in 2015. Meetings on the subproject were held with men and women.

252. All persons consulted said they wanted the water resource project and understood the need for water. Persons also understood the potential but temporary disruption during construction.

1. Summary of Consultations and Stakeholders Meetings

253. The following table contains the summary of topics discussed in four stakeholder meetings held at the Department of Environment and Commission Central offices.

a) Summary of Consultations and Stakeholders Meetings

Table 1: Summary Matrix of Meetings and Interviews

Stakeholders Meetings	Stakeholder's Meeting Outcomes/ Issues				
	Site Uncertainties	**Land Acquisitions**	**Stakeholder's Requirements**	**Road Accessibility**	**Namosi Joint Venture**
1st Meeting (04/02/15) Stakeholder's Meeting Outcomes/ Issues	Option 1 at Namaisini Settlement was chosen due to it elevation of the water treatment plant. This option was discussed. There was issues of land acquisitions, Environmental Issues and Socio-economic aspects.	There were no land acquisitions. The land acquisition was briefly present as an issue to look forward too.	There was no requirement given by any stakeholders.	This issue of the road accessibility was raised about option 1.	The involvement of Namosi Joint Venture was mentioned by some of the stakeholders as hindrance to the project for option 1.
2nd Meeting (18/02/15) Stakeholder's Meeting Outcomes/ Issues	Option 1 at Namaisini Settlement was discussed once more with additional assistance from Commissioner Central Division	Option 1 has an issue for the land acquisition need for the road accessibility.	There was no requirement given by any stakeholders.	The road accessibility issues were brought up as upon discussion. The village headmen claims to a survey were untaken and the village headmen support the road development.	Still Namosi Joint Venture did not attend the meeting.
3rd Meeting (04/03/15) Stakeholder's Meeting Outcomes/ Issues	Option 2 was presented to the stakeholders where it was located at Naitoaika for the Water Treatment Plant and the pump station to be at	The Itaukei Land trust Board presented the requirements for option 1 and 2. The Water Authority of	There was no requirement given by any stakeholders. There was only brief discussion about the Environmental Impact	The representative from Fiji Roads Authority confirms that there is a project but not confirming if it will go	The representative of Namosi Joint Venture is currently at exploration

Stakeholders Meetings	Stakeholder's Meeting Outcomes/ Issues				
	Site Uncertainties	**Land Acquisitions**	**Stakeholder's Requirements**	**Road Accessibility**	**Namosi Joint Venture**
	Naikini. Option 1 had a few land issues that would require 60 % of the land owners from Namuamua for the road accessibility to the site only.	Fiji Project unit confirmed that it land unit are currently working on the statues of land acquisitions for the both options.	Assessment Terms of Reference's. How it will be circulated through all the approving authorities. Department of Town and Country Planning would require the sub-division scheme and this would require an engineering design for the project. Most of the stakeholders would require the engineering design and confirmed site/option for the project.	up to the proposed site for option 1. Hence, the road accessibility will require the engineering design on the site.	stages. They welcome the project and will make sure the mine should have a good environmental management plans for disposal of the tailings. It aims to have a sludge pond to break it down before it gets disposed in the safe area.
4th Meeting (11/03/15) Stakeholder's Meeting Outcomes/ Issues	Option 3 was presented to the few stakeholders because it eliminates a huge risk of land acquisition and less capitals expenditure. As for the other two options seems infertile due to the land acquisition issues. As for option 2 it has a total 6 land owners and there is only one of them in the country.	For option 2 has 6 owners and only one land owner is currently in the country. In option 3, the Water Authority of Fiji will be trying to get the freehold land.	Upon the previous meeting, the project consultants still have not received any requirements. The Department of Environment has a requirement of 21 days maximum for reviews for the approving authorities. Also, the Ministry of Health and Medical Service will require 2 to 3 days for the processing of any	The issue of the road accessibility is minimal because option 3 is accessible by farm road. There would be a man made access road for the construction stage for both the Water Treatment Plant and Pump Station.	The issue of the Namosi joint Venture is not applicable because of the site is moved above the Wadina River. This Wadina River is connecting to the Waisoi river, in turn, will contribute any disposal from the

Stakeholders Meetings	Stakeholder's Meeting Outcomes/ Issues				
	Site Uncertainties	**Land Acquisitions**	**Stakeholder's Requirements**	**Road Accessibility**	**Namosi Joint Venture**
			approval.		tailing dam to the Rewa River.
5th Meeting (13/03/2015) Individual Stakeholder's Consultation Meeting Outcomes/ Issues (WAF-Forestry Department)	Option 3 – new site at Viria past Waidina River Y junction is being now under consideration for WTP. This was presented to the Conservator of Forest for commenting. Uncertainties on forestry activities like logging and any land clearing activities would bring down silts. The Conservator of Forests assured that there is no threat from forest activities as Forestry will protect the area by not issuing any logging licence instead can declare this as water catchment Forest Reserve area.	The Land is a freehold land and the owner is willing to sell this property. Reservoir site is above on a hill near the Waitolu village.	Payment under negotiation.	Road and electricity up to the land site. FEA negotiations will have to be made after confirmation on purchase agreements.	Namosi Joint Venture is eliminated by shifting the project to this new site. Forestry activities will be eliminated by declaration of this area as Forest Reserve.
6th Meeting (19/03/2015) Individual Stakeholders Consultation Meeting Outcomes/Issues (WAF- Department of Mineral	Option 3 – new site at Viria past Waidina River Y junction is being now under consideration for WTP. This was presented to the Mineral Resources Technical	Option 3 Land is a freehold land and the owner is willing to sell this property.	Payment under negotiation.	Road and electricity up to the land site. FEA negotiations will have to be made after confirmation on purchase agreements.	Namosi Joint Venture is eliminated by shifting the project to this new site.

Stakeholders Meetings	Stakeholder's Meeting Outcomes/ Issues				
	Site Uncertainties	**Land Acquisitions**	**Stakeholder's Requirements**	**Road Accessibility**	**Namosi Joint Venture**
Resources)	Staff for commenting. Uncertainties on new and existing mining sites to be located in Naitasiri Area. The MRD team have cleared the new site of any mining activities. There are no applications for mining in this area at present.				There are no Mineral extraction or mining activities planned or applications for mining has been received for this area above option 3 site.
7th Meeting (13/05/2015) Project briefings by T. Vakadravuyaca, D. Zoellner and J. Chappelow	Viria site minimizes site uncertainties from upstream activities; Favorable engineering; favorable reaction from consultations with area residents	Same as above	Same as above	Same as above	Same as above

254. For a record of the meeting minutes, see **Annex A-4, Stakeholder Meeting Minutes**

b) Information disclosure

255. Project documents will be disclosed as per ADB Public Communications Policy 2011. A copy of the IEE and EMP will be provided to the key stakeholders and local villagers as part of information disclosure. The public will have the opportunity to review and comment on the IEE during the public submission phase (during IEE review).

256. During project implementation, the contractor will provide a site office that people will be able to get more information about the works. The contractor is also required to communicate to the public, through public consultation and notice boards, the scope and schedule of construction as well as certain construction activities that may cause disruptions and access restrictions. Noticeboards and signs will provide information in English and Fijian languages

H. GRIEVANCE REDRESS MECHANISM

257. In order to receive and facilitate the resolution of affected peoples' concerns, complaints,and grievances about the project's environmental performance, a Grievance Redress Mechanism (GRM) is proposed for the Project. When and where the need arises, this mechanism will be used for addressing any complaints that may arise during the implementation and operation of the Project. The grievance mechanism is scaled to the risks and adverse impacts of the Project. It addresses affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. The mechanism is not impeding access to the Fijian judicial or administrative remedies. The EA through the IA will appropriately inform the affected people about the mechanism before commencement of any civil works.

