



**ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR WATER SUPPLY
IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY IN
KANYAKUMARI DISTRICT**



APRIL 2021

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List of Abbreviations

CPHEEO	Centre for Public Health Engineering and Environmental Organization
ESMF	Environmental and Social Management Framework
EMP	Environmental Management Plan
GLSR	Ground Level Service Reservoir
LL	Lakh Litres
LPCD	Litre Per Capita Per Day
LPM	Litres Per Minute
LS	Longitudinal Section
MLD	Million Litres per Day
NH	National Highways
OHT	Over Head Tank
PAP	Project Affected Person
SH	State Highways
TN – PWD	Public Works Department – Tamil Nadu
TNEB	Tamil Nadu Electricity Board
TNPCB	Tamil Nadu Pollution Control Board
TNUIFSL	Tamil Nadu Urban Infrastructure Financial Services Ltd.
TWADB	Tamil Nadu Water Supply and Drainage Board
WRO	Water Resources Organization
WSIS	Water Supply Improvement Scheme
WTP	Water Treatment Plant
WUC	Water Utilization Committee

EXECUTIVE SUMMARY

Introduction

Kanyakumari District is named after the goddess 'KANYAKUMARI'. The district lies at the southernmost tip of the Indian peninsula, where Indian Ocean, Arabian Sea and Bay of Bengal confluence. Kanyakumari District is located geographically at 8° 10' North latitude and 77° 25' East longitudes. Nagercoil is a Special Grade Municipality and the headquarters of Kanyakumari District. It lies at a distance of 20 KM from Kanyakumari. It is located at a latitude of 8°10'47" N and longitude of 77°21'50" E.

Existing water supply

Three water supply schemes are now functioning with Mukkadal Dam and Ananthanar channel other than the bore wells as source.

I. Water supply schemes executed by Travancore Cochin State during 1941.

The Scheme was designed for 7.08 MLD and 96 km D'System laid.

II. 1st Improvement scheme executed by TWAD during 1978.

- The improvement scheme was carried out for 13.5 MLD and 35.90 km D'system laid. Work carried out under deposit scheme by Municipality
- *5Nos. of Bore well provided by the Municipality for the areas MelaSoorangudi, Maravankudieruppu and Punnainagar.*

III. 2nd Improvement scheme executed by TWAD during 2002.

Improvement Scheme was carried for 90 LPCD for a daily requirement of 30.5 MLD.

Need for the Proposal

At present the level of supply of water to Nagercoil Municipality is 85 lpcd and with a supply once in five days. UGS Schemes has been sanctioned for Nagercoil Municipality and is under progress. Therefore prorate level of water supply has to be increased from 90 lpcd to 135 lpcd. In order to enhance the level of supply to 135 lpcd to urban local bodies, it is necessitated to formulate this proposal.

Scope of the Proposal

Considering the increasing demand of water supply of Nagercoil municipality as per the standards prescribed for the present and future year requirements, the water supply improvement scheme has been formulated. The present supply is inadequate ie 85 lpcd which is distributed once in 5 days.

This Project is to be implemented under World bank assisted Tamilnadu Sustainable Urban Development Project (TNSUDP).

Categorisation of Project

The proposed project is classified as **Environmental Categorisation as E1** (water treatment plant, water supply augmentation with new source/ head work/intake works). Hence this project requires detailed Environmental Impact Assessment and preparation of management measures. **Social Categorisation of Projects**, the number of PAPs in this project is nil, hence this project can be categorized under **S-3 category**.

Project Description

Introduction

The proposed project involves the construction of offtake well in Paraliyar River near Puthan Dam. The water is then treated in water treatment plant at Krishnankovil to make it more acceptable and specific to end use like drinking etc., The treated water is taken to Service reservoirs of 23 nos (12 Existing and 11 Proposed) through distribution networks connecting them.

Salient details of the project components are given below:

- Head works – For drawal of 52.04 mld (ultimate) from Paraliyar river
- Raw Water Pumping main for a length of 31.85 km
- Water Treatment Plant to treat water 41.12 mld (intermediate requirement) at existing WTP site in Krishnancoil – 2 units (demolishing and reconstructing) 1 unit – Augmentation- 1unit
- Clear Water Pumping Main I, II, IIIs for a total length of 31.006 km
- Length of Pipe carrying bridges 40m, 20m, 30m & 60m.
- Proposed Service Reservoirs – 11 Nos.
- Connecting to Existing SRs (12 nos) and proposed SRs (11 nos)

- Distribution system – 420.612 km
- HSC – 85000 NOS.
- SCADA – To monitor entire scheme for effective functioning.

Cost Details

The total cost of the project is **Rs. 251.43 Crores and addition, cost towards GST & Tender Excess is Rs.44.64 Crores.** The base cost/ initial cost of the project is estimated around **Rs.186.21 Crores.** The annual maintenance cost is about Rs 19.17**Crores.**

Head Works

It is proposed to tap 52.04 MLD of surface water from river Paraliyar by constructing 8m dia. Off-take well on the upstream side of Puthen Dam.

Off-take well cum pump house

MFL	=	76.50m
G.L.	=	70.98m
F.V.L.	=	64.98m
L.S.W.L.	=	67.98m

Raw Water Pumping Main

The water from the off take well is proposed to be pumped by means of 115 HP Turbine pump set with a duty of 14899 lpm x 26m head(2 nos.) parallel pumping (1No stand bye) to the proposed Aerator of the WTP through the proposed raw water pumping main as detailed below.

914mm x 8mm thick MS pipe – 20.190 km

813 mm x 8 mm thick MS pipe – 11.660 km

Treatment Plant

The proposed for construction of a new water treatment plant of 41.12 MLD capacity at Krishnancoil for the raw quantity from the Puthen dam using aerator, stilling chamber, raw water channel, Dividing chamber, Flash mixer, Clariflocculator, Flocculator, Clarifier, Filter bed and Clear water sump cum pump house and to enhance the treatment capacity of the existing treatment plant III upto 18 MLD for the raw water from the Mukkadal dam.

Analysis of alternatives:The Treatment plant site at puliyadi was selected for Nagercoil water supply improvement scheme and further alternatively WTP site has been changed which reduces cost of the scheme and further, the site for WTP belongs to Nagercoil Municipality.

Clear water Pumping Main

Water from the clear water sump will be pumped through 3 clear water pumping main (I, II, III) to the service reservoirs of 23 Nos (Proposed - 11 Nos. and existing - 12 Nos.).

Service Reservoirs

The clear water conveyed from the WTP at Krishnankovil will be stored in the newly proposed elevated Service reservoirs -11 Nos., existing elevated Service reservoirs -11 Nos. and GLSR- 1 No. for the entire Nagercoil Municipality.

Distribution System

It is proposed to use HDPE pipes up to 200mm dia. and above 200mm DI pipes in the existing and proposed distribution network. Accordingly the proposed distribution network for a length of 420.612 Km with new HDPE and DI pipes.

House Service Connections

It is proposed to provide 85000 Nos of House service connections to Nagercoil Municipality.

SCADA

SCADA system to be monitored at the Head works, WTP and Service Reservoirs, gathering the real time data from remote locations.

Source Sustainability

Water Balance Study:

Average outflow from Pechiparai and Perunchani dams	- 20292.97 mcft
Water required for irrigation	-9715mcft
Water required for existing WSS	-1494 mcft
Water demand for WSIS to Nagercoil municipality	- 670 mcft (52.04 mld)
Balance water available	- 8414 mcft 238.30 Mm ³

The above water balance study reveals that the total ultimate requirement can be tapped without any difficulty.

ENVIRONMENTAL REGULATORY FRAMEWORK

The proposed activity has no social impact and hence the project falls under **S3** as per **Social Categorization of ESMF** and is classified as **E1** as per **Environmental Categorization of ESMF**. Hence this project requires detailed environmental impact assessment and preparation of management measures.

Source Clearance

Approval for the proposal to tap 52.04 MLD of water from River Paraliar from Water Utilization Committee of PWD is under process.

Clearances/ NOC Required from Competent Authority

S.NO	Activity	Clearance / NOC Required	Statutory Authority	Status
1	Withdrawal of raw water (52.04 MLD) from Paraliar River	Clearance to be obtained from Water Utilization Committee of PWD for 52.04 MLD for the Ultimate stage Demand.	PWD – Water Utilisation Committee	Clearance obtained from Water Utilization Committee of PWD for 52.04 MLD
2	Construction of off take well in the headworks.	Alienation	Revenue	Enter- upon permission has been given by the District Collector.
3	Construction of pipe carrying bridges for river crossing	Permission	PWD	Obtained permission from PWD for construction.

BASELINE ENVIRONMENTAL PROFILE

Objective of the Study

The object of the study is to identify and assess the likely environmental and other Socio–economical Public Health Impacts of the project and its components. The study shall

derive an Environmental Management Plan for bringing out the project to environmentally sound and socially acceptable besides fulfilling their water requirement.

Surface Water Quality

There is no pollution occurred in the river source. The surface water quality of the river source from samples collected from Puthendam during different seasons.

- The pH of surface water in the study area is 6.9 & 7.22 and Conductivity is 181 & 345 $\mu\text{S}/\text{cm}$.
- TDS values were found to be 78 & 30 mg/l and Total Hardness found to be 34 & 10 mg/l. This indicates that water in the study area was hard in nature and it is observed that it lies within the standards. The Total alkalinity found to be 18 & 8 mg/L. These values are within the standard limit but turbidity is (18 & 127) above the standard limit.

The Existing SR site and Consumer Endwater quality is analysed. As the turbidity is very high and iron content is found to be above the permissible limits. Hence a full scale water treatment plant is proposed to treat the water to reduce the turbidity to bring the other parameters within the standard limits and to give residual chlorine at the consumer end.

Soil Analysis

The soil characteristics in the project sites are analyzed. The pH indicates that the soils in the study areas are basic in nature, with the pH varying in the range of 5.1 to 7.1. The Electrical Conductivity was observed in the range of 0.045-0.038mS/cm.

The Nitrogen values are in the range of 124 – 129 mg/kg indicating that soils have high Nitrogen levels. The Phosphorous values are in the range of 38 – 46 mg/kg indicating that soils have an average Phosphorous level. The Potassium values range between 9.8 – 9.5 mg/kg, which indicate that the soils have low quantity of Potassium. The soil from the study area shows that they are less fertile.

Biological Environment

Terrestrial Animal Ecology

The dominant groups are spiders, Theylphonus and Galeodes. Among vertebrates, field rats, Mabuya and Calotes are common. None of them belong to the rare or endangered species.

Terrestrial plant Ecology

The main cultivated crops are paddy, banana tree etc., the uncultivated lands are covered by a massive growth of species such as Rubber, partheniumhystopharus, Annona squamosa, Musa paradisiacal and some Herbaceous plants like Tephrosiasps., Tephrosiapurpurea etc., Kanyakumari District accounts for more than 95% of the production of natural rubber in the state of Tamil Nadu.

Socio Economic studies

The total present population of the study area is about 246753. The project area is about 1672 sq.km. The literacy level of the above area is about 91.96%.

The entire project area have been provided with electricity and well connected by road. Basic amenities like water supply, transport, telephone, post and telegraph, public health and sanitations facilities, health centers, recreation facilities like cinema, etc., are moderately available to the people.

ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

The impact during the construction and operation phase on land use , topography, surface water, ground water, ambient air quality, noise quality, land environment, traffic, ecology and social aspects have been assessed and management measures have been identified. Impacts will be minimal on account of the proposed mitigation measures.

Ambient Air Quality

Heavy machineries used for the project will be less, impacts on ambient air quality due to vehicular emissions will be insignificant. It is also to be noted that these impacts are temporary in nature and will have moderate impacts on the settlements along the proposed pipe line alignment. However, to minimize these minor air quality impacts measures such as periodic dust suppression measures to be implemented.

No component of the proposed water supply system is a source of air pollution during operation except DG sets which would be operated only during power failures. No impact on Air quality is anticipated along the pumping main.

Noise Levels

The impact on sensitive areas could be mitigated by staggering the operation of construction equipment and avoiding construction during night times so that the noise levels are reduced to the permissible limits. Considering the onsite noise levels, Personal Protective Equipment (PPE) such as ear muffs, etc. to the construction workers are provided.

The pump sets/motor noise levels are maintained as per norms, ie 85-90 dB at 1 mtr distance and it is reduced at the boundary of the site. In every location only 2 pump/motor sets are running at a time and the cumulative noise levels are expected to /rise. However in any case of requirement, the staff would be provided with PPEs while entering the pump room.

Water Environment

No pollution causing activities are proposed in upstream side of the River. However, during construction of the offtake well, care shall be taken to avoid dumping of construction debris, accidental spill of hazardous materials etc. into the River.

Further, rain water harvesting have been proposed in all the project sites including the administrative building, control rooms etc in the WTP and SR sites for recharging the ground water sources.

The wash water is collected in a back wash water collection sump from which it is pumped into the plant raw water inflow.

The Quarters at the Head works will be provided with sanitation facilities and the sewage arising from these units would be disposed through proposed septic tanks. The administration building in the WTP site has existing sanitation facilities and the sewage arising from this facility is disposed through already available septic tank.

Air valve is provided at an interval of 500m in all transmission main to prevent leakage.

Soil Environment

Soil erosion may take place from the pipeline alignments if the soil is not compacted properly after filling the trenches and if the excess soil is left at the site. Pollution would take place to a negligible extent due to spillage of construction material, oil, fuel and grease around the construction sites. Care should be taken to minimize spillages of construction materials.

Water treatment sludge will be dried in sludge drying beds and collected in Sludge pit and later periodically disposed to Dump yard. Water collected from under drain of sludge drying bed will be sent to recirculation sump and then recirculated with raw water.

Biological Environment

No forest areas, wild life sanctuaries or protected areas are present in the project influence area. No tree cutting is envisaged for laying of transmission lines, but during implementation options would be reviewed and it will be ensured that tree cutting would be minimized if any cutting is required. Further it is proposed to plant around 100 new trees as part of the scheme in the project sites like HW and SR sites.

Energy consumption and conservation

The total power consumption for the pumping mains and other miscellaneous consumption (lighting etc) is 630kw. The pumps are selected with efficiency level of 75% which is more economic in power consumption. Also the pumps are with 950-1000 rpm selected so as to minimize the power consumption compare to the high rpm pumps.

The consumption of electricity for lighting in Head works and WTP is 14 kilo watts for which energy efficient lighting has been proposed.

Management of floods

In case of any flooding due to heavy rains, any release from the dam would flow through the surplus river course and the head works is located near river bank of Paraliar . Hence no impact is envisaged during floods.

Safety measures

During construction, all necessary safety measures including barricading, signages, reflective lights, protective gears etc as applicable shall be provided to ensure safety of the labourers and public.

During operation, necessary safety measures for the storage and usage of Chlorine gas will be provided. The chlorine gas leak detectors will be provided to identify the leakage for immediate remedial actions. The emergency repair kit, Personal safety kit like full body cover, Oxygen kit for breathing, face mask, body shower and eye washers would be provided. The operating staff shall be given training as required for operation and handling chlorine gas plant.

All the project sites including head works and service reservoirs are proposed to be provided with compound wall of 3.0m height all around to protect the infrastructure and to ensure safety.

Handling of demolished materials

The WTP I & II units capacity are 5.68MLD and 7.08 MLD, it was constructed in 1941 & 1978 at Krishankovil. Due to leakage of Pipeline and damage of existing structure, the project envisages demolition of existing structures related to WTP units I & II. In this project. In this proposal, the first step to be enhances the existing WTP III 12 MLD to 18 MLD. The inlet of WTP I & II to be connected in WTP III, after demolition of existing WTP units I & II.

During demolition of structure, care shall be taken to avoid dust and to dump the scraps of materials in the site. Use personal protective equipment (PPE) during demolition work. Inspect all stairs, passageways and ladders, illuminate all stairways. Screen is providing for surrounding area for avoiding dust pollution. The demolition of the existing treatment units would be carried out by cordoning the area from trespass and to control dust. Efficient housekeeping would be practiced during demolition and handling of waste. The demolition waste shall be disposed in line as per C&D waste management rules 2016.

Social Impact Assessment

This project doesn't involve acquisition of private land and all the sites required for this project is free from encroachment, squatters, hawkers, hence this falls under the social category of S3 as per para 24, Table-7 of ESMF. However, if any impacts identified during the implementation of the project, such impacts will be mitigated/compensated as per the [ESMF](#) policy provisions. And all the sites required for this project will be under possession of TWAD Board prior to award of contracts.

Training of operation staff

Periodical training would be provided to the staffs and operators involved in the project O&M for chemical handling, emergency, SCADA O&M, line maintenance, valve operations, electrical & mechanical operations, cleaning of sumps and SRs.

ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan for Pre-Construction Phase

Environmental Management Plan (EMP) during Pre – Construction, Construction and operation phase is given

Sl. No.	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
Pre- Construction				
1	Clearances	All clearance required during construction will be ensured and made available before start of work. Permissions will be obtained from the concerned authority.	Before start of construction	TWAD
2	Tree cutting	Construction activity to be done without Tree cutting activity if any, Compensatory plantation will be 10 times to the number of trees being cut.	During construction	TWAD
3	Utility Relocation	Identify the common utilities to be affected such as: telephone cables, electric cables, electric poles, water pipelines, public water taps etc. Affected utilities will be relocated with prior approval of the concerned agencies before construction starts	Before start of construction	TWAD Board / Contractor
4	Permissions from other departments	State High ways, National High Ways, other district highways, and Railway crossing for which permission was applied for a length of approximately 62 km.PWD approval for the withdrawal of 52.04MLD and pipe carrying bridge for river crossing will be constructed at three locations for a length of 40m, 20m, 30m & 60m.	Before start of construction	TWAD
5	Design Criteria	All the units of Head Works, treatment plant, Sump, and Pump Rooms will be designed in such a way that it can withstand maximum load and without compromising performance. The design will take into consideration all the measures identified.	Before start of construction	TWAD

During Construction				
1	Baseline parameters	Adequate measures will be taken and checked to control the Baseline parameters of Air, Water and Noise pollution. Base line parameters recorded will be used for monitoring and conformance be ensured.	During Construction	TWAD/Contractor
2	Planning of temporary traffic arrangements	The activities are limited to the project sites and right of way. During execution of works, as per the need in the site, necessary permissions for temporary diversion will be obtained. Signages and safety measures including flagmen are provided at the site.	During construction	TWAD/Contractor
3	Storage of materials	The contractor will identify site for temporary use of land for construction sites / storage of construction materials, etc.	Before start of construction	Contractor/ TWAD
4	Construction of labour camps	<p>i) Contractor will follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp).</p> <p>ii) The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction.</p> <p>The construction will commence only upon the written approval of the Engineer.</p> <p>The contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the Engineer.</p> <p>All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. In case of women labourers, exclusive bathing and toilet facilities shall be provided.</p> <p>The sewage system for the camp must be planned and safely disposed.</p> <p>Necessary arrangement shall be made for collection of solid wastes and</p>	During construction	Contractor

		<p>disposal shall be in co-ordination with the municipality. Adequate health care is to be provided for the work force.</p> <p>The layout of the construction camp and details of the facilities provided will be prepared and will be approved by the Engineer.</p> <p>Awareness about HIV/AIDS will be provided, grievance redressal mechanism for the camps, [only suggestion]</p>		
5	Safety Aspects	<p>Adequate precautions will be taken to prevent the accidents and from the machineries. All machines used will conform to the relevant Indian standards Code and will be regularly inspected by the TWAD.</p> <p>Where loose soil is met with, shoring and strutting will be provided to avoid collapse of soil.</p> <p>Barricading of construction site / manholes at all times in a day with adequate signage.</p> <p>Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc.</p> <p>Welder's protective eye-shields will be provided to workers' who are engaged in welding works.</p> <p>Earplugs will be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation</p> <p>The contractor will supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc to workers and staffs.</p> <p>The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labour Organization (ILO) Convention No.62 as far as those are applicable to this contract.</p> <p>The contractor will make sure that during the construction work all</p>	During construction	Contractor

		<p>relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 and adhered to.</p> <p>The contractor will not employ any person below the age of 18 years for any work and no woman will be employed on the work of painting with products containing lead in any form.</p>		
6	Disposal of construction debris and excavated materials	A suitable site identified for safe disposal, in low lying areas within the project area, away from the water bodies as approved by the Engineer in charge and to other low lying area in consultation with engineer concerned and local body.	Pre-construction and Construction	Contractor / TWAD
7	Barricading site	The activities would be restricted to project sites and right of way for alignment. Barricading with adequate marking, flags, reflectors etc. will be provided along the alignment for safety of restricted traffic movement and pedestrians.	During construction	Contractor
8	Clearing of construction camps and restoration	<p>Contractor to prepare site restoration plans, the plan is to be implemented by the contractor prior to demobilization</p> <p>On completion of the works, all temporary structures will be cleared away, all rubbish cleared, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the contractor's expenses, to the entire satisfaction of the engineer.</p>	After completion of Construction	Contractor
9	Pollution from Fuel and Lubricants	<p>The contractor will ensure that all construction vehicle parking location, fuel / lubricants storage sites, vehicle, machinery and equipment maintenance and refuelling sites will be located at least 500m from rivers and irrigation canal / ponds</p> <p>All location and layout plans of such sites will be submitted by the Contractor prior to their establishment and will be approved by the</p>	During Construction	Contractor

		<p>Engineer</p> <p>Contractor will ensure that all vehicle / machinery and equipment operation, maintenance and refuelling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground.</p> <p>Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Engineer) and approved by the Engineer. All spills and collected petroleum products will be disposed off in accordance with MoEF and state PCB guidelines.</p>		
10	Pollution from Construction Wastes	All waste arising from the project is to be disposed off in the manner in consultation with TWAD Engineer	During Construction	Contractor
11	Storage of chemicals and other hazardous materials	Site identified for safe storage and handling of chemicals and other hazardous materials provided with proper display of requirements and marking as protected area.	During Construction	Contractor
12	Informatory signs and Hoardings	The contractor will provide, erect and maintain informatory/ safety signs hoardings written in English and local language, wherever required or as suggested by the Engineer	During Construction	Contractor
13	First Aid	<p>The contractor will arrange for:</p> <p>A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone.</p> <p>Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital</p>	During Construction	Contractor
14	Risk from	The contractor will take all required precautions to prevent danger from	During	Contractor

	Electrical Equipments	<p>electrical equipment and ensure that-</p> <p>No material will be so stacked or placed as to cause danger or inconvenience to any person or the public</p> <p>All necessary fencing and lights will be provided to protect the public in construction zones.</p> <p>All machines to be used in the construction will conform to the relevant Indian Standard (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer</p>	Construction	
15	Waste Disposal	<p>The contractor will provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Engineer.</p> <p>Unless otherwise arranged by local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Engineer will have to be provided by the contractor</p>	During construction	Contractor
16	Environmental Monitoring	The water, air, soil and noise quality will be monitored in pre-construction and Construction phase as detailed in Table 6.2 in EIA Report.	Pre-construction & Construction	TWAD & Contractor.
17	First Aid	<p>The contractor will arrange for:</p> <p>A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone.</p> <p>Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital</p>	During construction	Contractor

18	Rainwater harvesting	Rainwater harvesting arrangements shall be provided in WTP, and Sump for collecting and storing rainwater from rooftops and recharging ground water through pits.	Construction Phase	Contractor and TWAD
19	Protection of sites	Compound wall of 3.0 m height shall be provided at Headworks and service reservoirs except Krishnankovil, for protection. WTP Plant and krishnancovil reservoir already provided 3.0m Height.	Construction Phase	Contractor and TWAD
20	Accessibility to sites	Adequate road facilities have been provided in WTP for movement of vehicle and unloading of chemicals without disturbing of existing features and activities. OHTs are strategically located to have direct access and without disturbing existing structures in the identified site.	Construction Phase	Contractor and TWAD
21	Demolition of existing structures related to WTP units I & II AT krishankovil WTP Site	<p>Complete augmentation of the WTP III and connect the inlet of WTP I & II to WTP III prior to start of demolition of WTP I & II.</p> <p>During demolition of structure WTP I & II, care shall be taken to avoid dust and to dump the scraps of materials in the site.</p> <p>Use personal protective equipment (PPE) during demolition work. Inspect all stairs, passageways and ladders, illuminate all stairways. Screen is providing for surrounding area for avoiding dust pollution.</p> <p>The demolition of the existing treatment units would be carried out by cordoning the area from trespass and to control dust. Efficient housekeeping would be practiced during demolition and handling of waste. The demolition waste shall be handled in line as per C&D waste management rules 2016.</p>	Construction Phase	Contractor and TWAD
Head Works / WTP/ ESR				
1	Protection of top soil & Environmental enhancing	Top soil from the Head works area will be stored in stock piles and that can be used for gardening purposes at Head works site which will be an environmental enhancing measure	During construction	Contractor

2	Construction of Head work	Coffer dams will be provided for construction of head work without any disturbance of river water flow. After completion of work, the coffer dam and other construction debris will be removed, and river bed would be restored.	During construction	Contractor/ TWAD/ PWD
3	Water treatment plant	Adequate road facility has been provided inside of treatment plant for movement vehicles and heavy vehicles for unloading of chemical. Rain water harvesting will be provided for recharging of ground water through pit. Display boards on safety measures and emergency measures to be installed. Regular training for the staffs operating the units of WTP with various aspects of maintaining water quality and safety. Providing equipments like ear plugs to workers near the noise source. Adequate stack height is given in D.G Set as per CPCB norms.	During construction	TWAD / Contractor.
4	Downstream users (impacts arising due to coffer dams, etc.)	Ensure that the flow stream is not obstructed during construction of coffer dam as directed by Engineer in charge so that there is no impact on the downstream users.	During construction	Contractor
5	Permissions from other departments	Permissions from Southern Railways, National and state Highways, TNPWD, and Revenue Department etc., will be obtained.	During implementation	TWAD
6	Restoring river bed / water source	Ensure the restoring of river bed to its natural shape free from any debris or construction junk material that may obstruct the flow.	Prospective contractor	construction and operation
7	Disposal of construction debris and	The contractor shall identify the sites for debris disposal and should be finalized prior to start of the earthworks; taking into account the following	Pre-construction and operation.	Contractor/ TWAD/ Nagercoil

	excavated materials.	(a) The dumping does not impact natural drainage courses (b) no endangered / rare flora is impacted by such dumping (c) Settlement area located at least 1.0 km away from the site. (d) Should be located in non residential areas located in the down wind side (e) located at least 100m from the designated forest land. (f) avoid disposal on productive land. (g) should be located with the consensus of the local community, in consultation with the engineer and upon approval by the local body. Minimize the construction debris by balancing the cut and fill requirements. Wherever feasible, the construction debris shall be provided for reuse.		Municipality
7	Tree plantation	The project does not envisage tree cutting in any of the project sites or alignment. However, as an enhancement measure, trees will be grown in the head work and SR sites etc. Proposed list of trees is given in Table 5.1 of the EIA report.	During construction	TWAD / Contractor
Safety in Sites				
8	Additional safety measures	The structures will be provided with easy access ladders, and handrails, interconnections between all units with proper safe walkway platforms for movement to avoid falling of human and materials. Electrical cables are going to be laid in cable trenches. Open spaces at height will be covered with parapet walls and handrails.	During construction	Contractor.
Construction of Pumping Mains /Transmission Mains				
1	Protection of top soil	The top soil to be protected and compacted after completion of work, where the pipelines run.	During construction	Contractor
2	Laying of pipeline	Adequate precautions will be taken while laying the water supply mains to avoid the possibility of cross connection with sewer drains. Surge protection arrangements have been provided in the clear water main at three locations in order to avoid line bursts to prevent wastage.	During construction	TWAD/ Contractor

		<p>Air valve is provided at an interval of 500m in all transmission main to prevent leakage.</p> <p>Utilities like street light etc. will be relocated without disturbing existing power lines and obtaining prior permission from concerned department.</p> <p>In the event of any damaged pipes found in the distribution system it will be disposed to TSDF approved by TNPCB.</p> <p>Pipe carrying bridges: Necessary Flow Diversion arrangement will be provided for construction of Pipe carrying bridges without any disturbance of river water flow.</p> <p>After completion of work, the flow diversion will be removed, and river bed would be restored.</p>		
3	Shifting of common utilities	<p>Ensure community consensus and minimum impact to common utilities like telephone cable, electric cables, electric poles, water taps and etc., Proper clearance to be obtained from the concerned authorities before commencement of works.</p>	Pre-construction & construction phase	Concerned departments / TWAD
4	Traffic diversion	<p>Before taking up of construction activity, a Traffic Control Plan will be devised and implemented to the satisfaction of the Engineer.</p> <p>Construction will be taken phase-wise so that sections are available for traffic</p> <p>Temporary diversion will be provided with the approval of the engineer. The Detailed traffic management plans prepared and submitted to the engineers for approval one week prior to commencement of works will contain details of temporary diversion, details of arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, SIGNAGES, safety measures for transport of hazardous materials and arrangements of flagmen.</p>	During construction	TWAD / Contractor

		<p>The arrangement for the temporary diversion of the land will ensure to minimize the environmental impacts like loss of vegetation, productive lands etc., prior to the finalization of diversion and detours. Special consideration will be given to the preparation of the traffic control plan for safety of pedestrians and workers at night.</p> <p>The contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. He will inform local community of changes to traffic routes, conditions and pedestrians access arrangements. This plan will be periodically reviewed with respect to site conditions.</p> <p>The temporary traffic detour will be kept free of dust by frequent application of water.</p>		
5	Temporary flooding due to excavation	Excavation during the laying of mains should be carried out with proper drainage arrangements to avoid the overflowing of existing drains.	During construction	TWAD / Contractor
6	Using of modern machineries	Using of modern machineries such as JCBs, backhoes etc, will be used to minimize the construction period, it will reduce the construction period impacts to the nearby residents	During construction	Contractor
7	Dust pollution near settlements	<p>All earth work will be protected in manner acceptable to the engineer to minimize generation of dust. Area under construction will be covered & equipped will dust collector.</p> <p>Construction material will be covered or stored in such a manner so as to avoid being affected by wind direction.</p> <p>Unpaved haul roads near / passing through residential and commercial areas to be watered thrice a day</p> <p>Trucks carrying construction material to be adequately covered to avoid the dust pollution and to avoid the material spillage</p>	During construction	Contractor

8	Protection of residential sensitive receptors	Noisy construction operations in residential and sensitive areas will be done only between 7.30 am and 6.00 pm Preventive maintenance of construction equipment and vehicles to meet emission standards and to keep them with low noise Provision of enclosing generators and concrete mixers at site. Sound barriers in inhabited areas will be installed during the construction phase. Adequate barricading / other measures to protect dust pollution near sensitive receptors like schools and hospital etc. to be ensured	During construction	Contractor
9	Vehicular noise pollution at residential / sensitive receptors	Idling of temporary trucks or other equipment should not be permitted during periods of loading / unloading or when they are not in active use. The practice must be ensured especially near residential / commercial / sensitive areas. Stationary construction equipment will be kept at least 500 m away from sensitive receptors. All possible and practical measures to control noise emissions during drilling will be employed. The TWAD may direct to take adequate controls measures depending on site conditions.	During construction	Contractor
10	Noise from vehicles, plants and equipments	Servicing of all construction vehicles and machinery will be done regularly and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. Maintenance of vehicles, equipment and machinery will be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum.	During construction	Contractor
11	Storage of construction materials	Site for storage of pipes and construction materials to be identified, without affecting the traffic and other common utilities	During construction	Contractor