1. Grievance Focal Points, Complaints Reporting, Recording and Monitoring

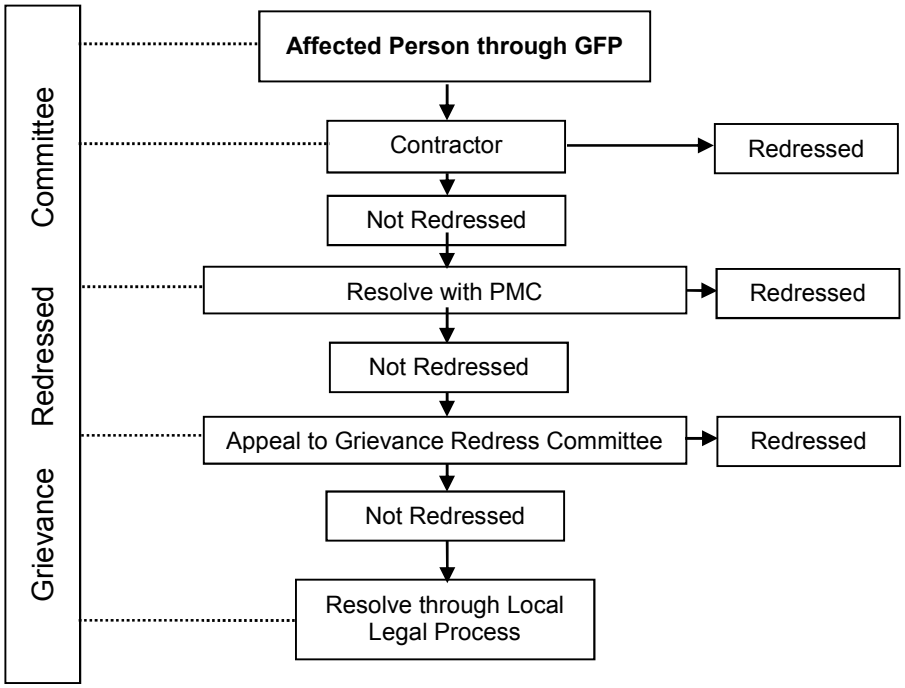
258. The process for solving environmental complaints that may arise in the project is the Grievance Redress Mechanism, which will be established at project level, the process is described below:

- Environment complaints will be received through the Grievance Focal Point (GFP); these will be designated personnel from within the community who will be responsible for receiving the environmental complaints. The Contractor will record the complaint in the onsite Environmental Complaints Register (ECR). The GFP will discuss the complaint with the Contractor and have it resolved.
- If the Contractor does not resolve the complaint within one week, then the GFP will bring the complaint to the attention of the PMU Safeguard Specialist. The PMC Safeguard Specialist will then be responsible for coordinating with the Contractor in solving the issue.
- If the Complaint is not resolved within 2 weeks the GFP will present the complaint to a Grievance Redress Committee (GRC). The GRC will be comprised of designated officials from the following organizations:

Contractor's Environment Specialist, PMU Safeguard Specialist, GFP, and the WAF Project Manager or representative.

- The GRC will have to resolve the complaint within a period of 2 weeks and the resolved complaint will have to be communicated back to the community. The Contractor will then record the complaint as resolved and closed in the Environmental Complaints Register. In parallel to the ECR placed with the Contractor, each GFP will maintain a record of the complaints received and will follow up on their rapid resolution.

259. EA through IA will also keep track of the status of all complaints through the Monthly Environmental Monitoring Report submitted by the Contractor to the PMU, and will ensure that they are resolved in a timely manner.



I. ENVIRONMENTAL MANAGEMENT PLAN

1. Introduction

260. The environmental assessment of the construction and operation stages of the two subprojects has determined that they will have relatively minor and site-specific impacts on the local environment. Environmental mitigation measures have been proposed to avoid or minimize environmental impacts to acceptable levels.

261. International best practice requires the EMP contained in the approved EIA be updated based on detailed design and then the contractor prepare the CEMP detailing the methods they will use. These plans are approved by WAF, DOE and ADB prior to implementation. The roles and responsibilities for various environmental management tasks as well as the overall institutional arrangements are discussed below.

262. An EMP for the project is presented below and complies with government and ADB/WB requirements. The EMP includes the following information:

- Implementation arrangements for the EMP including: (i) institutional roles and responsibilities for EMP implementation throughout all stages of the project (procurement, design, construction, operation); (ii) capacity building requirements for executing agency to ensure environmental management requirements are properly understood and fully implemented; and (iii) grievance redress mechanism;
- Environmental mitigation and monitoring matrices including: (i) potential environmental impacts that could occur during each stage of the project (pre-construction/design, construction, operation); (ii) proposed mitigation measures to address each impact identified; (iii) agency responsible for implementing each mitigation measure; (iv) monitoring tasks to ensure mitigation measures have been implemented effectively during each stage of the project; and (v) schedule and responsibility for monitoring;
- Costs associated with implementation of all aspects of the EMP.

263. Prior to construction commencing, the outline EMP matrix will be developed into a detailed CEMP by the contractor. A project supervision team will be set up within WAF which will include an environment manager. This unit will be responsible for supervision of the CEMP implementation through regular observation and spot checks of construction-related activities. WAF with DOE's endorsement will ensure that the CEMP will be adequately prepared and consistent with the EMP matrix. WAF will ensure that adequate and timely remedial actions are taken by the contractor.

264. Local communities will have access to the supervising engineer to report and have resolved any project-related concerns or problems. Any construction-related problems, along with follow-up actions undertaken, will be reported by the supervising engineer to WAF and ADB on a quarterly basis.

2. Institutional Arrangements, Roles and Responsibilities

265. These include WAF's project supervision team which will be responsible for overseeing and managing project execution including compliance with project requirements (financial management, procurement, safeguards, and monitoring and

evaluation). A DSC will be responsible for the screening and analysis required for the prioritization and ranking of subprojects, preparation of feasibility studies of selected subprojects, preliminary and detailed designs, preparation of bidding documents and assisting with bid evaluation, and monitoring construction.

a) Water Authority of Fiji.

266. WAF will be the implementing agency for the project, and a project supervision team will be established for the purposes of delivering the project. The project supervision team will be responsible for overseeing and managing project execution including compliance with project requirements (financial management, procurement, safeguards, and monitoring and evaluation). The project supervision team will consist of a project manager/engineer, accountant, environment manager, and social impact manager. The environment manager will be consulted to ensure that the procedures and processes established in this IEE are followed for the project. However, documentation of how the IEE will be applied for the project will be the responsibility of the safeguards specialists within the DSC.

267. Feasibility studies (including screening and analysis required for the prioritization and ranking of subprojects, safeguards assessments and consultation), detailed designs, and supervision of construction and civil works contractor will be the responsibility of the DSC. Many of these have already been carried out, with detailed and final designs undergoing current evaluation.

b) Design and Supervision Consultant.

268. The DSC will include international and national specialists to implement the safeguard tasks as required by this IEE and the EARF. Amongst a number of others, the DSC will include: (i) environmental safeguard specialist (international) (ESS); (ii) social safeguard/resettlement specialist (international) (SSS); (iii) safeguards specialist (national) (NSS); and (iv) gender and community development specialist (national) (GCDS). The DSC will be headed by a team leader.

269. General environmental management responsibilities of the DSC include:

- Updating of the WAF COEP to reflect current WAF institutional arrangements and requirements of Environmental Management Act 2005.
- Through the team leader, ensuring that the environmental safeguards are implemented as set out in this IEE so as to meet intended requirements. This includes undertaking safeguards assessments during the feasibility study, ensuring that the EMPs from approved environmental assessments are included as part of construction section and tendering conditions of the bid and contract documents, and monitoring is undertaken.
- Providing training to contractor, as required, prior to preparation of CEMP, and review and approval of CEMP;
- Supervising the implementation of the CEMP during construction.