12	Pollution from Construction wastes	The Contra will take all precautionary measures to prevent the wastewater generated during construction (e.g., during the testing of pipeline) from entering into streams, water bodies.	During construction	Contractor
13	Environmental Health and Safety.	EHS guidelines of World Bank will be complied with during construction.	During construction and post-construction	Contractor
IN OPERATION PHASE				
1	Noise Management	The pumps will adhere to the standards of noise. Regular maintenance will be carried out to restrict the noise levels. Provided noise control measures and Staffs entering the pump room will be provided with PPEs. Noise monitoring will be carried out at WTP and Head Works periodically near the noise generating units like the pump operations and D.G.Sets. Green belt is provided in WTP and SR sites for reduction of noise level.	During operation	Contractor/ TWAD
2	Water Management	Control valves would be provided in the inlet of sump and service reservoirs to control the flow. It can be used to stop the flow until the leakage is rectified. Water meters at pumping stations are used to measure and monitor the flow. In this project, monitoring and controlling the flow in the system will be done with flow control valve with the help of SCADA system. The backwash water is collected in the recycle sump and re-circulated with raw water. Drained Water collected from sludge drying bed will be re-circulated with raw water.	During operation	TWAD/ Contractor

		SCADA system will be provided for monitoring the water treatment plant. The details on SCADA system is given in Chapter 5.2.4 in EIA report.		
3	Soil Management	The dry sludge from the treatment plant will be stored in sludge pit and utilized for filing in low laying area in consultation with the Engineer.	During operation	Contractor/TWAD
4	Air Management	Automatic chlorine leak detection and related alarm equipment to be installed at chlorine storage room in WTP. It is connected to a remote audible and visual alarm system and checked on a regular basis to verify proper operation. Separate storage room provided for full, partial, or empty chlorine cylinders. Diesel generators will be operated only for emergency power backup. The emission source diesel generators will have adequate stack height as per the norms of CPCB and regular maintenance of diesel engines has to be ensured in the Treatment Plant.	During operation	Contractor/TWAD
5	Transportation and storage of hazardous chemicals	Guidelines and procedures in Motor vehicle Act 1986 for transportation; Manufacture, Storage and import of Hazardous Chemicals Rules 1989 to be followed for storage and handling of Hazardous chemicals: Insurance covers to be taken for accidents and cost of clean-up operations.	During operation	Contractor
6	Handling of Chemicals	The unit will be provided necessary safety measures for the storage of Alum & Chlorine cylinders and provide emergency repair kit and personal safety kit like full body cover, face mask, body and eye shower etc. at the site. Eye showers will be provided in WTP. The unit will install Chlorine gas leak detector system (Chlorine Gas Sensor) at the site.	During operation	Contractor
7	Environmental Monitoring	The water, air noise and soil quality will be monitored periodically. The water quality will be monitored at various points prior to distribution – head work, treatment plant, sump, SR sites.	During operation	TWAD & Contractor.

		Monitoring of noise levels will be carried out at head work, WTP and Sump. Detailed monitoring record will be maintained. Periodical report will be send to the Engineer. The frequency and parameters for Environmental Monitoring detail is given in Table 6.3 of the EIA report.		
8	Other Management measures at Sites	<p>Providing equipments like ear plugs to workers near the noise source.</p> <p>Providing PPEs for safe working of personnel in critical areas like chlorination plant will be ensured.</p> <p>Display boards on safety measures and emergency measures to be installed.</p> <p>Regular training for the staffs operating the Head Works with various aspects of maintaining water quality and safety in operation maintenance and chemical handling.</p> <p>PPEs for the workers exposed to high noise.</p> <p>Regular maintenance of the greenbelt and landscaping made at the project sites with watering, manuring, pruning etc.</p>	During operation	TWAD & Contractor
9.	Online Monitoring System through SCADA	Installation of SCADA System for online monitoring at the Head works, WTP sump, Service Reservoirs gathering the real time data from remote locations. The detail of SCADA is given in Chapter 5.3.7 in EIA report..	Operation Phase	TWAD/Contractor
10	Training for staff	Periodical training would be provided to the staffs and operators involved in the project O&M for chemical handling, emergency, SCADA O&M, line maintenance, valve operations, electrical & mechanical operations, cleaning of sump and SRs.	During Operation	TWAD / Contractor.

11	O&M Measures	<p>Rain water harvesting structures, sludge drying pits, Sump and WTP units shall be cleaned periodically.</p> <p>Periodically inspection of Pump/motor, Wear ring, impeller and lubrication, alarm systems.</p> <p>Repair and renewal of Mechanical & electrical equipments, civil works etc.,</p>	During Operation	Contractor/T WAD
12	Water Treatment Plant	<p>The backwash water is collected in the recycle sump and re-circulated with raw water.</p> <p>On-line monitoring through SCADA is proposed which would prevent overflow and wastage water.</p> <p>Dried Sludge will be stored in sludge pit and utilized for filing in low laying area.</p>	During Operation	Contractor/T WAD
13	Disposal of sludge	<p>The sludge from the treatment plant after drying in the sludge drying bed shall be disposed in the pit constructed within the site.</p>	During Operation	Contractor/T WAD



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EMP COST

S.No	Management measure	Group Code	Description	Cost Estimate	Reference
1.	Tree plantation	A	1000 trees at Rs100/tree and tree guard at Rs. 800 for 1000 trees.	Rs.1,09,600/=	Included in cost estimate
		A	Maintenance arrangement with watering	Included in above cost	
2	Removal of coffer dam in Offtake works and restoration of river bed	A	Construction and removal of Cofferdam for construction of Offtake structures.	Included in BOQ	Included in BOQ
3	Barricading trenches	A		Included in BOQ	Included in BOQ
4	Recirculation arrangements, Sludge drying bed and sludge pit	A	Included in specifications under Sludge	Included in BOQ	Included in BOQ
6	Disposal of sludge	B	Rs.2500/trip/tipper /5tonnes/month	Rs.60,000/ Annum	Required from operation stage
7	Chlorine Leak Detection/Alarm eye showers Mask with Cylinder	A	-	-	Included in Technical Specification for Chlorinators
8	Construction of Compound wall	A	Head works, 10 SRs with 3 mtrs height.	Included in BOQ	Included in BOQ
9	Septic Tank and Pipe connection works to existing sewerage	A	At Headworks, WTP sites and SR sites		Included in BOQ
10	Rain water Harvesting Structures				Included in BOQ
11	Energy Efficient Lighting	A	Lighting fixtures in project sites	Included in BOQ	Included in BOQ



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12	Disposal of excavated excess earth and construction debris	A			Included in BOQ
13	Environmental Monitoring	B	Noise	Rs.30,000/Annum	Required from operation stage
		B	Raw Water quality (Seasonal)	Rs.4000/ annum	Required from operation stage
		B	Clear Water quality – Minimum 5 locations Monthly testing (Rs.1000/test)	Rs.60,000/ annum.	Required from operation stage
		B	Sludge – 1 location Monthly (Rs.1000/test)	Rs.12000/annum	Required from operation stage
10	PPEs for O&M	C	Included in BOQ for O&M Period	Rs.25000/annum	Required after 5 years of O&M
11	Safety Training	C	Included in BOQ for 1 year of O&M	Rs.20000/annum after completion of O&M	Required after 1 year of O&M
TOTAL (A) – During Construction				Rs.1,09, 600	
TOTAL (B) – Yearly recurring cost from operation stage				Rs.1,66,000	
TOTAL (B + C) – Yearly cost after completion of contractor’s O&M				Rs.2,11,000	

PUBLIC CONSULTATION

The Public Hearing was arranged by TWAD Board officials at beneficiary Municipality. Information on Public Consultation were informed explicitly to the stake holders/beneficiaries concerned in the municipality notifying the date and time in newspapers, pamphlets, issuing notices door to door and keeping displays etc,. The consultation was carried out in the Nagercoil Municipality office on 05.05.17.

Subsequently, the public consultation was held on 16.04.2021 at Nagercoil Corporation office.



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

Out Come of Public Consultation

It was evident from the public consultation that the people are eagerly awaiting for the early implementation of the project. The public also expressed their grievances on present water scarcity and assured complete support during the implementation of this much awaited water supply scheme in Nagarcoil Municipality.

IMPLEMENTATION AND INSTITUTIONAL ARRANGEMENTS

This project is being implemented on by TWAD under the scheme of Tamil Nadu Sustainable Urban Development Project (TNSUDP). The proposed project involves engagement of prospective contractors during construction and operation phases. The management measures identified for contractor will be included in the bid document. Implementation of the management measures by the contractor will be ensured by TWAD Board and report on ESMF compliance is being submitted to TNUIFSL periodically along with progress report.

GRIEVANCE REDRESSAL MECHANISM:

The TWAD Board will have Grievance Redressal mechanisms to handle the grievances of the project. A project level grievance Redressal committee has been set up and the members are as follows (preferably one of them as women)

1. Executive Engineer (Projects –TWAD Board)
2. Commissioner /Nagercoil Municipality
3. A person who is publicly known in the local area.

PROJECT BENEFITS

The existing sources three water supply schemes (Mukkadal Dam and Ananthanar Channel) of Nagarcoil Municipality are inadequate to draw the additional requirement. At present the level of supply of water to Nagarcoil Municipality is 85 lpcd and supply once in five days. Considering the Population growth and as per present norms, it has been proposed to step up the service level from 90 lpcd to 135 lpcd taking into account of proposed UGSS in Nagarcoil Municipality. The proposed project is an innovative and demand-driven approach to improve the water supply in the study area. Hence the implementation of this project will definitely assure improved access to water in the water scarce area.



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

1. INTRODUCTION

1.1 Profile of Study area

Kanyakumari District is named after the goddess 'KANYAKUMARI'. The district lies at the southernmost tip of the Indian peninsula, where Indian Ocean, Arabian Sea and Bay of Bengal confluence. Kanyakumari District is located geographically at 8° 10' North latitude and 77° 25' East longitudes. Kanyakumari District spreads over an area of 1694 Sq. Kilometres. It occupies 1.29% of the total extent of Tamil Nadu. It ranks first in literacy among other districts in Tamil Nadu. Unlike other district in Tamil Nadu, it has a rainfall both during the South West and the North East monsoons.

Nagercoil is a Special Grade Municipality and the headquarters of Kanyakumari District. It lies at a distance of 20 KM from Kanyakumari. It is located at a latitude of 8°10'47" N and longitude of 77°21'50" E. The town, at present including the extended areas has got an area of about 49.10 sq km. The population as per 2011 census after merger of four nearby Village Panchayats (1.Kariamonicapuram, 2.Gandhipuram, 3.NorthSoorankudy, 4.Peruvilai) and one Town Panchayat. (Asaripallam) is 246753. The main occupation of the people is agriculture. The average annual rainfall is 1045 mm. The total road length is 502.78 km including added areas. A new UGSS Scheme is under progress for this Municipality.

1.2 Existing water supply Nagercoil Municipality:

The following three water supply schemes are now functioning with Mukkadal Dam and Ananthanar channel other than the bore wells as source.

- I. Water supply schemes executed by Travancore Cochin State during 1941.
The Scheme was designed for 7.08 mld and 96 km D'System laid.
- II. 1st Improvement scheme executed by TWAD during 1978.
 - The improvement scheme was carried out for 13.5 mld and 35.90 km D'system laid. Work carried out under deposit scheme by Municipality



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- 5Nos. of Borewell provided by the Municipality for the areas MelaSoorangudi, Maravankudieruppu and Punnainagar.

III. 2nd Improvement scheme executed by TWAD during 2002.

Improvement Scheme was carried for 90 lpcd for a daily requirement of 30.5 mld.

1.3 Need for the Proposal

At present the level of supply of water to Nagercoil Municipality is 85 lpcd and with a supply once in five days. UGS Schemes has been sanctioned for Nagercoil Municipality and is under progress. Therefore prorated level of water supply has to be increased from 90 lpcd to 135 lpcd. In order to enhance the level of supply to 135 lpcd to urban local bodies, it is necessitated to formulate this proposal.

The existing sources (Mukkadal Dam and Ananthanar Channel) of Nagercoil Municipality are inadequate to draw the additional requirement. Hence it is proposed to provide water supply improvement scheme to Nagercoil municipality in Kanyakumari district with River Paraliar (Puthen Dam) as source.

The Nagercoil Municipality has decided to implement WSIS to Nagercoil Municipality in resolution No 41/dated 03.02.2011 and No.3632 dated.29.11.2013. The Managing Director, TWAD Board, Chennai has given permission to take up the investigation works in letter no .F.241111/AE-8/PM/2013-1/ dt.13.2.2013.

1.4 Scope of the Proposal

Considering the increasing demand of water supply of Nagercoil municipality as per the standards prescribed for the present and future year requirements, the water supply improvement scheme has been formulated. The Table below indicates the water required for various design periods. The present supply is inadequate ie 85 lpcd which is distributed once in 5 days.

This Project is to be implemented under World bank assisted Tamilnadu Sustainable Urban Development Project (TNSUDP).



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY



Figure 1. 1Location Map of Nagercoil Municipality



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

Table 1.1: Water requirements for various design periods for the proposal

S.NO	Description	Base year 2017	Intermediate 2032	Ultimate 2047
1	Population	2,80,000	3,20,000	3,90,000
2	Pro rate in lpcd	135	135	135
3	Requirement in MLD	36.45	43.20	52.65
4	Total requirement in MLD	37.80	43.20	52.65
5	Existing Supply in MLD	(-) 7.60	(-) 7.60	(-) 7.60
6	Net requirement in MLD	30.20	35.60	45.05
7	Transmission Loss @ 10% in MLD	3.02	3.56	4.51
8	Total in MLD	33.22	39.16	49.56
9	Treatment loss @5% in MLD	1.66	1.96	2.48
10	Total raw water Requirement in MLD	34.88	41.12	52.04

1.5 Categorisation of Project

The proposed project is classified as **Environmental Categorisation as E1** (water treatment plant, water supply augmentation with new source/ head work/intake works). Hence this project requires detailed Environmental Impact Assessment and preparation of management measures. **Social Categorisation of Projects**, the number of PAPs in this project is nil, hence this project can be categorized under **S-3 category**.

TNUIFSL is promoting the following principles of Environmental & Social sustainable infrastructure projects. The TWAD board implementing comprehensive water supply schemes and follow the TNUIFSL principles.

- a) Environmental sustainability by minimizing release of polluting wastes, ensuring quality life in urban environment, conserving natural resources, preserving bio-diversity and ecological equilibrium; and integrating mechanisms within projects to maintain and enhance environmental quality of project locations.
- b) Social relevance by
 - Addressing legitimate concerns of relevant stakeholders, especially project affected persons irrespective of their legal rights.



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

- Avoiding or minimizing resettlement and rehabilitation due to land acquisition and transfer of government land under different tenure system through appropriate technical and management measures.
- Ensuring appropriate resettlement and rehabilitation of project affected persons irrespective of legal status with a view to providesustainable livelihood options that enable the affected people to improve or at least restore their standard of living in the post impact period.
- Protecting marginalized and vulnerable groups, including the economically and socially disadvantaged people through additional support and
- Minimizing health and safety hazards.