270. Within the DSC team, the ESS, SSS and NSS will have specific responsibilities for implementation of this IEE. Their duties include:

(i) During the project inception, brief the DSC team on the IEE and safeguard and CPP requirements that need to be implemented during the project.
(ii) Undertaking the screening of the subproject (including individual components such as water crossings at different locations) and identify main environmental impacts and prepare project descriptions.
(iii) Prepare the development consent applications including component descriptions and the screening forms, and after approval by WAF submit to DOE for assessment determination.
(iv) Prepare the assessments (IEE or just EMP as determined by DOE) for the selected or prioritized elements as required to meet the requirements of the project's EARF.
(v) Undertake adequate consultations with affected people and studies of the subproject area/catchment to identify baseline conditions and impacts;
(vi) Ensure that disclosure of the draft assessments is done in accordance with the project's CPP in compliance with ADB's Public Communications Policy (2011) and government requirements.
(vii) Submit the environmental assessment to DOE. Arrange for a copy and the conditions of the IEE issued by DOE to be sent to the ADB.
(viii) During pre-construction, ensure that issues that need to be addressed by the design engineers are considered. Prepare a design brief containing main requirements for action by the technical design team.
(ix) Based on detailed designs, update the EMP from the approved environmental assessment. Integrate the revised/updated EMP and DOE's IEE conditions into the construction section of the bid and contract documents.
(x) With the GCDS arrange public consultation to advise affected communities of the scope and scheduling of the subproject and to raise awareness within the communities of the likely phasing of events that will occur within their boundaries.
(xi) If required by the team leader, provide a review of environmental management aspects during bid evaluation.
(xii) Following the award of the contract and prior to submission of the CEMP, provide general EMP and safeguards induction for the contractor (if required).
(xiii) Ensure that contractor has access to the environmental assessments of the subproject and the IEE conditions issued by DOE.
(xiv) Evaluate, and when satisfactory, advise WAF that the CEMP may be approved.
(xv) Advise the contractor of their responsibilities to mitigate environmental impacts and issues associated with construction activities.
(xvi) With the project engineer, supervise and monitor the contractor's compliance with the approved CEMP. As required, issue defect notices concerning non-compliant work which will be channeled to the contractor via the project engineer. Any instructions or requirements for corrective actions will be issued through the project engineer.
(xvii) Prepare reports of site visits and compliance checks at least every two months (preferably monthly), contribute to the quarterly progress reports (summary of compliance reports and contractor's monthly reports and any other safeguards activities including training seminars or workshops and the like), and prepare safeguards monitoring reports twice per year.

c) Contractor

271. The contractor will be responsible for complying with the environmental management requirements included in the contract as follows:

(i) Prior to construction commencing, the contractor will address the construction section of the EMP which will be developed into the detailed CEMP that addresses the IEE conditions and details working statements and methodologies as required by the EMP. It will include a monitoring plan and a reporting program. Submit the CEMP to the DSC for clearance.
(ii) Designate an environmental and safety officer and deputy environmental and safety officer who will take lead responsibility for implementation of the CEMP.
(iii) Provide briefings and training seminars for all workers (and sub-contractors as relevant) on the CEMP and safeguards requirements governing the project.
(iv) Following approval of the CEMP, the contractor is required to attend a site meeting where the CEMP is further discussed to ensure that all compliance conditions are clearly understood.
(v) The contractor's site engineer and environmental and safety officer will be responsible for daily supervision of the CEMP. The contractor is required to undertake work as directed by the project engineer (who will be assisted by the ESS and NSS). If the work is non-compliant with the CEMP or conditions, the contractor must respond to the defect notice issued and rectify the issue or work.
(vi) The contractor will cover CEMP implementation, including grievance redress, in the monthly reports that will be submitted to the DSC. The report will also contain the monthly accident/incident report.

d) Department of Environment.

272. The DOE will be responsible for: (i) respond to the initial screening application and determine what assessment is required for each subproject and review the assessment reports when submitted; (ii) issue EIA approval with or without conditions or advise on why it has not been approved; (iii) participate in a monitoring committee and review monthly monitoring reports (for larger projects), iv) undertake periodic monitoring of the subprojects and implementation of EIA conditions as required; and (v) undertake to review the environmental grievances or complaints that cannot be resolved through the GRM.

e) ADB

273. During the project, the ADB will provide support to WAF and DSC as required during review missions and at other times as required. ADB will review and clear environmental assessments prepared for subprojects and safeguards monitoring reports and disclose these documents as per Public Communication Policy 2011. Review missions will review the procedures being implemented by DSC, and the contractor, and will include review of screening, assessment, consultations, EMP updating, bid documents, and monitoring.

3. Environmental Management Plan

a) Summary of impacts, mitigation, monitoring, implementation and cost for water supply subproject

Table 2: EMP Matrix

Impact	Mitigation	Monitoring	Implementation	Cost
1. bank erosion and flooding—Rewa River and all other rivers and streams, permanent and intermittent	Protect pump electricals; enforce embankments with large rock and gabions; at Rewa intake consider submersible pumps; at Waidina and Waimanu consider horizontal drilling	During construction: inspect adequacy. Weekly report with pictures. Post construction: periodic inspection.	Contractor to provide protection per specs in contract. WAF Project Engineer to inspect, Plant Mgr. after construction along with WAF Environment Unit	Estimated cost: $15k to $20k (horizontal drilling would add substantially to the cost)
2. Release of sediment a. during clearing b. during trenching c. during embankment construction	Erection of temporary barrier structures, particularly on sloping land - 15° or more. Arrange in series if required by WAF Environment Unit	During construction: inspect adequacy. Weekly report with pictures. Make corrections when advised. Maintain properly. WAF Environmental Unit to monitor and receive reports	Contractor to provide per specs in contract. Project Engineer to inspect along with representative from WAF Environmental Unit	Estimated cost: $10k to $15k
3. Waste from workers and hygiene practice	Collect solid waste daily and place in container and dispose of container in landfill (Naboro or other official landfill) at least weekly; provide portable sanitary facilities and service at least weekly. Provide washing facilities.	Inspection by Project Engineer, follow-up by WAF Enviro. Unit. Weekly report	Contractor to provide and maintain facilities per contract. WAF Enviro. Unit to inspect. Contractor to make any advised adjustments	Estimated cost $20k to $30k
4. Removal of topsoil and vegetation—trees, shrubs, grasses and other plants	Place in designated low areas, with WAF Environment Unit agreement and restore site when finished	Weekly inspection by Project Engineer or WAF Environment Unit. Monthly report with pictures	Contractor, per contract, identifies placement area with WAF Enviro. Unit approval. Contractor restores.	Estimate cost $4k to $5k