1.6 Structure of the Report

The structure of the EIA report is given below:

Chapter 1 – Introduction

Chapter 2 – Project Description

Chapter 3 – Environmental Regulatory Framework

Chapter 4 – Baseline Environmental Profile

Chapter 5 – Environmental Impact Analysis

Chapter 6 – Environmental Management Plan

Chapter 7 – Public Consultation

Chapter 8 –Implementation and Institutional Arrangements

Chapter 9 – Project Benefits

Chapter10 –Conclusion



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

2. PROJECT DESCRIPTION

2.1 Introduction

Tamil Nadu Water Supply and Drainage Board have proposed to supply water from Paraliar River to Nagercoil Municipality throughout the day. At present the level of supply of water to Nagercoil Municipality is 85 lpcd and supply is once in five days. This project has proposed to increase the service level of water from 90 lpcd to 135 lpcd in Nagercoil Municipality.

The proposed project involves the construction of offtake well in Paraliyar River near Puthan Dam. The water quality is found to be good and potable; it is then treated in water treatment plant at Krishnankovil to make it more acceptable and specific to end use like drinking etc., The treated water is taken to Service reservoirs of 23 nos (12 Existing and 11 Proposed) through distribution networks connecting them. The Structure of intake well, location of the offtake well, WSIS Flow diagram of Nagercoil Municipality and are given in **Figure 2.1 2.2, and 2.3** respectively.

Salient details of the project components are given below:

- Head works – For drawal of 52.04 MLD (ultimate) from Paraliar river
- Raw Water Pumping main for a length of 31.85 km
- Water Treatment Plant to treat water 41.12 MLD (intermediate requirement) at existing WTP site in Krishnancoil – 2 units (demolishing and reconstructing) 1 unit – Augmentation- 1unit
- Clear Water Pumping Main I, II, IIIs for a total length of 31.006 km
- Pipe carrying bridges of length 40m, 20m, 30m & 60m.
- Proposed Service Reservoirs – 11 Nos.
- Connecting to Existing SRs (12 nos) and proposed SRs (11 nos)
- Distribution system – 430.612 km
- HSC – 85000 NOS.
- SCADA – To monitor entire scheme for effective functioning.



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

Head Works	At Upstream of Puthendam. Raw water intake Intermediate stage (2032) - 41.12 MLD Ultimate stage (2047) - 52.04 MLD
Source	Off take well 8.0m dia. and scheme 7.0m depth Over head pump room 12.0 m dia.
Pump set	115 HP Turbine pump set 14899 lpm x 26 m head - 2 +1 Nos. (50% Stand by).
Raw water pumping main	914 mm x 8 mm MS pipe - 20.190 Km 813 mm x 8 mm MS pipe - 11.660 Km
Treatment Plant @ Krishnancoil	
1) Enhancement of WTP unit III 13.42 MLD to 18.00 mld using Dual Media Filters	18.00 MLD
2) Construction of Full scale Water Treatment Plant using Tube settlers and Dual Media Filters after demolishing existing WTP units I and II	41.12 MLD
Clear Water Pumping mains and Pump sets	
Clear Water Pumping Main I	9956 m
Clear Water Pump set	145 HP Turbine pump set - 9961 lpm x 49 m head (1+1 No)
Clear Water Pumping Main II	10440 m
Clear Water Pump set	145 HP Turbine pump set - 11263 lpm x 44 m head (1+1 No)
Clear Water Pumping Main II1	10510 m
Clear Water Pump set	150 HP Turbine pump set - 8886 lpm x 57 m head (1+1 No)
Clear Water Gravity Main	100 m
Service reservoirs	Existing -12 Nos. Proposed -11 Nos.
Distribution system	420.612 Kms.
House service connections	85000 Nos.

2.2 Cost Details

The total cost of the project is **Rs. 251.43 Crores and addition, cost towards GST & Tender Excess is Rs.44.64 Crores.** The base cost/ initial cost of the project is estimated around **Rs.186.21 Crores.** The annual maintenance cost is about Rs 19.17 Crores. The detailed project cost detailed given in **Table 2.1.**



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

Table 2.1: General Abstract

Sl.No.	Description	Amount (Rs. in Crores)
1	Head works at Puthen Dam	6.92
2	Raw water pumping main	54.40
3	Water Treatment Plant at Krishnancoil	12.29
4	Clear water Pumping mains and Branch mains	16.28
5	Clear water Pump sets	2.81
6	Service Reservoirs	10.00
7	Distribution System & HSC - 85,000 Nos.	79.50
8	SCADA arrangements	4.01
I	SUB TOTAL (Base Cost)	186.21
Ii	Contingencies & Unforeseen items at about 2.5%	4.30
Iii	Centage 5 %	9.31
Iv	Price escalation @ 5% for the I year	9.31
V	Price escalation @ 5% for the II year for 70% of I year	6.52
Vi	Labour welfare fund @ 1%	1.86
Vii	Provision for third party proof checking @ 0.15%	0.28
Viii	DPR preparation charges @ 0.5%	0.93
Ix	Third party Materials testing charges @ 0.23%	0.19
X	TWAD Lab testing charges of materials	0.08
Xi	Road Restoration charges and Railway crossing charges including 1% service charges	13.27
Xii	Maintenance for 5 years (Base year cost)	19.17
GRAND TOTAL		251.43

(RUPEES TWO HUNDRED AND FIFTY ONE CRORES AND FORTY THREE LAKHS ONLY)

2.3 Project Components

2.3.1 Head Works

It is proposed to tap 52.04 MLD of surface water from river Paraliyar by constructing 8m dia. Off-take well on the upstream side of Puthen Dam.



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

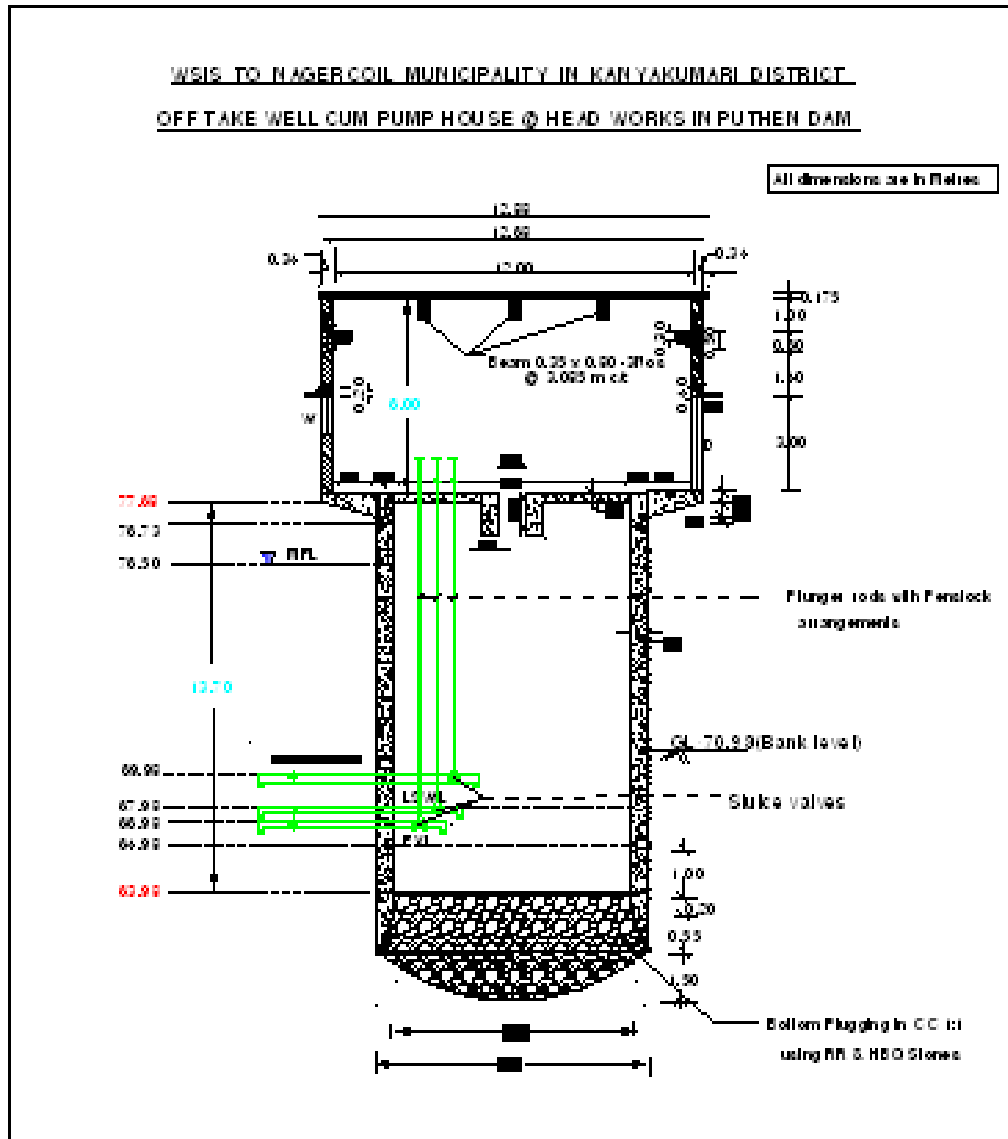


Figure 2.1: Structure of offtake well

Off-take well cum pump house

MFL	=	76.50m
G.L.	=	70.98m
F.V.L.	=	64.98m
L.S.W.L.	=	63.98m

Based on the remarks pointed out in the Regional Technical Committee meeting held at Madurai on 26.06.2013, raw water sample was taken at the proposed source point on 27.06.2013 and the water sample was analyzed in TWAD Board, Water Testing Lab at Nagercoil. The raw water quality is discussed in the sections later.



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

WSIS TO NAGERCOIL MUNICIPALITY HEAD WORKS LOCATION



Figure 2.2-Location of Head work

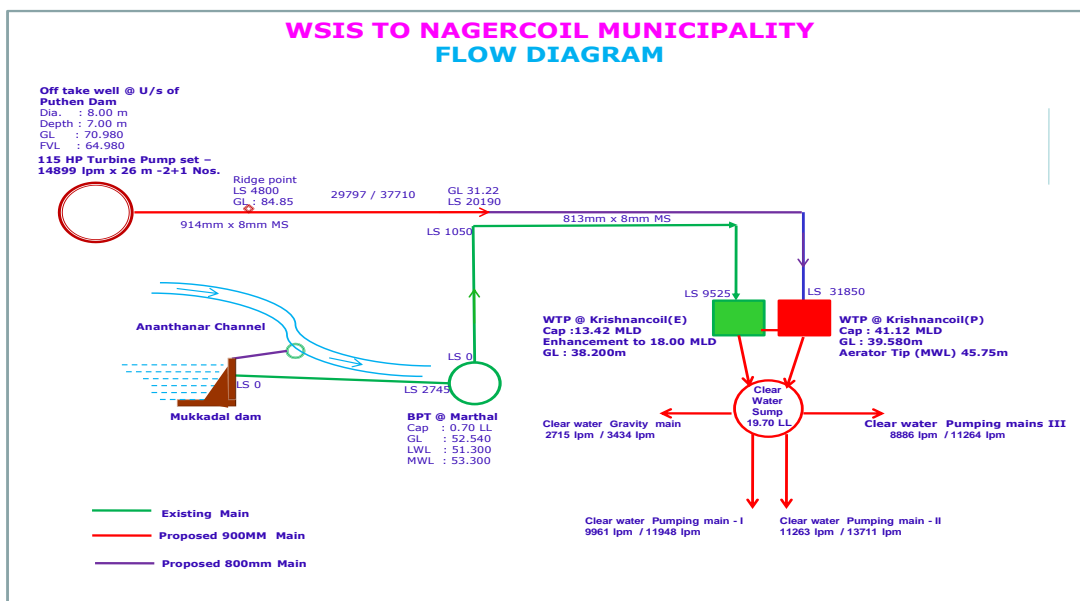


Figure 2.3-WSIS Flow diagram of Nagarcoil Municipality



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

2.3.2 Raw Water Pumping Main

The water from the off take well is proposed to be pumped by means of 115 HP Turbine pump set with a duty of 14899 lpm x 26m head(2 nos.) parallel pumping (1No stand bye) to the proposed Aerator of the WTP through the proposed raw water pumping main as detailed below.

- 914mm x 8mm thick MS pipe – 20.190 km
- 813 mm x 8 mm thick MS pipe – 11.660 km

Surge Protection System will be provided to absorb sudden raise of pressure, as well as to quickly provide extra water during a brief drop in pressure. No surge Tank is proposed as per surge Analysis and Surge protection devices like Disc valve and Surge Anticipating Relief Valves in the main are proposed along the alignment. Pressure is monitored online through SCADA System.

2.3.2.1 Pipe Carrying Bridge

Pipe Carrying Bridges are constructed for a length of 30m, 40m, 20m and 60m in varies location in Paraliar River, Pzhayar River and channel crossings. Flow direction arrangement will be made necessary. The diagram is given in **Figure 2.4**.



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

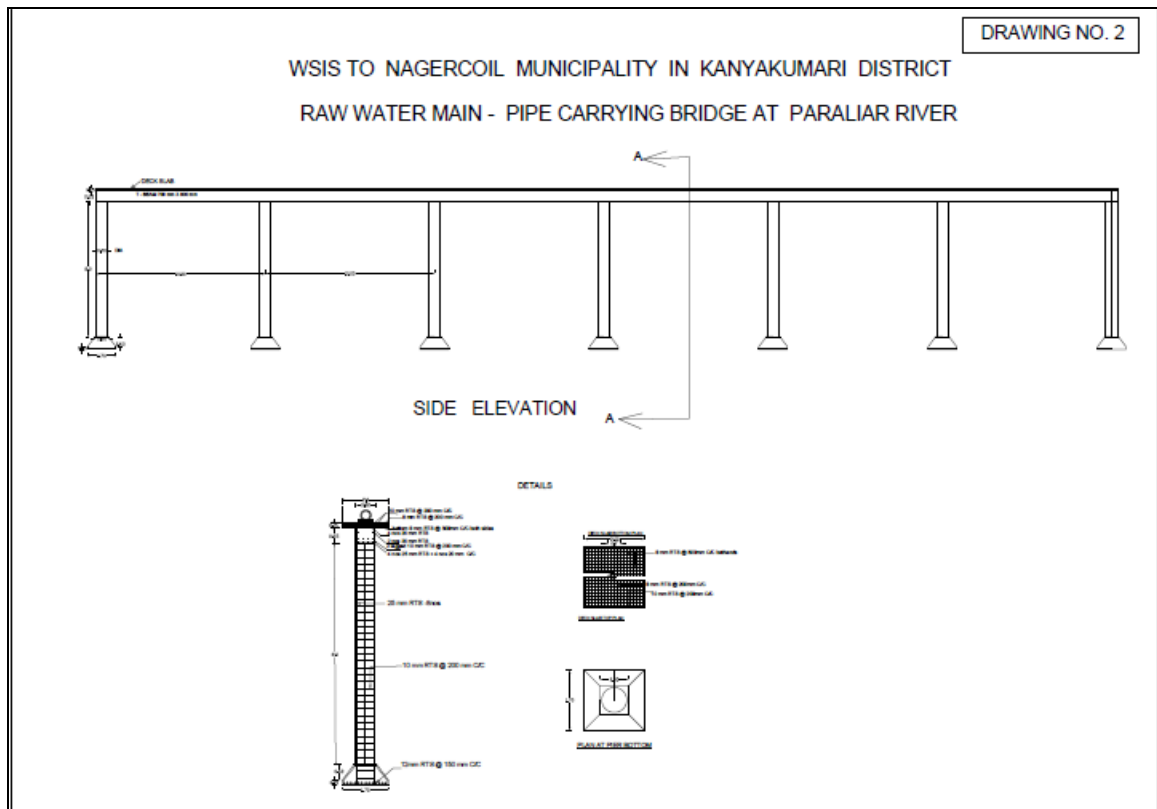


Figure 2.4-Pipe Carrying Bridge

2.3.3 Treatment Plant

Instead of originally proposed separate treatment plant at KrishnanKovil, water treatment plant is proposed for the total requirement in the existing water treatment plant site at Krishnancoil itself. It is proposed for construction of a new water treatment plant of 41.12 MLD capacity for the raw quantity from the Puthen dam using tube settlers and rapid sand filters with Dual Media Filers and to enhance the treatment capacity of the existing treatment plant III upto 18 MLD for the raw water from the Mukkadal dam. The details of proposed treatment plant are as given under.



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

Table 2.2: Proposed Treatment Plant for Total Capacity

Sl. No	Description	Intermediate 2032 in mld	Ultimate 2047 in mld
1	Total Requirement	43.20	52.65
2	Existing Supply Bore well sources	(-) 2.02	(-) 2.02
3	Net requirement	41.18	50.63
4	Transmission Loss @ 10%	4.12	5.06
5	Sub Total	45.30	55.69
6	Treatment Loss @ 5%	2.27	2.78
7	Total	47.57	58.47

At this site, there are totally three existing units of treatment plants treating water under different schemes supplying to Nagercoil municipality.

Under this proposal, the existing WTPs I & II are to be demolished and the existing WTP III is to be augmented. In the demolished location of existing WTP I & II at Krishnancoil, a new full scale water treatment plant 41.12 MLD at intermediate stage is proposed with tube settlers and Dual Media Filters using Anthracite coal for treating the raw water quantity proposed from Puthen dam.

Augmentation of WTP III

Considering the present raw water drawal quantity both from Mukkadal dam and Ananthanar channel, the existing water treatment plant III at Krishnancoil is proposed to be augmented for the capacity of 18.00 MLD by providing Dual Media Filters using Anthracite coal as first phase.

The existing WTP III components such as aerator, stilling chamber, raw water channel, Dividing chamber and Flash mixer have withstand upto 18.00 MLD capacity only. Considering the above reason the existing rapid sand filter bed have been proposed for enhancement by providing Dual Media Filters using Anthracite coal.

After completion of the new WSIS, the present drawal from the Ananthanar Channel has to be disconnected based on the instruction of the district administration.

The raw water characteristics of Mukkadal dam and Puthendam are different. Besides due to high turbidity value for raw water from Puthendam, Clariflocculator is essentially required. In view of the above providing additional Clariflocculator for



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

18.00 MLD is uneconomical to improve the existing WTP III at Krishnancoil. Therefore 6.45 MLD raw water from Mukkadala dam will be fed into the existing aerator of WTP III and the remaining 11.55 MLD water fed through a separate channel from the newly proposed Clariflocculators to the existing filter bed of WTP III are proposed. As a result, the total quantity $6.45 + 11.55 = 18.00$ MLD will be treated with augmented existing WTP III on completion of the improvement scheme.

Proposed Full-scale WTP at Krishnancoil

The existing treatment plants I & II constructed around 1941 and 1978, currently have issues with structural stability and leakage, necessitating major improvements. Hence to address this issue and to cater to the increased supply, a full-scale water treatment plant is proposed replacing the units I & II.

In the newly proposed WTP, clariflocculators are designed for 41.12 MLD at intermediate stage by providing tube settlers. For enhanced WTP III, 11.55 MLD quantity of water from the clariflocculators is proposed to pass through a channel to filter bed. The remaining water from the clariflocculators will be passed through the proposed rapid sand filter beds with dual media filters using Anthracite coal for 29.57 MLD (41.12-11.55). Thus the total capacity of both the WTP is arrived at $29.57 \text{ MLD} + 18.00 \text{ MLD} = 47.57 \text{ MLD}$.

The details of the components proposed for the new Water treatment plant are

Aerator

Diameter of collection tray : 14.0m

Stilling chamber Size : Size 6 m x 4.00 m x 3.60 m

Measuring channel

Length : 10 m

Size : 2.40 m x 1.70 m

Water depth : 1.0 m

Dividing chamber

Detention time : 45 sec.

Diameter : 3.0 m

Water depth : 3.05 m



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

Flash mixer (2 Nos.)

Detention time : 60 Sec.

Diameter : 2.50 m

Clariflocculator : 2 Nos.

Flocculator

Detention time : 30 minutes

Diameter : 15.3 m

Storage depth : 3 m

Clarifier

Detention time : 60 minutes

Diameter : 29 m

Size of launder channel: 0.85 m x 0.50 m

Clarified water channel size : 1.50 m x 1.75 m

Total depth : 1.20 m

Filter bed : Rapid sand Filter bed

(7+1 stand=by)

Twin bed size : 3.17m x 4.20 m- 8 Nos.

Depth of media : 1.20 m

Depth of sand : 0.45 m

Depth of anthracite : 0.30 m

Depth of gravel : 0.45 m

Clear water sump cum pump house

Capacity : 19.70 LL

G.L : 35.355 m

LWL : 31.355 m

MWL : 37.355 m

Sump cum pump house : 20 mx7m

Analysis of alternatives: The Treatment plant site at puliyadi was selected for Nagercoil water Supply improvement scheme and further alternatively WTP site has



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

been changed which reduces cost of the scheme and further, the site for WTP belongs to Nagercoil Municipality.

2.3.3.1 Raw Water and Treated Water Analysis

Table 2.3: Raw Water Quality

S.No	Parameter	Range	Limits (IS:10500:1991)
I	PHYSICAL		
1	Turbidity NT units -NTU	18-26	10
2	Total Dissolved Solids mg/lit.	78-200	500
3	Elect. Cond. Micro ohm/cm	118-260	-
II	CHEMICAL		
1	PH	6.9-7.8	6.5-8.5
2	Total Alkalinity	18-100	200
3	Total Hardness as CaCO ₃	34-100	300
4	Calcium as Ca	10-15	75
5	Magnesium as Mg	2-4	30
6	Sodium as Na	9 - 12	-
7	Potassium as K	1 to 2	-
8	Iron as Fe	1.8- 2.2	0.3
9	Nitrate as No ₂	0.24 - 0.30	45
10	Nitrite as No ₃	2 to 3	-
11	Chloride as Cl	20- 40	250
12	Fluoride as F	0.1 - 0.4	1
13	Sulphate as SO ₄	3-6	200
III	BIOLOGICAL		
1	Feecal Coliform per 100 ml	0	-

It is seen that the characteristics of raw water has to treated with full scale treatment confirming to within the respective permitted range of CPHEEO Manual for water supply.

Table 2.4: Treated Water Quality

S.No	Parameter	Range
I	PHYSICAL	
1	Turbidity NT units	< 1
2	Taste and Odour	Unobjectionable
3	Colour	Not Exceeding 5 Hazen
4	Aluminum Al	Not exceeding 0.2 mg/l as Al
5	PH	7-8.5
6	Iron Fe	Not exceeding 0.3 mg/l
7	Manganese	Not exceeding 0.1 mg/l
8	Free Chlorine	Not less than 0.5 mg/l
9	Total Coliform Bacteria	Nil in any 100 ml sample



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2.3.3.2. Treatment Process

- Aeration: The raw water contains traces of Iron and will get removed in aeration process. Cascade aeration has been proposed.
- Coagulant dosing (Lime and Alum): Lime, alum dosing has been proposed to aid coagulation of suspended solids. The exact dosing has to be arrived by conducting jar test. During major portion of the year, lime addition may not be required but provision has been made for the same to provide for any contingency for pH addition
- Flash mixing: For effective mixing of the coagulants.
- Flocculation: To aid formation of flocs before allowing settling in the clarifiers.
- Clarification: Various types of clarifiers are being offered like radial flow Reactor Clarifier, sludge blanket clarifiers, tube settlers, pulsators etc. In order to get the most cost effective technology, it is proposed to provide tube settlers technology.
- Filtration: Rapid sand filters with Dual Media Filters will be provided to bring down the turbidity to less than 1 NTU.
- Post chlorination: The treated water shall be further chlorinated in Chlorine contact tank/ clarified water sump to maintain the minimum residual chlorine level in the treated water up to the entry to the city. The treated water sump shall be provided with minimum 30 minutes detention time to serve the dual purpose of chlorine contact time and treated water storage. The treated water stored in the clear water sump will be pumped to the transmission main using Vertical turbine pumps.

Sludge/ back wash water

Sludge from the Water treatment plant is proposed to be dried in the sludge drying beds. The dried sludge is proposed to be collected in Sludge pit inside the WTP site and after to be disposed to the dump yard. Water from sludge drying bed under drain is re-circulated in to recirculation sump.



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The back wash from the Rapid Gravity filter beds and the filtrate from sludge drying bed will be sent to the raw water distribution chamber through recirculation sump. The treatment layout and process has been illustrated in **Figure 2.5 & 2.6**.

The WTP is designed for intermediate capacity of 41.12mld. The ultimate requirement of 52.04 MLD shall be handled by providing an additional clariflocculator for which space is available in the site.

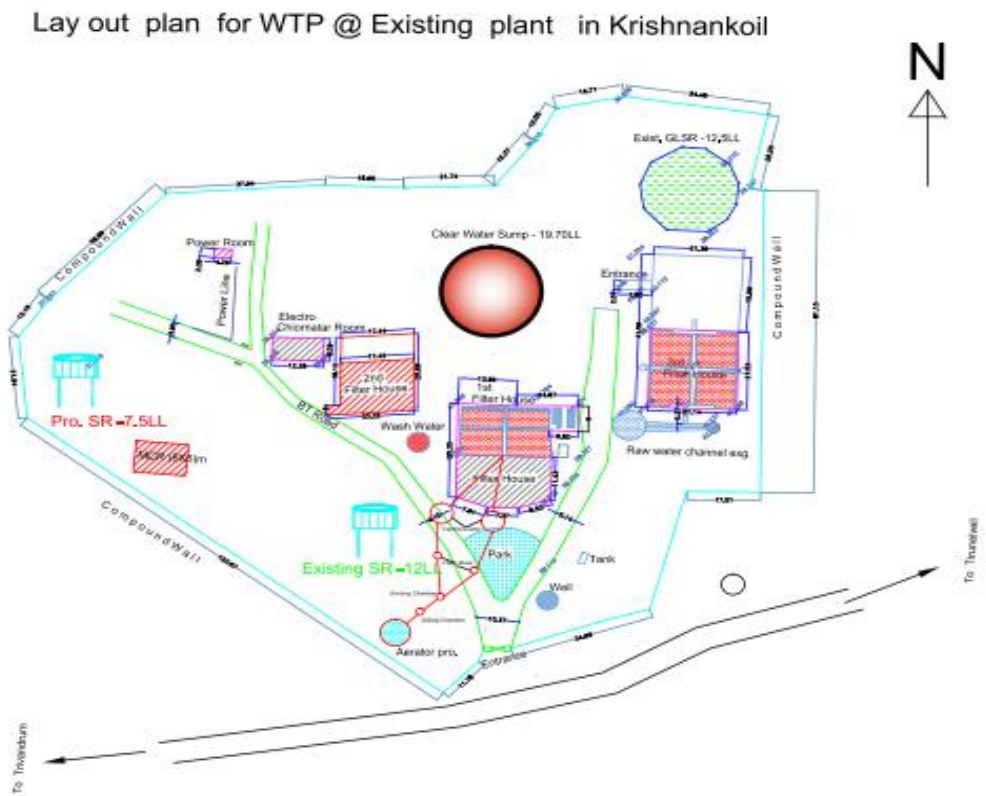


Figure 2.5: Layout of WTP



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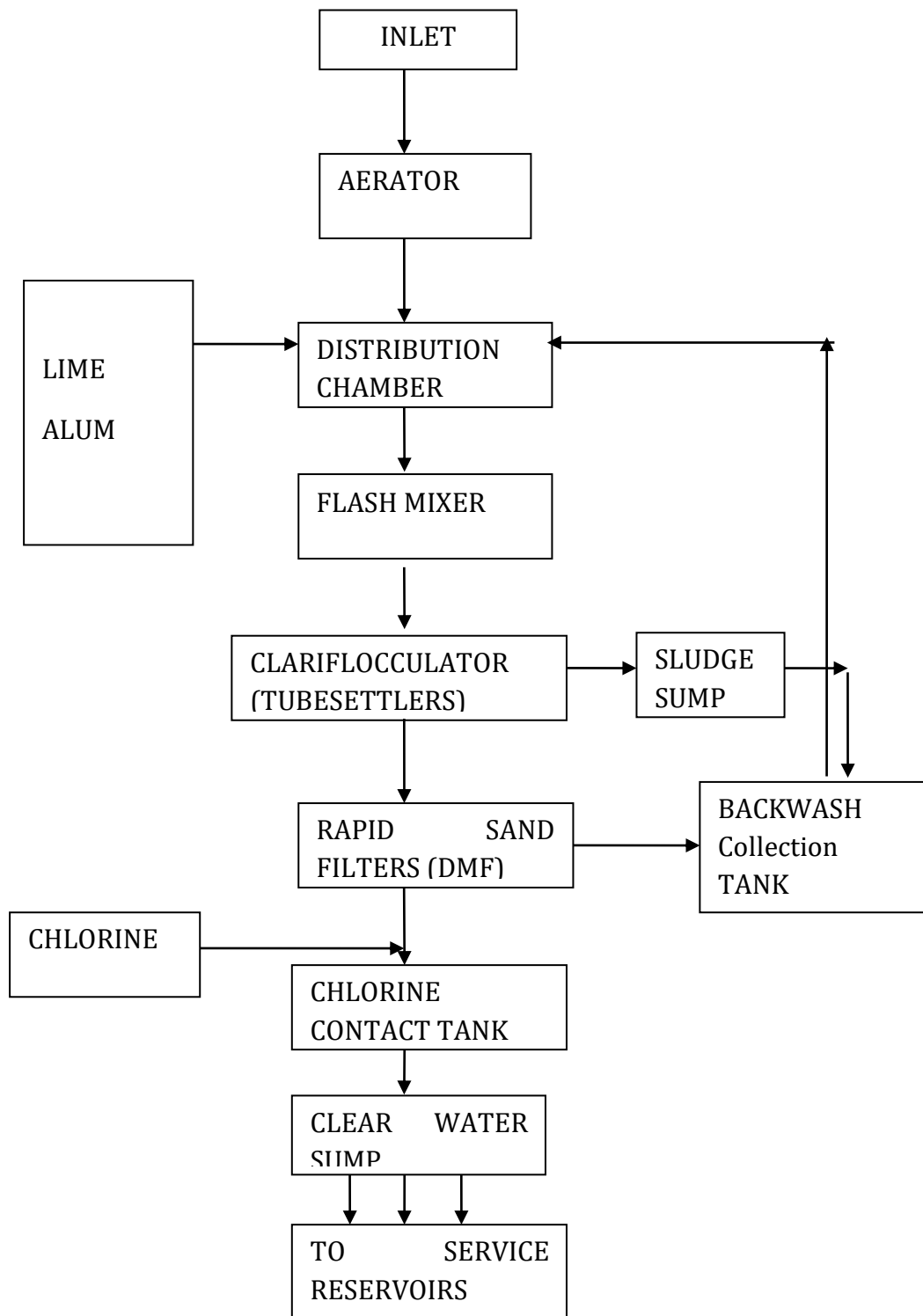


Figure 2.6: WTP Process Flow Diagram

An underground sump and pump house is proposed for storing the treated water at the WTP site itself. Required Land is available within the WTP area. The



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pump house of size 20 m x 7 m is proposed over the clear water sump which is designed to accommodate the required 3 numbers heavy duty pump sets required for the intermediate and ultimate demand. The capacity of tank proposed is 19.70 LL. The effective storage will be about 60 minute's capacity of ultimate demand.