Impact	Mitigation	Monitoring	Implementation	Cost
5. Waste from machinery and vehicles—solid and liquid, particularly hydrocarbons	Designate areas for servicing and parking with impermeable ground cover and low berm. Remove spills where possible. Collect solid waste and dispose with worker solid waste	Construction monitoring by Project Engineer and followup monitoring by WAF Environment Unit with weekly report with pictures	Contractor, per contract, to prepare area. WAF to monitor and report.	Estimate cost $2k to $4k per area
6. Traffic congestion	Place signage on road alerting drivers to construction ahead and advise caution; use construction personnel and traffic cones to direct traffic where necessary	Monitoring by Project Engineer and WAF Environment Unit with weekly rep or with pictures	Contractor, per contract, to provide equipment and personnel. WAF Environment Unit to monitor and report	Estimate cost $5k to $7k
7. Open trenches	Ensure that barriers for pedestrians and cones for vehicles, as well as signage warning of open areas. Provide lighting at night. Backfill all laid pipe that day.	Monitoring by Project Engineer; WAF Environment Unit to report and document	Contractor, per contract, to provide equipment and facilities and maintain same; WAF Environment Unit to monitor and report	Estimate cost $3k to $4k
8. Dust and noise	Trafficked area to be wetted periodically and decibel limit (80 to 85 db) to be set for vehicles and equipment	Weekly inspection with report and sound meter by WAF Environment Unit	WAF Environment Unit to monitor and report	Estimate cost $4k to $6k
9. Habitat disturbance (rural—estim. 3 to 4 acres total, principally at Waitolu reservoir site and access road) a. human activity b. loss of land cover c. already disturbed, as in crop and orchard land at Rewa intake and WTP site	Soil, rock and veg. disposal area restored and land around intake, treatment plant and reservoirs landscaped with indigenous species where possible when construction finished. Steep sides at Waitolu require pilings 6 to 20m.	WAF Environment Unit to monitor with monthly report with pictures	Contractor, per terms of contract, to restore and landscape	Estimate cost: $5k to $6k

Impact	Mitigation	Monitoring	Implementation	Cost
10. Access roads a. Rewa intake/treatment plant/reservoir (estimate150m) b. possible reservoir at Waitolu (estimate 200m) c. Kinoya upgrades (estimate 100m)	Erect temporary barriers to block downhill sediment loss to river, streams and ditches; develop road runoff scheme post construction	WAF Environment Unit to monitor construction and operation of barriers with weekly reports and pictures; WAF Project Engineer to monitor	Contractor to install and maintain per contract with WAF Environment Unit approval	Estimate cost: $4k to $6k
11. Storage of construction materials and supplies, particularly lime, cement, hydrocarbons, acids	Designate areas with impermeable ground cover and low berm (similar to vehicular service area); pipes stored in fenced area with only pipes for use that day on site	Proj. Engr. to inspect adequacy of construction and WAF to monitor operation with weekly reports with pictures	Contractor to construct and WAF Environment Unit to monitor. Contractor to make adjustments per WAF Environment Unit advisory	Estimate cost: $6k to $8k
12. Standing water from rain in low areas, trenches, holes and other excavated areas	Pump rainwater into storage tanks for settling, separation and disposal or pump to river, stream or ditch, but using filters that are changed at least each 3 hours	Proj. Engr. to inspect adequacy of operation and WAF Environment Unit to provide monthly reports with pictures	Contractor to provide equipment and materials per contract with WAF inspection	Estimate cost $8 to $10k
13. Vehicular emissions from trucks, construction equipment (heavy and generators)	Ensure that construction contractors' vehicles have all safety and emissions certified by Ministry of Health, Land Transportation Authority and other relevant authorities	WAF Environment Unit to inspect and report with documentation	Contractor per contract to provide adequately certified vehicles	Estimate cost: $4k to $6k
14. River water quality from upstream (Viria 2km and further upstream – logging, agriculture, roads, development). Heavy sediment in rainy season	Implement regular river water quality sampling routine – elements of attention would be heavy metals, protozoa and fecal coliforms; install screens on pump intakes at Rewa	WAF Environment Unit to monitor with treatment plant staff on weekly basis. Add monthly sample of full chemical range to monitor trends; Project Engineer (and later, plant staff) to	WAF Environment Unit to process samples in National Water Quality Laboratory; contractor to install screens; Lab personnel to clean screens as needed, but inspect daily	Estimated recurring weekly cost: $500

Impact	Mitigation	Monitoring	Implementation	Cost
		inspect screens		
15. Release of residuals, particularly alum solids from water treatment plant operation	Construction of holding basin for filter backwash sediments for separation and release of supernatant (possibly under permit)	Project Engineer to inspect. WAF Environment Unit to monitor with monthly reports during operation	Contractor to construct per contract and Proj. Engr. to inspect quality and adequacy and WAF Environment Unit to advise DOE to issue permit if needed	Estimated cost: $75,000 to $100,000 (capital cost only)
16. Worker safety, risk and accidents; health protection	Maintain full first aid equipment and materials as well as require all safety clothing, equipment and materials; require physician's health certification for all workers, with annual renewal	Project Engineer to inspect initially and monthly; provide replacements where necessary	Contractors, per contract, to provide all items of first aid, safety and health certification. WAF Environment Unit and Project Engineer to verify	Estimated cost: $15k to $20k

b) Mitigation Notes

- Since alluvial soils in the Rewa watershed have a high erosion index, protection of embankments from construction disturbances with large rock and rock filled gabions are needed;
- Commonly used temporary materials can be effective against sediment washing downhill if constructed and maintained properly. In some cases of very steep slopes, arrangement of barriers should be placed in a series when a single barrier may not be sufficient;
- Solid waste will accumulate at construction sites—from materials and from workers. Sanitary waste is handled through portable toilet facilities and washing facilities. Solid waste is collected in containers and deposited at the nearest official landfill, such as Naboro;
- Placement of top soil and vegetation in nearby low areas, but not intermittent streambeds, if not to be reused, is restored, ie compacted and if possible covered with soil and seeded with indigenous species;
- Areas for parking of vehicles and equipment should be in a place with an impermeable ground cover—paved or compacted clay to prevent seepage of hydrocarbons to groundwater and nearby environment and a protective berm should be placed around the edges of the are (one that cannot be flattened by vehicles/equipment);
- In coordination with the Fiji Roads Authority, when traffic becomes congested, assistance to drivers is provided by an individual directing traffic and with traffic cones for direction. This is used along with signage warning of construction ahead.
- Dust and noise, particularly in residential areas, are controlled through wetting with used oil or water, whichever is appropriate for the area, and noise is controlled both by setting limits (80 to 85 db) for noise and to also obtain agreement with residents for working hours;
- Disturbed areas can be restored with landscaping using indigenous plants, rather than ornamentals or imported species, where possible. Under no circumstance should a disposal area or disturbed area be merely left to “regenerate” on its own. In some cases this may involve simple landscaping, while in others extensive damming, bracing and terracing may be required;
- In constructing access roads, often at steep angles, controlling sediment loss (after clearing and deposition) with small check dams is important both to prevent future soil erosion from exposure and to prevent sediment deposit into watercourses, so the use on
- Similar to areas for parking of vehicles and equipment, the storage of construction materials and supplies, if not in sheds or covered buildings, should be done in areas with impermeable ground and a low berm around the edges;
- In Fiji rains are frequent and water runoff and control is important, so that clearing excavated areas of rain water is frequent and the return of sediment from pumped water is to be avoided—through capture and holding for separation and disposal or through the use of filters;
- Air pollution is to be avoided also, so that, besides the prohibition of open burning, all contractor vehicle emissions should be certified by LTA before construction begins through acquisition of Certification of Roadworthiness;