2.3.4. Clear water Pumping Main

Water from the clear water sump will be pumped through 3 clear water pumping main(I, II, III) to the service reservoirs of 23 Nos (Proposed - 11 Nos. and existing - 12 Nos.). The details of the pumping mains are as follows

Clear water pumping main I

500mm DI K7 pipe	= 150 m
450mm DI K7 pipe	= 900 m
400 mm DI K7 pipe	= 1058 m
350mm DI K7 pipe	= 2827 m
250mm DI K7 pipe	= 1936 m
200mm DI K7 pipe	= 2985 m
150mm DI K7 pipe	= 60 m
100mm DI K7 pipe	= <u>40 m</u>
Total	= <u>9956 m</u>

Clear Water Pumping main II

500mm DI K7 pipe	= 2490 m
400mm DI K7 pipe	= 1220 m
300mm DI K7 pipe	= 1000 m
250mm DI K7 pipe	= 2605 m
200mm DI K7 pipe	= 1270 m
150mm DI K7 pipe	= <u>3610 m</u>
Total	= <u>10440 m</u>

Clear water pumping main III

500mm DI K7 pipe	= 1425 m
400mm DI K7 pipe	= 2103 m
350mm DI K7 pipe	= 1582 m
250mm DI K7 pipe	= 1070 m
200mm DI K7 pipe	= 1625 m
100mm DI K7 pipe	= <u>2705 m</u>
Total	= 10510



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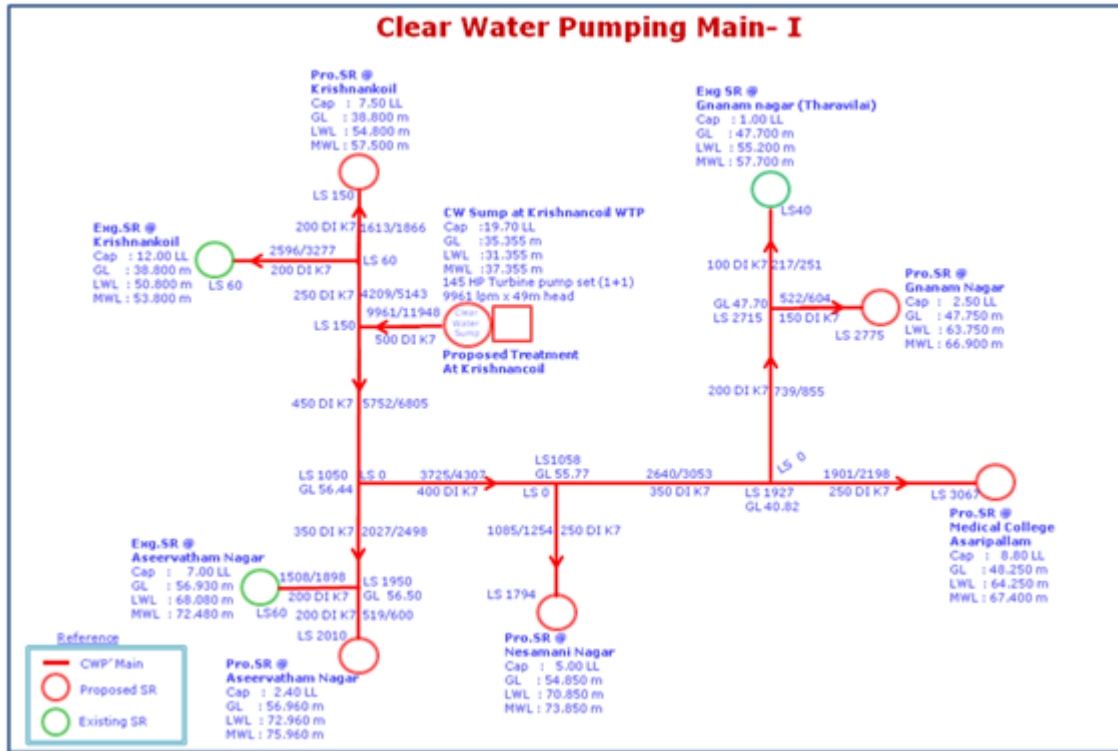


Figure 2.7: Clear water Pumping main - I

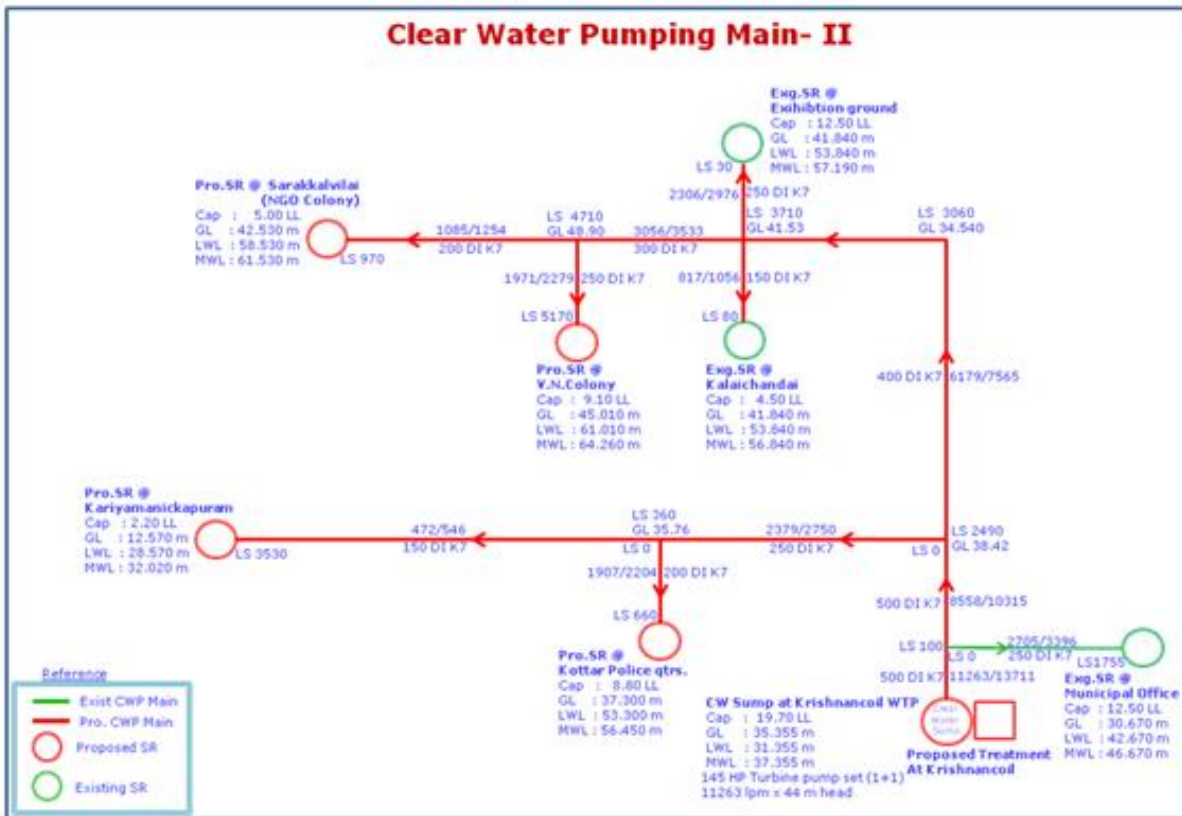


Figure 2.8: Clear water Pumping main - II



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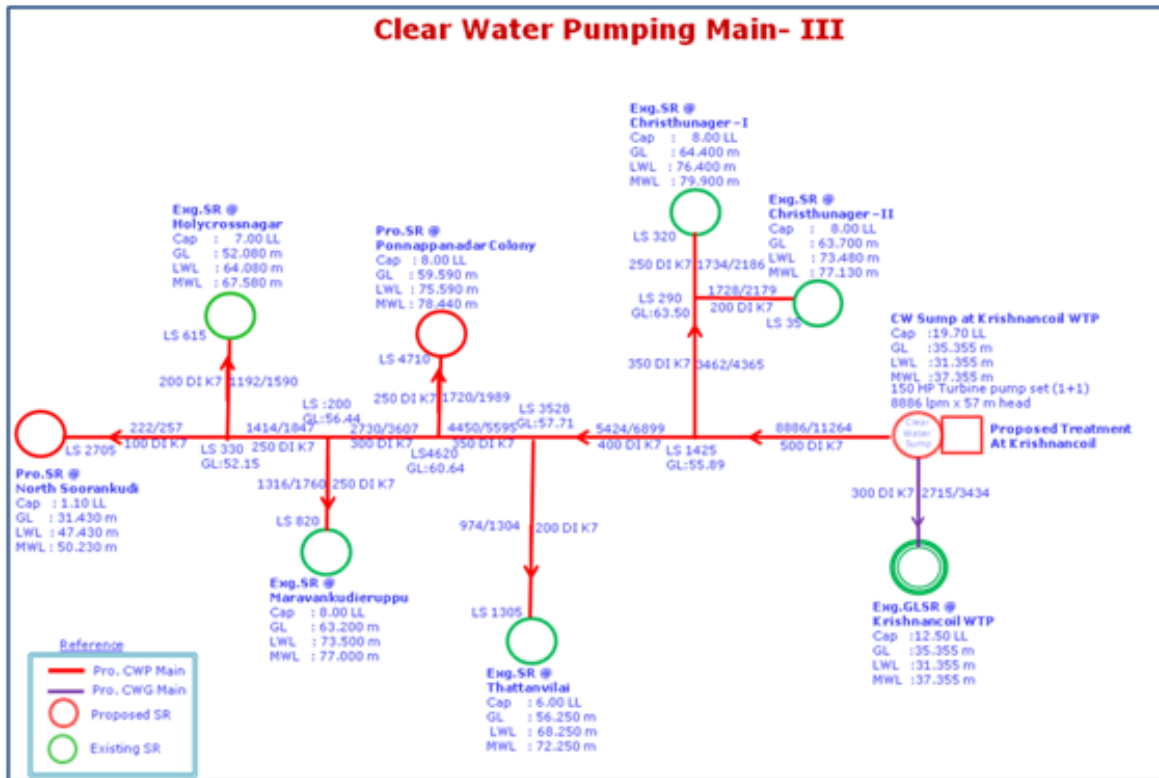


Figure 2.9: Clear water Pumping main - III

The alignment of the pipe line is along the SH 15 owned by the Highways Department and hence no land acquisition required and permission obtained from Highways department for laying. Balance pipe lines will be laid along TWAD service road. A general survey of alignment indicates that sufficient space is available trenching and no tree cutting is involved in this reach.

2.3.5 Service Reservoirs

The clear water conveyed from the WTP at Krishnankovil will be stored in the newly proposed elevated Service reservoirs -11 Nos., existing elevated Service reservoirs -11 Nos. and GLSR- 1 No. for the entire Nagercoil Municipality. Details of existing and proposed Service Reservoirs are as listed below.



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Table 2.5: Details of Existing Service Reservoirs

Sl.No	Location	Capacity
1.	Krishnancoil GLSR	12.50 LL – 1 No.
2.	Holycrossnagar	7.00 LL – 1 No.
3.	Thattanvilai	6.00 LL – 1 No.
4.	Kalaichandai	4.50 LL – 1 No
5.	Aseervatham Nagar	7.00 LL – 1 No.
6.	Krishnancoil WTP	12.00 LL – 1 No.
7.	Municipal Office campus	12.50 LL – 1 No.
8.	Exhibition ground	12.50 LL – 1 No.
9.	Christhunagar	8.00 LL – 2 Nos.
10.	Maravankudieruppu	8.00 LL – 1 No.
11	Gnanamnagar (Tharavilai)	1.00 LL – 1 No.

Table 2.6: Details of Proposed Service Reservoirs

Sl.No	Location	Capacity
1.	Krishnancoil	7.50 LL – 1 No.
2.	Aseervatham Nagar	2.40 LL – 1 No.
3.	Asaripallam (Near Medical College)	8.80 LL – 1 No.
4.	Gnanamnagar	2.50 LL – 1 No.
5.	Kottar	8.80 LL – 1 No
6.	Kariamanickapuram	2.20 LL – 1 No.
7.	V.N colony	9.10 LL – 1 No.
8.	Sarakkalvilai(Near NGO Colony)	5.00 LL – 1 No.
9.	Ponnappanadar colony	8.00 LL – 1 No.
10.	North Soorankudi	1.10 LL – 1 No.
11.	Nesamonynagar	5.00 LL – 1 No.

2.3.6 Distribution System

The water stored in the proposed and existing service reservoirs will be distributed through the proposed distribution system network. In addition provisions have been made for flow control valves at salient locations in order to maintain equitable distribution. Necessary provision for House Service connections has been made up to the boundary of the property limit. It is proposed to provide HDPE pipes up to 200mm dia. and above 200mm DI pipes in the existing and



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proposed distribution network. Accordingly the proposed distribution network for a length of 420.612 Km with new HDPE and DI pipes. The proposed lengths of distribution system for new zones are as tabulated below.

Table 2.7: Proposed Distribution system

Sl.No	Name & Location & Zone No.	D' System pipe length in m
1.	Krishnancoil (GLSR) Zone I	20035
2.	Municipal Office Complex Zone II A	12155
3.	Exhibition Ground Zone II B	23230
4.	Aseervatham Nagar Zone III	18621
5.	Krishnankoil WTP Zone IV	21023
6.	Christhu Nagar Zone V	25800
7.	Christhu Nagar Zone VI	34453
8.	Thattanvilai Zone VII A	18676
9.	Holy cross Nagar Zone VII B	20627
10.	Maravankudiyiruppu Zone VIII	20793
11.	Kalaichandai Zone IX	9270
12.	Gnanam Nagar (Marukalthalavilai)	11825
	Sub Total A	236508
13.	Krishnancoil SR Zone X	6666
14.	Aseervatham Nagar SR Zone XI	7458
15.	Nesamani Nagar Zone XII	23277
16.	Asaripallam MC SR Zone XIII A	10050
17.	Asaripallam MC SR Zone XIII B	13775
18.	Gnanamnagar SR Zone XIV A	14200
19.	Gnanamnagar SR Zone XIV B	4930
20.	North Soorankudi SR Zone XVI	5273
21.	Ponnappannadar Colony SR Zone XVII	18351
22.	V.N.Colony SR Zone XVIII	21085
23.	N.G.O.Colony SR Zone XIX A	14382
24.	N.G.O.Colony SR Zone XIX B	27659
25.	Kariyamanickapuram SR Zone XX	3435
26.	Kottar Police quarter SR Zone XXI	13563
	Sub Total B	184104
	Grand Total	420.612 Km



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2.3.7 House Service Connections

It is proposed to provide 85000 Nos of House service connections to Nagercoil Municipality. The House service connections includes replacement and new. Among the 85000nos, 11000 nos is in DI MAIN and balance 74000 nos is in HDPE Main.

2.3.8 SCADA

It is proposed to implement system with the following parameters to be monitored at the Head works, WTP and Service Reservoirs, gathering the real time data from remote locations, so as to monitor the entire components at a reduced maintenance cost. Centralized data storage and monitoring at the Master Control Room of the project is proposed at Water Treatment Plant.

1. Level in the collection well.
2. Pressure at the lines.
3. Flow at the discharge line of pump houses.
4. Energy monitoring of each pump outlet.
5. Control valves actuator in the tender specified locations.
6. Flow at the inlet and outlet of WTP, SRs.
7. Level at each Sumps and at Service Reservoirs.
8. Control valves at the outlet line of the Reservoirs.
9. Data recording at the Pump houses and reservoirs
10. Data transfer from RTU/PLC to SCADA monitoring Master Control Room (MCR). Centralized data storage and monitoring at the Master Control Room of the project.

2.4 Source Sustainability

The source has been selected based on DHG's report and cleared in the RSSFC during 5/13. The river Paraliar is considered as Source for the WSIS to Nagercoil municipality. It is proposed to tap 52.04 MLD of surface water from river Paraliyar. In order to draw water from the river Paraliar, necessary proposal for obtaining clearance from Water utilization committee with required hydraulic particulars and other related particulars had been sent to the Chief Engineer/PWD/WRO/ Madurai by the Chief Engineer/TWAD Board/Madurai vide Lr.No.



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3108/F.NGL/AE3(D)/2014/dt.24.03.2014. The clearance proposal is under scrutiny by the PWD authorities.

Water Balance Study:

Average outflow from Pechiparai and Perunchani dams	- 20292.97 mcft
Water required for irrigation	- 9715mcft
Water required for existing WSS	- 1494 mcft
Water demand for WSIS to Nagercoil municipality	- 670 mcft (52.04 mld)
Balance water available	- 8414 mcft 238.30 Mm ³

The above water balance study reveals that the total ultimate requirement can be tapped without any difficulty. The Regional sustainability source finding committee (RSSFC) has cleared the proposal for tapping of 52.04 mld of water in Paraliar River near Puthen dam.



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

3. ENVIRONMENTAL REGULATORY FRAMEWORK

3.1 Introduction

This section reviews the policies, regulations and administrative framework within which the project works are to be implemented. The review includes the Environmental and Social Management Framework (ESMF) developed by TNUFSL, Operational policies / directives of Funding Agencies through TNUFSL, sector-specific Environmental Policies & Regulations of the Government of India and the institutional profile of various agencies such as Tamil Nadu Pollution Control Board (TNPCB) and other stakeholders associated with the project.

3.2 Environmental Policies and Regulations

The environmental policies and regulations reviewed are broadly divided into the following four categories:

- Environmental and Social Management framework (ESMF)
- Operational policies of external Funding Agencies
- Environmental Policy and Regulatory Frameworks in India
- Regulatory Framework in the State of Tamil Nadu

3.2.1 Environmental and Social Management Framework

From Various Funding Agencies through TNUFSL, under which the proposed water supply project is to be funded, has formulated an exclusive Environmental and Social Framework to address Environmental and Social Impacts associated with infrastructure projects. Environmental and Social Management framework (ESMF) is in line with the Environmental and Social safeguard Policies and directives of the Various Funding Agencies through TNUFSL.

The proposed activity has no social impact and hence the project falls under **S3** as per **Social Categorization of ESMF** and is classified as **E1** as per **Environmental Categorization of ESMF**. Hence this project requires detailed environmental impact assessment and preparation of management measures.

3.2.2 Operational Policies and Directives of World Bank

- OP 4.01 for safeguard policies of World Bank which provides for the environmental assessment guidance for the lending operations is applicable.



PROVIDING WATER SUPPLY IMPROVEMENT SCHEME TO NAGERCOIL MUNICIPALITY

This OP 4.01 requires the borrower to screen projects for potential impacts and through appropriate EA assess, minimize and mitigate potentially adverse impacts from the project.

- The Environmental Assessment (EA) leads to be integrated in the project development process such that timely measures can be applied to address the identified impacts.
- Environmental Health and Safety guidelines of the World Bank are applicable for the project which will be ensured during project implementation.

3.2.3 Source Clearance

Approval for the proposal to tap 52.04 MLD of water from River Paraliar from Water Utilization Committee of PWD is under process.

S.NO	Activity	Clearance / NOC Required	Statutory Authority	Status
1	Withdrawal of raw water (52.04 MLD) from Paraliar River	Clearance to be obtained from Water Utilization Committee of PWD for 52.04 MLD for the Ultimate stage Demand.	PWD – Water Utilisation Committee	Clearance obtained from Water Utilization Committee of PWD for 52.04 MLD
2	Construction of off take well in the headworks.	Alienation	Revenue	Enter- upon permission has been given by the District Collector.
3	Construction of pipe carrying bridges for river crossing	Permission	PWD	Obtained permission for construction.

3.2.4 Environmental Policy and Regulatory Frameworks in India

The following are the key regulations in India applicable for various development projects.

- Constitutional Provisions
- The Environment (Protection) Act, 1986
- The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act 2013



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- Forest (Conservation) Act, 1980 - as amended in 1988. Water (Prevention and Control of Pollution) Act, 1974 – and Tamil Nadu Water (Prevention and Control of Pollution) Rules, 1974
- Air (Prevention and Control of Pollution) Act, 1981 and Tamil Nadu Air (Prevention and Control of Pollution) Rules, 1983
- The Treasure Trove Act, 1878
- Hazardous Wastes (Management & Handling) Rules, 1989;
- Manufacture, Storage and Import of Hazardous Chemicals Rules, 1989
- Noise Pollution (Regulation and Control) Rules, 2000

This section reviews the policies, regulations and administrative framework within which the project is to be implemented. The review includes the Environmental and Social framework of TNUFSL, operational policies / directions of the World Bank and sector-specific environmental policies and regulations of the Govt. of India and Govt. of Tamilnadu.

a) Constitutional Provisions

The Constitution of India in its Article 48 provides for the protection and preservation of the environment and states that “the state will endeavour to protect and improve the environment and to safeguard forests and wild life of the country.” Further Article 51-A (g) on fundamental duties emphasizes that, “It will be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wild life and to have compassion for living creatures.”

b) The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act 2013

This Act ensures essential infrastructural facilities and urbanisation with least disturbance to the owners of the land and other affected families and provides just and fair compensation for land acquisitions. The proposed project does not have any private land acquisitions.

c) Forest (Conservation) Act, 1980

The Act pertains to diversion of forestland and felling of roadside plantation. Depending on the size of the tract to be cleared, clearances are to be obtained.



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Restrictions and clearance procedures proposed in the Forest (Conservation) Act apply to the natural forest areas, even in case the protected/designated forest area does not have any vegetation. Hence the project does not cross any natural forest areas.

d) The Environment Protection Act 1986, & Notifications

In order to create national environmental legislation, the EPA articulates a policy for environmental protection covering air, water and land and provide a framework for Central Government to coordinate between Central and State Authorities established under various laws, including the Water Act and Air Act. Under this umbrella Act, the Central Government must set National Ambient and Emissions Standards, establish procedures for managing hazardous substances, regulate industrial sites, investigate and research pollution issues and establish laboratories and collect and disseminate information.

Among other relevant legislation, the Public Liability Insurance Act (PLIA) of 1991 mandates that business owners operating with hazardous substances take out insurance policies covering potential liability from an accident and establish Environmental Relief Funds to deal with accidents involving hazardous substances. The National Environmental Appellate Authority Act of 1997 requires the Central Government to establish an authority to hear appeals on area restrictions where operations will not be carried out or will be carried out with certain safeguard measures.

e) The Air (Prevention and control of pollution) Act, 1981 amended in 1987

This Act provides prevention, control and abatement of air pollution. With a framework similar to the Water Act, the Air Act gave the central and State Board's authority to issue consents to industries operating within the designated air pollution control areas. The State also prescribes emission standards for stationary and mobile sources. Since the proposed project involves operation of DG sets, the above said Act and emission standards will be complied.



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f) Water (Prevention & Control) Act 1974

Water Act is the first environmental regulation that brought at the state and center levels, pollution control boards to control / regulate environmental pollution in India. The Act was amended in 1978 and 1988. Salient features of the Act are the following:

- **Section 25** of the Act requires an application to be made to the state board to establish any treatment and disposal system that is likely to discharge sewage or trade effluent in to a stream or well or sewer on land

These laws seek to control pollution of water and enhance the quality of water. Under this law, it is mandatory to obtain consent to establishment for in case of any outlet for disposing waste/ effluent.

g) The Treasure Trove Act, 1878

The Indian Treasure Trove Act, 1878 (Act No. VI of 1878) was promulgated to protect and preserve treasure found accidentally but having the archaeological and historical value. This Act was enacted to protect and preserve such treasures and their lawful disposal. In a landmark development in 1886, James Burgess, the then Director General succeeded in prevailing upon the Government for issuing directions forbidding any person or agency to undertake excavation without prior consent of the Archaeological Survey and debarring officers from disposing of antiquities found or acquired without the permission of the Government.

h) The Noise Pollution (Regulation and Control) Rules, 2000

In order to curb the growing problems of noise pollution, the government of India has enacted the noise pollution rules 2000 that includes the following main provisions:

- The state government may categorize the areas as industrial or commercial or residential.
- The Ambient air quality Standards in respect of Noise for different areas has been specified.



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- The State government will take measures for abatement of noise including noise emanating from vehicular movement and ensure that the existing noise levels do not exceed the ambient air quality standards specified under these rules.
- Areas not less than 100 m around Hospitals, Educational institutions and Court is declared as silence area under these rules.
- A person found violating the provisions as to the maximum noise permissible in any particular area will be liable to be punished for it, under the provision of these rules and any other law in force.

i) Manufacture, Storage and Import of Hazardous Chemical Rules, 1989

These rules aim at controlling the generation, storage and import of hazardous chemicals. These Rules are applicable to an industrial activity or isolated storage in which there is involved a quantity of hazardous chemical listed in the Schedule of the Rules which is equal to or more than the quantity specified in the entry for that chemical in the Schedule. According to these rules, the user of hazardous chemicals has to perform the following and dispose hazardous waste as mentioned in the rules.

- Identify the potential hazards of the chemicals and take adequate steps to prevent and control such hazards
- Develop or provide information about the chemical in the form of safety data sheets
- Label the specified information on the container of the hazardous chemical

Chlorine used as a disinfectant in WTP is categorized as hazardous chemical as per MHSIC rules 1989. Maximum 2.7 Tonnes of Chlorine is stored at WTP and does not attract the provisions of these rules.

(Note: On exceeding 5 nos of chlorine cylinders licence from PESO under Gas Cylinders Rules to be obtained.). Hence obtaining licence from PESO does not arise.

3.2.5 Regulatory Framework in the State of Tamil Nadu

Railway Crossings:

Permission from Southern Railways has been obtained in order to lay raw water pumping main crossing the railway lines.



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Highway Crossings

The raw water and clear water pumping mains crosses the National Highways at 1 locations and State highways at 4 locations.

Table 3.1: Details of National and State Highways Crossings

S.NO	Activity	Description	Status
1.	Railway Crossing	2 No	Obtained permission for construction.
2	State Highways Crossings	4 Nos	Obtained permission for construction.
3	National Highways Crossings	1 Nos	Obtained permission for construction.

3.2.6 Clearances/ NOC Required from Competent Authority

The summary of applicable **Clearance / NOC** required for the proposed project is given in **Table 3.2.**

Table 3.2: Clearances/ NOC Required from Competent Authority

S.NO	Activity	Clearance / NOC Required	Statutory Authority	Status
1	Withdrawal of raw water (52.04 MLD) from Paraliar River	Clearance to be obtained from Water Utilization Committee of PWD for 52.04 MLD for the Ultimate stage Demand.	PWD – Water Utilisation Committee	Clearance obtained from Water Utilization Committee of PWD for 52.04 MLD
2	Construction of off take well in the headworks.	Alienation	Revenue	Entered upon permission has been given by the District Collector.
3	Construction of pipe carrying bridges for river crossing	Permission	PWD	Obtained permission for construction.



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4. BASELINE ENVIRONMENTAL PROFILE

4.1 Introduction

The scope of the project is to provide water supply improvement scheme to the people residing at Nagercoil municipality in Kanyakumari District which will evidently have a positive impact. However, during the project implementation and operation, the environmental components are likely to be affected which have to be assessed and mitigation measures taken.

4.2 Objective of the Study

The object of the study is to identify and assess the likely environmental and other Socio –economical Public Health Impacts of the project and its components. The study shall derive an Environmental Management Plan for bringing out the project to environmentally sound and socially acceptable besides fulfilling their water requirement. Necessary monitoring mechanism for the proper operation and maintenance of the project with regard to environment has been focused.

4.3 Baseline Environmental Profile

a) Meteorological features:

The District experiences tropical pleasant climate throughout the year. Winter temperature ranges from 33.8°C to 21.6°C while summer temperature ranges from 34.8°C to 22.4°C. January to February is the winter season and March to May is the summer season. The project area receives rainfall both during the south-west and the north-east monsoons. The southwest monsoon period starts from the month of June and ends in September, while the north-east monsoon period starts from October and ends in the middle of December. January to February is the dry season and March to May is the hot season. The annual average rainfall in the project area is 1045 mm.. During the North-East monsoon, between October and December, a precipitation of 549 mm is received in 24 rainy days and during the South-West monsoon 537 mm is received from June to September in 27 rainy days. In summer, 332mm of rainfall is received in 11 rainy days between March and May. Relative humidity ranges between 60 to 100 %.



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b) Geology and Minerals:

The geological formation of the district is simple, comprising essentially alluvial deposits of Pazhayar lying over tertiary weathered rock. This formation covers the entire area. The formation consists of fine sands, gravely sands, clays and sandy clays. In its more western areas, the alluvium partakes more of the nature of a rich loam - being mixed, sometimes with fine reddish silt or mainly of pale clayey mud, which gradually shades off in to the blown sands of the coast. The beach deposits of the project area contain minerals of Industrial use such as rutile, illmenite, zircon, monozite etc. Salt pans are located along the Pazhayar River bank. Salt is the important resource extracted from Pazhayar river. River sand is another important mineral source. According to classification, soils of this region fall into coastal and riverine alluvium and red loam soil types. Major part of the project area is covered by Sandy coastal alluvium and red soil types cover the rest of the area

c) Soil Characteristics:

Results of the soil samples collected as part of the investigations by the TWAD Board shows that the soil type in the project area is dominated mostly red soil and lateritic, clayey and alluvium soil. The permeability rate varies from very high to medium, depending upon the soil texture. It was reported that the over-exploitation of ground water cause heavy decline in water level in the Kanyakumari District.

d) Water quality:

The water samples collected from river Paraliar, analyzed for various characteristics of water quality. These are found to conform to CPHEEO Guidelines.

4.3.1 Air Quality

The ambient air quality measured at the project site is given in Table 4.1. Nearby two sites have been identified for measuring the ambient air quality. The two sites were details in given in Table 4.2.



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Table 4.1- Ambient Air Quality Results

Ambient Air Quality Primary Data					
Sl.No	Locations	Results			
		PM ₁₀	PM _{2.5}	SO ₂	NO _x
NAAQ Standards (24 Hrs)		100	60	80	80
1	Near Puthendam	93.2	50.3	19.2	28.4
2	Krishnancoil WTP	80.37	38.3	21.9	23.2

Table 4.2-Techniques used for Baseline analysis

S.No	Parameter	Technique
1	Particulate Matter (PM10 & PM2.5)	PM10 Particulate Sampler & Fine Particulate Sampler (Gravimetric method)
2	Respirable ParticulateMatter	Respirable Dust Sampler (Gravimetricmethod)
3	Sulphur Dioxide	Modified West and Gaeke
4	Nitrogen Oxide	Jacob &Hochheiser

From the study, it was observed that the parameters for air quality are within the standards for prescribed National Ambient Air Quality Standard.

4.3.2 Ambient Noise Levels

The ambient noise measured at the project sites are given in table below.

Table 4.3- Ambient Noise Level result

Noise level - Primary Data					
Sl.No	Location	Day Time		Night Time	
		Minimum	Maximum	Minimum	Maximum
1	Near Puthendam	51.90	54.00	48.00	52.00
2	Krisnancoil WTP site	41.30	45.00	37.60	40.00

The noise qualities in general found to be within the limits in project site.