- Advanced knowledge as well as trend information and status quo all are important to supplies of raw water for public consumption, therefore identifying and collecting this information is a front line defense against contamination of supplies;
- Normally the operation of a water treatment plant is benign regarding emissions, however, the release of residuals (from the filter backwash process), particularly alum solids and other unhealthy residuals should be avoided through capture and settling for separation before releasing the supernatant and disposing of the solids residual; Release of the supernatant to the Rewa River will likely require a permit, depending on the analysis of the supernatant after operation begins;
- Workers health and safety should always be secured, therefore having all necessary certification and supplies available and required use is critical

c) Monitoring Notes

- Inspections are conducted during construction by Project Engineers, WAF engineers, Contractors and WAF Environment Unit personnel. They will be filing reports concerning quality of work, adherence to schedule, potential issues to be addressed. They more often will be recording the inspection with photos. Some inspections will be weekly because of the pace of work and the nature of the item for inspection, sedimentation, for example and other inspections may be monthly, habitat disturbance, for example. Some inspections may increase to daily should there be a need for the change due to environmental conditions—sedimentation control, river water quality sampling, for example.
- In the case of weekly river sampling, the following constituents as a minimum will be routinely monitored:
- temperature, ii) pH, iii) conductivity, iv) turbidity, v) TDS, vi) DO, vii) chlorides, viii) iron, ix) iron (total), x) manganese (total), xi) aluminum, xii) calcium, xiii) magnesium, xiv) copper, xv) nitrate-nitrogen, xvi) fecal coliforms, xvii) protozoa (Giardia and Cryptosporidia) and this weekly sampling is to be accompanied by recording the flow data at Navolau gauging station, so that weekly flow data will complement weekly water quality data.

d) Implementation Notes

- All construction contractors will have specified in their contract, with the guidance and approval of the WAF Environment Unit, **requirements** for
  a) bank stabilization for all streams
  b) sediment control for clearing, trenching, excavation, access road construction and all other removal of land cover
  c) worker, vehicular and machinery waste management
  d) placement of topsoil and vegetation
  e) traffic congestion equipment and personnel
  f) dust and noise control procedures
  g) habitat restoration and landscaping
  h) creation and management of areas for storage of equipment and supplies and for parking and servicing of vehicles and machinery
  i) management of standing rainwater at construction sites

j) provide certification of emissions for all vehicles
k) design and construction of settlement basin for alum solids at Rewa WTP
l) provision of safety equipment and clothing and certification of health for all workers

- The following parties will share **implementation** responsibilities (indicated in the EMP table). This is a summary of the detailed responsibilities described under Institutional Arrangements, Roles and Responsibilities above:
  a) bank stabilization—WAF Project Engineer, WAF Environment Unit
  b) sediment control—Project Engineer, WAF Environment Unit
  c) waste management—WAF Environment Unit
  d) topsoil and vegetation placement—WAF Environment Unit
  e) traffic management—WAF Environment Unit (coordination with LTA)
  f) dust and noise management—WAF Environment Unit
  g) habitat management—WAF Environment Unit
  h) access roads—WAF Environment Unit
  i) materials and supplies storage—Project Engineer, WAF Environment Unit
  j) standing water management—WAF Environment Unit
  k) vehicular emissions—WAF Environment Unit (coordination with Department of Environment)
  l) river sampling—WAF Environment Unit with treatment plant personnel
  m) residuals management—Project Engineer, WAF Environment Unit
  n) worker health and safety—Project Engineer, WAF Environment Unit

- Each contractor will retain a full-time environmental staff person to assist WAF Environment Unit in monitoring and reporting and also act as liaison in communications, briefings and progress reports. This person must be available at all times and not share duties with other contractor personnel. This position is the Contractor's Representative to the WAF Environment Unit.
- Each contractor will be subject to all Fiji environmental laws and subject to penalties if violated.
- Each contractor will provide all work, reports, materials and equipment per contract on schedule. Any delay, misrepresentation or failure in delivering services, project and materials will result in delay of payments until restitution is made.

e) Performance notes

274. Potential performance indicators that may be measurable, include:

- Number of environmental protective works completed on time and with high quality control;
- Successful operation of the alum solids control process;
- No accidents to workers that are protected (goal)
- No complaints from residents regarding noise and dust (goal)
- No accidents with persons falling into excavated areas (goal)
- No spillage of liquids, chemicals, materials into water bodies (goal)

J. SUMMARY AND CONCLUSIONS

1. Conclusions

275. All populations currently and for the future are assured a clean and safe water supply served through the new intake and treatment facilities on the Rewa River;

276. There do not appear to be any serious impacts and those that do occur are adequately mitigated;

277. Anticipated impacts from climate change and from mining on the Waidina River are avoided with the final location of the water supply intake.

2. Recommendations

a) Capacity Strengthening

278. In the planning, design, construction phases of the project there is a need for staff, equipment and materials in both the Environment Unit and the Trade Waste Unit. Examples of this need are: engineering and technical expertise, safety clothing and equipment, appropriate vehicles for sample, staff and equipment transport and formation of joint agreements with international NGOs, with international trade waste companies. An associate need is full funding and support for international certification of the National Water Quality Laboratory—equipment, procedures and staff.

b) Contractor Certification

279. As part of their qualifications to contract for the Subprojects, Contractors should be required to provide certification they all project managers and project technical personnel have both attended a short course—at least one week on Environmental Management. Course to be provided by WAF Environmental Unit, WAF staff in cooperation with Department of Environment and other relevant institutions—USP/FNU, natural resource agencies, and others. Example topics might include: laws and legislation, procedures for sampling, installation of control measures, water supply and wastewater technology, monitoring and mitigation, natural resources in Laucala Bay and Rewa River watershed and other topics.

NOTE: this certification could be expanded to include all WAF contractual procedures, scheduling, requirements, penalties, qualifications and other topics.

c) WAF Library

280. There is a need to develop a serious library for permanent and reference records, for critical documents, for books as both reference and background—subjects in engineering methodology, survey techniques, environmental quality and regulations and guidelines, accounting and auditing processes. Provision of adequate space for now and future expansion is as important as the content of the library. There should be a **full-time** librarian in charge.

d) Climate Change

281. Given the government policy, international verification and immediate impacts of climate change in the South Pacific, it is time for WAF to develop a full and complete (with annual revisions and updates) Climate Change Action Plan and to implement it. This is a task for perhaps the Strategic Planner to initiate with inputs from all WAF units and relevant personnel. Eventually best practice procedures should be developed for all departments going forward and implementation of the Plan should be part of all reports and projects. This work should be carried out in conjunction with the updating and implementation of the Code of Environmental Practice.

e) Integrated Water Resource Management

282. Upstream watershed protection is always a concern for downstream water users. With the passage of time, WAF will be increasingly concerned with the protection of their investments and assets, as well as public safety. The development of the current new source in the Rewa River at Viria will source water from the largest watershed in Fiji (roughly one-third of the land area of Viti Levu). Currently upland watershed contains numerous activities—farming, forestry, mining, industrial processing and other development with construction implications—that have consequences for downstream users, particularly raw water for drinking. At the moment, there is no government agency in charge of watershed management, but parts are managed by the Ministry of Lands and Mineral Resources, Ministry of Agriculture, Ministry of Forestry, i-Taukei Land Trust Board, Ministry of Town and Country Planning and other ministries and departments—fisheries, environment, energy, roads and others. There is an urgent need for coordination of planned and operating watershed activities and a plan for sourcing and maintaining quality water resources for WAF. A strategy for managing the watershed in a sustainable manner is needed and WAF could take the lead in preparing such a plan.

283. In proposing an aggressive program of integrated water resource management through legislation ultimately, but in the short term through committees, working groups and other cooperative arrangements, a solution can be achieved. There are many approaches already in place—local, regional and with national agencies claiming responsibility for water resources, but there is no permanent legislation clearly spelling out roles, responsibilities at all levels to preserve what is still a natural gift to the Fijian people.

ANNEXES

A–1 Relevant Conventions, Policy and Plans

Green Growth Framework (2014)

Peter Wise, Permanent Secretary of the Ministry of Strategic Planning National Development and Statistics summarizes the National Green Growth Framework for Fiji: Restoring the Balance in Development that is Sustainable for Fiji as follows:

> "The Framework is a tool to accelerate integrated and inclusive sustainable development that inspires action at all levels in the country to build environmental resilience, build social improvement and reduce poverty, build economic growth and build resilience to the anticipated adverse effects of climate change.
>
> To support its vision of "A Better Fiji For All" and taking into consideration the global and regional developments in green growth, the guiding principles of the Framework are as follows:
> - Improving resource productivity (doing more with less);
> - A new integrated approach, with all stakeholders collectively working together for the common good. The cross-cutting nature of issues relating to sustainable development requires harmony and synergy in the development strategies;
> - Socio-cultural education of responsible environmental stewardship and civic responsibility;
> - Increasing adoption of comprehensive risk management practices;
> - Increasing adoption of environment auditing on past and planned developments in order to support initiatives that not only provide economic benefits but also improve the environmental situation;
> - Structural reform to encourage fair competition and efficiency; and
> - Incentivizing investment in efficient use of natural resources.
>
> Regulatory and institutional arrangements needed to further develop and strengthen the national enabling environment in order to support the application of this Framework and assure that risks are identified and addressed, and development is sustainable include the following:
> - Partnerships;
> - Informed Decision-Making;
> - Human Resources and Capacity Building;
> - Governance Mechanisms;
> - Regulatory Framework;
> - Technological Innovation and Development;
> - Strengthening Private Sector Development; and
> - Finance and Economic Incentives.
>
> Ten Thematic Areas were identified to stimulate the development and/or strengthening of an integrated and cross cutting national enabling environment for future development. This contrasts with the traditional sector focused approach which has increasingly been referred to as "working in silos". This approach highlights the opportunity the Green Growth Framework provides for Fiji to do business differently. At the same time it encourages people to think outside the box. Furthermore, it is an approach that accepts that business as usual is

no longer an option for Fiji. Every attempt has been made to keep the Thematic Areas to a manageable number whilst at the same time leaving nothing or no-one out. Each includes a section on key challenges and a way forward including actions and time-bound indicators. They are grouped in alignment with the three pillars of sustainable development.

Environment Pillar:
- Building Resilience to Climate Change and Disasters;
- Waste Management;
- Sustainable Island and Ocean Resources,

Social Pillar:
- Inclusive Social Development;
- Food Security;
- Freshwater Resources and Sanitation Management.

Economic Pillar:
- Energy Security;
- Sustainable Transportation;
- Technology Innovation and Development;
- Greening Tourism and Manufacturing Industries."

The National Summit endorsed the Framework and recommended it to Cabinet subject to some changes made during working group consideration of the Framework. It is anticipated implementation will commence with translation into the two vernacular languages and a vigorous advocacy and awareness campaign."

National Climate Change Policy 2012

The National Climate Change Policy is based on the *Climate Change Policy Framework*, endorsed by Cabinet on Tuesday 4 December, 2007. The Policy is aligned to the *Roadmap for democracy and sustainable socio- economic development 2009–2014*, which identifies the need to give priority to protection of the environment, sustainable management and utilization of natural resources.

The policy presents objectives, principles and overarching strategies to effectively address constraints. It is intended to guide the development of detailed strategies and assist in the formulation and delivery of projects and initiatives.

Mission:

- To increase Fiji's capacity to cope with the impacts of climate change by strengthening institutional and legal frameworks, providing sound scientific information, and implementing effective awareness and education initiatives
- To maximize access to and secure globally available financing for climate change mitigation and adaptation efforts
- To strengthen Fiji's support towards neighboring Pacific Island countries that are highly vulnerable to the impacts of climate change
- To strengthen engagement in international climate change policy processes and fulfill obligations on climate change mitigation and adaptation

Policy goals:

As a signatory to various international agreements and conventions such as UNFCCC, UNCCD, CBD, and the Kyoto Protocol, Fiji is obligated to develop appropriate national responses. It is also fitting that Fiji establishes national mechanisms that contribute to addressing issues identified in regional policies.

The goals of this climate change policy are:

1. to support the implementation of Fiji's *Roadmap for democracy and sustainable socio-economic development 2009–2014* under the *People's charter for change, peace and progress;*
2. to promote integration of climate change issues in national planning, budgeting and implementation processes;
3. to provide guidance on government's responses to climate change issues;
4. to guide sectors to develop appropriate climate change adaptation and mitigation strategies;
5. to support requests to regional and international agencies to provide resources and assistance in addressing national climate change issues;
6. to contribute to Pacific regional actions and to meeting international commitments.

Policy principals:

1. Long-term sustainability
2. An integrated approach
3. Community ownership
4. Strategic partnerships
5. Scientifically sound and appropriate information
6. Reporting and feedback mechanisms
7. Monitoring and evaluation
8. Equity and fairness
9. Practical, affordable and appropriate solutions
10. Gender considerations
11. Incorporating lessons learned
12. International collaboration

National Biodiversity Strategy and Action Plan

The Convention on Biological Diversity was signed by Fiji and more than 150 other nations on 5 June 1992, at the United Nations Conference on Environment and Development in Rio de Janeiro. The Convention came into force in December 1993 and as of February 1999, 174 countries and the European Union have ratified the convention. Fiji is, therefore, a Contracting Party to the Convention. One of the obligations of the CBD is preparation of a strategy and plan for biodiversity. It was endorsed by Cabinet in 2003.

Goal: To conserve and sustainably use Fiji's terrestrial, freshwater and marine biodiversity, and to maintain the ecological processes and systems, which are the foundation of national and local development.

Guiding Principles

- The conservation and sustainable use of Fiji's biodiversity is the foundation for all
- Biodiversity conservation is central to sustainable use of biological resources.

- Biodiversity conservation is a collective responsibility of all levels of government, the private sector, resource users and landowners.
- Biodiversity conservation in Fiji is greatly dependent on the manner in which landowners and local user communities choose to manage their landholdings and fishing rights ownership;
- Control of local resources by traditional resource owners and users is critical to the success of biodiversity conservation.
- Biodiversity conservation initiatives ensure that local communities and both men and women have continued access to the resources required to meet subsistence needs.
- That although communal land ownership has played, and continues to play a positive role in biodiversity conservation, the increasing commercialization of natural resource use is threatening this system and constitutes a major challenge to biodiversity conservation.
- Biodiversity is best conserved in those places where it naturally occurs (*in situ*), however *ex-situ* conservation may be needed to assist in the conservation management of threatened species or forms.
- The establishment of a comprehensive and representative system of reserves and conservation areas at the national and local levels is critical to successful biodiversity conservation;
- The conservation and sustainable management of Fiji's natural forests is the single most important means of conserving the vast majority of Fiji's endemic fauna and flora;
- To conserve and sustainably use Fiji's terrestrial, freshwater and marine biodiversity, and to maintain the ecological processes and systems which are the foundation of national and local development.
- The conservation and sustainable management of Fiji's reefs, lagoons and mangroves as well as its freshwater habitats are critical significance to sustaining the traditional livelihoods of the majority of Fiji's rural communities;
- The control of invasive organisms is critical to the success of biodiversity conservation.
- Improved scientific knowledge of biodiversity and enhanced ethnobiological understanding is required for improved conservation management and sustainable use.
- Inadequate knowledge should not be used to defer or prevent biodiversity conservation.
- Biodiversity conservation is a specialized discipline, which requires advanced training, skills and international collaboration.
- Education, public awareness and local knowledge are essential for enabling the conservation of biodiversity.
- The principle of polluter and/or user pays is adhered to when assessing responsibilities relating to the use and conservation of biodiversity.
- Biodiversity conservation initiatives should be implemented in a way that local communities - men and women and youth are actively involved in their planning, implementation, monitoring and evaluation.
- The intellectual property rights to biodiversity, genetic resources, bio-derivatives and knowledge about biodiversity be recognized and that appropriate mechanisms adopted to ensure, henceforth, fair remuneration, credit or other benefits are received by local communities, the discoverer or developer, and the nation.

Relevant International Conventions

b) Cartagena Protocol on Biosafety to the Convention on Biological Diversity 2001/3

Fiji's National Biodiversity Strategy and Action Plan is maintained and updated in support of this protocol.

c) Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) 1997. Ratified

The Endangered and Protected Species Act 2002 is enacted to support this convention

d) Convention on Wetlands (Ramsar)

Fiji signed on November 8, 2006 and it was entered in force on 11 August 2006.

Recent meetings on the Pacific Mangrove Declaration have been held in Suva. Secretariat of the Pacific Regional Environmental Program (SPREP) is developing a draft Charter. The Rewa River area (Nasoata mangrove island) will be proposed to list under Ramsar Convention.

A–2 National Water Quality Laboratory (NWQL) Chemical Sampling

A–3 Rewa Flow Data

A–4 USP Lab Results

A–5 Climate Change Studies

* Above annexes available upon request due to file size

A–6 Stakeholder Meeting Minutes

Consultation Meeting Minutes

Venue: Waitolu Community Hall.

Date: 26/05/15

Stakeholders: Villagers, WAF, Provincial Office

Attendees: 30 people

- Meeting proper started with the presentation of the sevusevu to the village elders by the Assistant Roko Tui Naitasiri.
- A prayer was offered by one of the village elders to start the meeting.
- Assistant Roko briefed the house of the purpose of the consultation meeting which was to inform the village of the proposed Rewa River Water Source Project and its purpose.
- LAO Naca Lewesi briefly outlined the purpose of the project adding that the project site will facilitate a raw water intake, a treatment plant in Wainikia, Viria and part of the pipeline with the remaining pipeline to be constructed will follow the existing road network to the proposed reservoir site.
- The proposed pipeline will also be passing through the village following the main road.
- Also the proposed reservoir site that is to be constructed on top of the hill past Waitolu village.
- APM Mosese Temo gave a brief on the technical and civil works that is involved in the proposal mainly the construction of the pump station and treatment plant with part of the pipeline that will be passing through.

Q & A

- ***A question was raised regarding the land that is to be acquired for the pipeline and the reservoir site.***
  Answered by Naca stating that the after the survey is conducted then TLTB will come in to facilitate the land dealings for the landowners with confirmation of the boundaries of the proposed site to be acquired.

- ***A question was raised about how the land consent will be obtained since the land is communally owned by the 'yavusa' together with the village of Nacokaika.***
  Answered by Naca that Nacokaika village will also be visited for the same consultation meeting scheduled for Thursday.

- ***A question was asked if it was possible to connect the village to the proposed system when completed.***
  Answered by Mosese stating that there is a high possibility of this happening given the proximity of the village to the project location of the proposed reservoir site. The WAF to confirm and let the village if there are any processes that the village needs to follow to make this happen.

- ***A question asked was if it was possible for the youths to be employed in the project when it comes through their land.***
  Answered by Mosese stating that this can be facilitated by the WAF.

Meeting proper was closed by the Assistant Roko with a vote of thanks on behalf of the visiting delegation to the vanua and the presentation of the 'i tatau'.

Consultation Meeting Minutes

Venue: Navuso Community Hall.

Date: 27/05/15

Stakeholders: Villagers, WAF

Attendees: 15 people

- Meeting proper started with the presentation of the sevusevu to the village elders by the LAO Naca.
- A prayer was offered by one of the village elders to start the meeting.
- LAO Naca briefed the house of the purpose of the consultation meeting which was to inform the village of the proposed Rewa River Water Source Project and its purpose as a solution to the low water level at Waimanu and Waila previously during last years' dry seasons.
- LAO Naca Lewesi also outlined the works involved of the project adding that the project site will facilitate a raw water intake, a treatment plant and part of the pipeline along the existing road network to the proposed reservoir site and to Raralevu.
- The main purpose of the meeting at Navuso as clarified in the forum was the acquisition of the land proposed for the reservoir site.

Q & A

- ***A question was raised regarding the employment of the villagers in the project .***
  Answered by Naca stating that WAF to facilitate this request as it has been the practice for previous projects crossing native land for villagers to be recruited as project staff.

- ***A question was raised about the completion of the reservoir and if the locals can be employed as attendants to look after the reservoir.***
  Answered by Naca stating that this request can be an issue to be further discussed by WAF and the land owners in the future until the completion of the project. May also require top level management to decide.

- ***Question was also asked the portion of land to be acquired, the area required for such development and how will it be acquired.***

Answered by Naca saying that after completion of the survey of the proposed sites there would be clear demarcation of the land boundaries and how much to be acquired as per the designs for the reservoir and pipelines. This will also show the area of land required and the ownership of the land.

This results with the assistance of TLTB will be brought back to the relevant Land Owning Units affected for further consultation.

Meeting proper was then closed by LAO Naca with a vote of thanks on behalf of the visiting delegation to the vanua and the presentation of the 'i tatau'.

Consultation Meeting Minutes

Venue: Navatuvula Community Hall.

Date: 27/05/15

Stakeholders: Villagers, WAF

Attendees: 20 people

- Meeting proper started with the presentation of the sevusevu to the village elders by the LAO Naca.
- A prayer was offered by one of the village elders to start the meeting.
- Assistant Roko briefed the house of the purpose of the consultation meeting which was to inform the village of the proposed Rewa River Water Source Project and its purpose.
- LAO Naca Lewesi briefly outlined the purpose of the project adding that the project aims to assist Waila and Waimanu to boost supply to the current system mainly for the projected future demand.
- That the project site will facilitate a raw water intake, a treatment plant in Wainikia, Viria and part of the pipeline with the remaining pipeline to be constructed will follow the existing road network to the proposed reservoir site on the hill at Waitolu village.
- Proposed pipeline route passes through the village following the existing road network and is the main reason for the consultation meeting.
- Re assured the villagers that the survey has just begun and the exact pipeline route has not been confirmed yet. After the survey there will be another meeting with the affected land owning unit and to facilitate land negotiations TLTB.

Q & A

- ***A question was raised regarding the land that is to be acquired for the pipeline.***
  Answered by Naca stating that completion of the survey will confirm the exact pipeline route then TLTB will come in to facilitate further land negotiations for the landowners and the WAF.

- ***A question was asked if it was possible to connect the village to the proposed system when completed.***
  Answered by Naca stating that the village will be connected to the proposed system since it is also a reason for the project to connect new areas. Should there be any need for the village to fulfil any requirements, WAF will let the village know.

- ***A question asked was if it was possible for the youths to be employed in the project when it comes through their land.***
  Answered by Naca stating that WAF will facilitate this request and that it has been the practice in previous projects where it crosses Native land.

Meeting proper was closed by the presentation of the vote of thanks on behalf of the visiting delegation to the vanua and the presentation of the 'i tatau' by LAO Naca.

Consultation Meeting Minutes

Venue: Viria Community Hall.

Date: 26/05/15

Stakeholders: Villagers, WAF, Provincial Office

Attendees: 15 people

- Meeting proper started with the presentation of the sevusevu to the village elders by the Assistant Roko Tui Naitasiri.
- A prayer was offered by one of the village elders to start the meeting.
- Assistant Roko briefed the house of the purpose of the consultation meeting which was to inform the village of the proposed Rewa River Water Source Project and its purpose.
- LAO Naca Lewesi briefly outlined the purpose of the project adding that the project site will facilitate a raw water intake, a treatment plant and part of the pipeline to the proposed reservoir.
- Also that the subject land is of freehold tenure.
- PM Mosese Temo gave a brief on the technical and civil works that is involved in the proposal mainly the construction of the pump station and treatment plant with part of the pipeline.

Q & A

- ***A question was raised regarding the employment of the villagers in the project .***
  Answered by Mosese stating that WAF to facilitate this request.

- ***A question was raised about the traditional fishing rights "i qoliqoli" of the village of Viria since the land is freehold.***
  Answered by Naca that the WAF to clarify on how the issue of traditional fishing rights "i qoliqoli" is addressed. (TLTB, NLC, FAB)

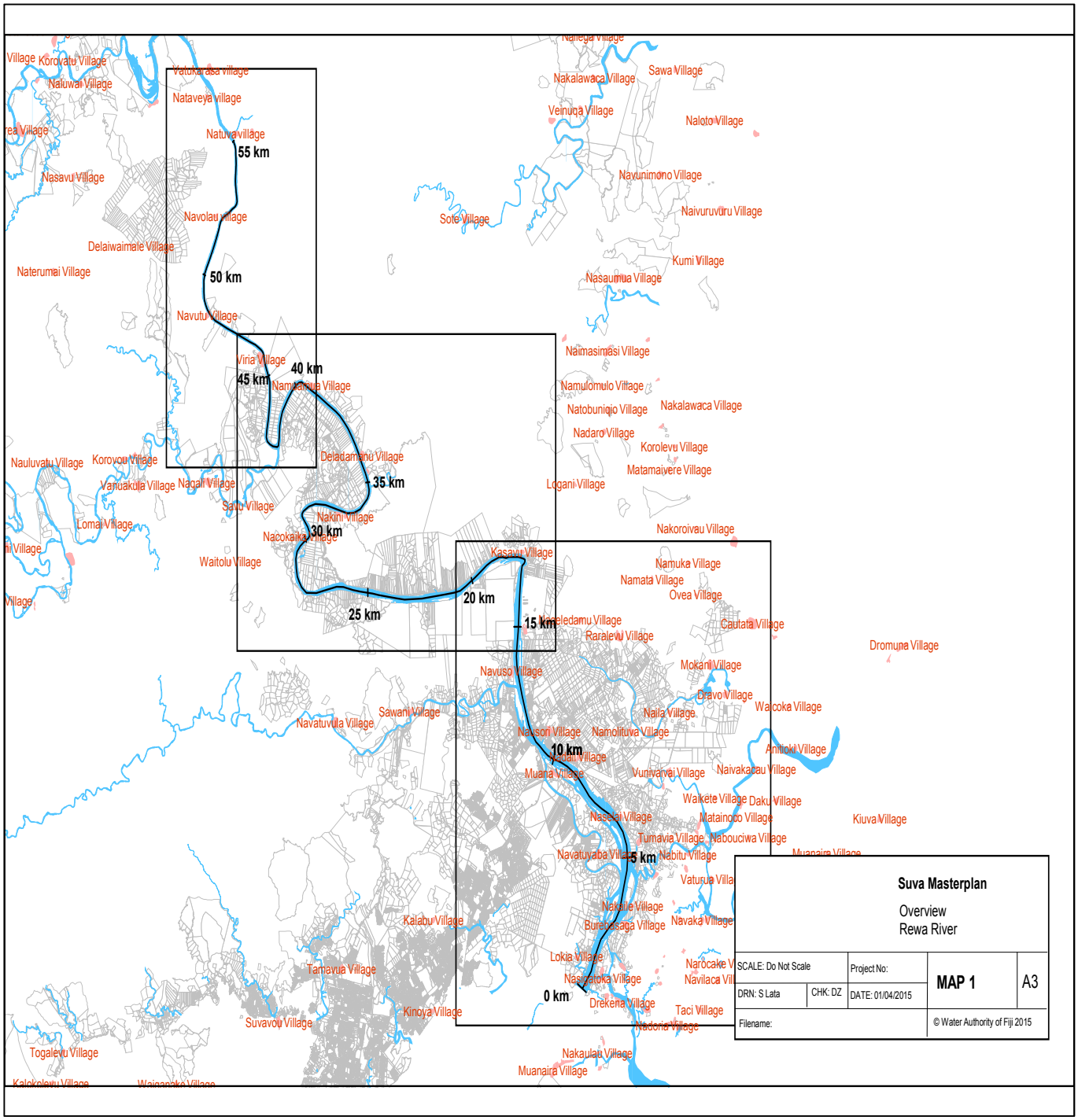
- ***Last question asked was if it was possible to connect the village, the two schools and neighbouring farms to the proposed system when completed.***
  Answered by Mosese stating that there is a high possibility of this happening given the proximity of the village to the project location. The WAF to confirm and if there is a process that the village needs to follow to make this happen.

  Meeting proper was closed by the Assistant Roko with a vote of thanks on behalf of the visiting delegation to the vanua and the presentation of the 'i tatau'.

A-7 Rewa River Studies

Figure 1 shows the Rewa River up to slightly beyond Viria, with kilometer marks each 5 kilometers, so the reader can get some idea of distances in reading the discussion of the studies below.

Figure 1 – Rewa River



a) The 2000 Study

This study was designed to examine water quality at 8 sites over a 12-month period in 1999 on the Rewa River.

In summary for the 2000 study:

- For salinity, the influence of sea water only reaches Nadali;
- For heavy metals in the water column, Pb, Cd and Cu levels exceed recommended levels at both reference sites and study sites and suggest the influence of the Copper mine;
- For heavy metals in kai tissue, means for the study area exceeded the recommended levels for Cd and Pb, while Cu levels were under the recommended levels and Zn exceeded the recommended levels only at the reference site, presumably influenced by the Namosi mine;
- For heavy metals in sediment, values in the study exceed recommended levels for Pb, Cu and Cd at some sites and at the reference sites, all values are within recommended levels, with some close to the limit.

b) The 1995 Study

A low-flow water sampling and analytical program was undertaken in the drainage system downstream of the Namosi Prospect in August 1994, where the primary objective was to characterize existing water quality at a number of stations during the 1994 dry season. Water samples were taken at:

- Waisoi Creek East
- Waidina River at Nabukaluka
- Rewa River at Nausori Bridge
- Rewa River at Drekeinakelo

Findings included:

- General water quality variables were generally typical of Ca-HCO_3 waters;
- Some marine influence was evident at the Nausori Bridge site (based on slightly higher conductivity readings);
- Total suspended solids concentrations at all sites were low;
- Concentrations of key trace metals (Cu, Cd, Pb, Zn, As, Sb, Se and Hg), other than Waisoi Creek, reflected the low suspended solids values;
- Arsenic and copper levels at Waisoi Creek East were elevated relative to concentrations at the other sites;
- Concentrations of the key trace metals, other than copper at Waisoi Creek East, were lower than relevant ecosystem protection and drinking water guidelines;
- Copper concentrations at Waisoi Creek East were potentially problematic with respect to aquatic biota.

c) The 2015 Study[32]

The National Water Quality Laboratory (NWQL) focused on four sets of analyses: salinity, riverbed slope, chemical constituents and heavy metals.

Salinity

[32] Water Authority of Fiji, National Water Quality Laboratory. Unpublished data. 2015.

A total of 14 sampling exercises were carried out to determine the salt wedge. The above three results shows high tide results that stands out for maximum intrusion of salt water upstream.

The highest point is at Nausori Airport with a reading of 0.1ppt on the 20th of February and full high tide at 7.00am and sample was obtained at that point in time.

For low tide the salt wedge was detected at the Fisheries Station, which is 1.62km down from the Nausori Airport.

This was the only low tide result, as the other 14 sampling results have no salinity value detected since location was changed mainly from upstream at Nadali till Naduruloulou.