4.3.3 Surface Water Quality

There is no pollution occurred in the river source. The surface water quality of the river source from samples collected from Puthendam during different seasons is given Table 4.4.



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Table 4.4- The Surface Water Quality Puthendam

Sl. No	Parameters	Unit	Sample collected on June'13	Sample collected on Sep'14
1	Colour	Hazen	Slightly yellowish	Brownish
2	Turbidity	NTU	18	127
3	Ph		6.9	7.22
4	Electric conductivity- EC	Mho/cm	118	345
5	Dissolved Solids	Mg/lit	78	30
6	Permanent Alkalinity- PA	Mg/lit	0	0
7	Total Alkalinity- TA	Mg/lit	18	8
8	Total Hardness- TH	Mg/lit	34	10
9	Calcium –Ca	Mg/lit	10	4
10	Magnesium- Mg	Mg/lit	2	0
11	Sulphate - So4	Mg/lit	3	1
12	Nitrite – No3	Mg/lit	2	1
13	Fluoride – F	Mg/lit	0.2	0.2
14	Iron – Fe	Mg/lit	1.88	2.71
15	Sodium – Na	Mg/lit	9	6
16	Potassium - K	Mg/lit	1	0

- The pH of surface water in the study area is 6.9 & 7.22 and Conductivity is 181 & 345 μ S/cm.
- TDS values were found to be 78 & 30 mg/l and Total Hardness found to be 34 & 10 mg/l. This indicates that water in the study area was hard in nature and it is observed that it lies within the standards. The Total alkalinity found to be 18 & 8 mg/L. These values are within the standard limit but turbidity is (18 & 127) above the standard limit.

The Existing SR site and Consumer Endwater quality is given in **Table 4.4**.



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Table 4.5- Existing SR Site and consumer end water quality

S.No	Parameters	Unit	SR site	Consumer end
1	pH		7.12	7.1
2	Turbidity	NTU	4	0
3	Colour	Hazen	Clear	Clear
4	Odour		Unobjectionable	Unobjectionable
5	Chlorides as Cl ⁻	mg/lit	6	2
6	Sulphates as SO ₄ ²⁻	mg/lit	1	1
7	TSS	mg/lit	4	0
8	Residual Chlorine	mg/lit	Nil	Nil
9	TDS	mg/lit	39	10
10	Total Hardness as CaCO ₃	mg/lit	8	6
11	Calcium as Ca ²⁺	mg/lit	3	3
12	Magnesium as Mg ²⁺	mg/lit	0	0
13	Total Alkalinity as CaCO ₃	mg/lit	8	6

As the turbidity is very high and no residual chlorine exists, it is essential to treat the water to reduce the turbidity and to give residual chlorine at the consumer end and to bring the other parameters within the standard limits, a full scale water treatment plant is proposed.

4.3.4 Soil Analysis

The soil characteristics in the project sites are given in Table 4.5.



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Table 4.6- Soil Quality

Sl.No	Parameters	Units	Puthendam	Krishnancoil
1	Texture		Sandy Loam	Clay Loam
2	Lime Status		Present	Present
3	Electrical Conductivity	mhos/cm	0.045	0.038
4	pH Soil Reaction	No	5.1	7.1
5	Nitrogen	Kg/Ac	124	129
6	Phosphorus	Kg/Ac	38	46
7	Potassium	Kg/Ac	9.8	9.5
8	Iron	Ppm	2.5	2.7
9	Manganese	Ppm	1.4	1.3
10	Zinc	Ppm	1.6	1.8
11	Copper	Ppm	0.8	1.0

The pH indicates that the soils in the study areas are basic in nature, with the pH varying in the range of 5.1 to 7.1. The Electrical Conductivity was observed in the range of 0.045-0.038mS/cm.

The Nitrogen values are in the range of 124 – 129 mg/kg indicating that soils have high Nitrogen levels. The Phosphorous values are in the range of 38 – 46 mg/kg indicating that soils have an average Phosphorous level. The Potassium values range between 9.8 – 9.5 mg/kg, which indicate that the soils have low quantity of Potassium. The soil from the study area shows that they are less fertile.

4.3.5 Biological Environment

(a) Terrestrial Animal Ecology

The dominant groups are spiders, Theylphonus and Galeodes. Among vertebrates, field rats, Mabuya and Calotes are common. None of them belong to the rare or endangered species.



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(b) Terrestrial plant Ecology

The main cultivated crops are paddy, banana tree etc., the uncultivated lands are covered by a massive growth of species such as Rubber, partheniumhystopharus, Annona squamosa, Musa paradisiacal and some Herbaceous plants like Tephrosiasps., Tephrosiapurpurea etc., Kanyakumari District accounts for more than 95% of the production of natural rubber in the state of Tamil Nadu. Due to the ideal soil and climatic conditions existing in Kanyakumari district, the natural rubber yield from here has the finest superior quality in India. Rubber is cultivated mainly in the hilly areas (on the Western Ghats) in the interior, while paddy fields and other crops are mainly found on the plains, near the coast. The other crops under cultivation are rice, coconut, tapioca, banana, pulses, cashew, mango, palmyrah, tamarind, areca nut, jack fruit clove etc. Regarding the status of fauna, there are no habitations or breeding place of wild life species. The bio diversity of plant, animal and bird species are limited in the study area. The soil fertility, shortage of water and low water table could be attributed as causing the poor status of biodiversity.

4.3.6 Socio Economic studies

The total present population of the study area is about 246753. The project area is about 1672 sq.km. The literacy level of the above area is about 91.96%.

The entire project area have been provided with electricity and well connected by road. Basic amenities like water supply, transport, telephone, post and telegraph, public health and sanitations facilities, health centers, recreation facilities like cinema, etc., are moderately available to the people.

As the project envisages on water supply to the beneficiaries, there is no involvement of air and its impact other than the construction phase.

4.3.7 Environmental Profile

Baseline study was carried out for various environmental parameters based on the various activities in the proposed project. The stations identified for the study included the project sites where the components proposed to be located are envisaged to have significant activity during operation.



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Puthendam - Site for construction of Head Works

Krishnancoil - Site for construction of WTP

4.4 Screening of the Project as per the ESMF of TNUIFSL

4.4.1 Environmental Screening

Environmental screening of the proposed project is carried out for the proposed activities. Based on which the possible impacts are given below:

- Negative impacts on surrounding environmental conditions (temporary impacts due to Air/Noise pollution).
- Water resource problems (i.e., reduction in water availability for water supply and irrigation projects downstream of Paraliar River).
- Air pollution (during construction stage, by dust generated due to construction activities) and noise pollution during construction stage (due to construction activities) and operation stage (due to operation of pumps).
- Energy consumption for pumping activities
- Pollution of water bodies
- Construction hazards to residents (due to pipe laying works).
- Release of toxic gases (chlorine) and accident risks (due to collapse of reservoirs) which may lead to health and safety risks in the neighborhood during operation stage.

In view of the above, and the Project proposed activities like Water treatment plant and river intake work, the Project is categorized as “E1” per ESMF of TNUIFSL. As per this categorization the Project requires Environmental Impact Assessment and project specific EMP. **Environmental screening prepared for the project in the prescribed format is provided as Annexure I.**

4.4.2 Social Screening

A Social screening exercise has been carried and the filled in social screening format is enclosed as **Annexure-II**. Based on this, this sub project is classified as S3 as per ESMF. In this social screening exercise all the identified sites are screened for encumbrances.



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4.5 Description of sites of Project Components

Description of sites identified for locating the project components are given below. For future expansion the land is kept vacant for WTP components, the raw water and clear water pump houses are designed to meet out the future demands. The site layout plan for the project sites are given in **Annexure III**.

4.5.1 Head Works (Raw Water offtake)

The head works (River offtake) is proposed to be located at the bank of river Paraliyar on the upstream side of Puthendam. An extent 0.50 Acres of land has been earmarked for the construction of the proposed off take well cum pump house and other infrastructures like Staff Quarters, SCADA room. Generator shed, Transformer yard and also for the construction of compound wall. There is separate access will be provided for the head works and quarters. The Head works site is situated near Perunchani village and is ThoppuPoromboke owned by Revenue.



4.5.2 Alignment of Transmission Main

The alignment of the raw water Pumping main from Offtake well to Water treatment plant at existing WTP site at Krishnancoil is along road berms within the right of way of the road. Surveys has been taken along the alignment of Raw water pumping main. Pipe lines will be laid for the length of 31.85km in which Revenue department- 0.5km, State highways(MDR).4.55 km, SH- 26.5KM, NH- 0.5 KM are involved.





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There is no forest area land adjoining the alignment.

The alignment of the Clear water Pumping main from Water treatment plant to Service Reservoirs in various locations is along the road berms within the right of way owned by Highways Department and Urban Local body. Pipe lines will be laid for the length of 31.006km out of which State highways- 8 km, NH -2.2 KM, Municipal road- 20.806km are involved. There is no forest area land adjoining the alignment. Due to unavoidable circumstances if necessary and compensatory new plantations will be planted 10 times the number of trees to be cut.



4.5.3 Water Treatment Plant

The Proposed WTP site is located in the near existing Water Treatment Plant site for Nagercoil Municipality.





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The site is situated along NH 47B and near to Vadasery Main Bus stand. The site has clear access to enter to the work spot. The total extent of the site is 3.56 acres. This site has three treatment plant units I, II and III. The new treatment plant for the scheme is proposed to be constructed in the extent occupied for WTP I & II after demolition of the existing structures.



4.5.4 OHTs.

It is proposed to construct 11 Over Head Tanks, and the sites are owned by ULB, Public Works Department, Cooperative Housing Society and Medical. The details of each of the 11 sites are provided below.

i) Krishnankoil

The SR site is located in existing Water Treatment Plant premises of Nagercoil Municipality. The site is situated along NH 47B and near to Vadasery Main Bus stand. The site has easy access. The proposed SR is to be constructed near the existing SR in this site.





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ii) Aseervatham Nagar

In this site one existing Service Reservoir and compound wall is available. OHT is proposed in the vacant area. The site is the main city area and has easy access from Main road. Dwelling houses are nearby the site.



iii) Nesamony Nagar

This site is belongs to urban Local body. The extent earmarked for the OHT is vacant and easily accessible through adjacent roads. Dwelling houses are adjoining the site.



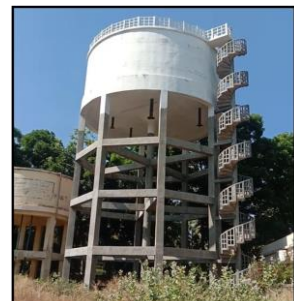
iv) Asaripallam (Medical College)

This site is situated in the backside compound of Asaripallam Medical college and along the road to Gnanamnagar. Private Coconut thoppu is adjoining the site. The site is also inside the city and easily accessible through road.



v) Gnanamnagar

In this site one existing Service Reservoir is available. The OHT is proposed in the vacant extent in the site. The site is inside the city and houses exists around the site.





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vi) North Soorangudi

In this site one existing Service Reservoir and RR Masonry compound wall are available. The extent identified is directly accessible from the adjacent road. There are Dwelling houses inside the site.



vii) Ponnappanadar colony

The site is located within the Muncipal limit. The site belongs to urban local body. There are roads on all sides, the OHT would be constructed without disturbing the existing trees. There are dwelling houses nearby the site, it is an easily accessible.



viii) V.N. Colony

The site is located within the Municipal limit. The site belongs to urban local body. There is a municipal building in one portion of the site. The OHT is proposed in the vacant portion of the site. OHT would be constructed without disturbing the existing trees present along the boundary. There are dwelling houses nearby the site, it is an easily accessible from adjacent road.



ix) NGO Colony

The site is located within the Muncipal limit. The site belongs to urban local body. OHT is proposed





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in the vacant portion of the site with direct access from the adjacent road. There are dwelling houses nearby the site, it is an easily accessible,

x) Kottar

The site is in the premises of Police Quarters and inside the main city. The police staff quarters are available near by the site. The site is vacant land and has access from main road.



xi) Kariamanickapuram

The site is far from the city and in Kanyakumari road. The site is situated near by the Pond and outside the village. It is the end of Kulathoor village. The site is vacant land and has easily accessible.



Distribution System

The pipe lines will be laid along the berm and within the right of way of Municipal roads and Highways road and Streets.



Table -4.5: Land Details for the proposed project facilities



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S.No	Name of location/ Sump	Area of Land required in m ²	Area of land available in m ²	Owner of the land	Remarks
A From Source to Municipal Limit					
1	Headworks in River Paraliar			PWD	Enter Upon Permission obtained from PWD
2	Construction of WTP in Krishnan Kovil			Nagercoil Municipality	
B Within Municipal Limits					
1	Construction of Service Reservoir at Krishnan Kovil (7.5LLCapacity)	283.39	16800	Nagercoil Municipality	
2	Construction of Reservoir at Asirvathanager (2.4LL Capacity)	143.06	546	Nagercoil Municipality	
3	Construction of Reservoir at Asaripallam near Medical College (8 LL Capacity)	349.49	2500	Asaripallam medical college	Enter Upon Permission obtained
4	Construction of Reservoir at Gnanam nagar (3.4 LL Capacity)	113.04	9100	Nagercoil Municipality	
5	Construction of Reservoir at Kottar (7.5 LL)	283.385	350	PWD	Enter Upon Permission obtained
6	Construction of Reservoir at Kariamannickapuram (2.2 LL)	113.04	10600	PWD	Enter Upon Permission obtained
7	Construction of Reservoir at V. N. Colony (9.1 LL)	333.12	800	Nagercoil Municipality	
8	Construction of Reservoir at sarukkal vilai (Near N.G. O. Colony) (5 LL)	221.55	350	Nagercoil Municipality	
9	Construction of Reservoir at Ponnappa Nadar Colony	298.5	685	Nagercoil Municipality	
10	Construction of Reservoir at North Soorankudi	200	200	Nagercoil Municipality	
11	Construction of Reservoir at Neasamony nagar (5 LL)	221.55	350	Nagercoil Municipality	



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Table-4.6: Details of Proposed offtake/Headworks structures

Location/components	Extent required	Extent available	Ownership	Current Land Use	Alienation Status
Offtake Well @ Puthen dam	1500 m2	50 cent	Revenue	Owned by PWD	Entered upon permission has been given by the District Collector.

Table-4.7: Details of Proposed WTP

Location	Extent required	Extent available	Ownership	Current Land Use
WTP at Krishnan Kovil	50 cent	3.56 acres	The Commissioner NGL Municipality	Existing WTP plant is functioning

Table-4.8: Right of Way and Ownership Details for Pipe Laying

Component	Name of Road	Ownership	Length	Status
Transmission Main				
Raw Water Pumping Main – 31.85 KM	Head Work site Thoppu promboke to Perunchani Road	Revenue	0.5 km	Permission obtained
	Perunchani Road to Surulacode	SH (Major District Road)	4.55 km	Permission obtained
	Surulacode to Erachakulam	SH	26.5 KM	Permission obtained
	Erachakulam to Krishnankoil	NH	0.3 KM	Permission obtained
Pipe carrying bridge at 11 No locations	Across Paraliyar River, Pzhayar River and Channel crossings	PWD	(40m, 30m 60m & 20m)	Permission obtained
Clear Water Pumping Main – 31.006 km	WTP to 23 OHTs	NH	2.2 km	Permission obtained
		SH	8 km	Permission obtained
		Municipality Road	20.806 km	Own road



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5. ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

5.1 Introduction

Environmental Impact can be defined as “any alteration of environmental conditions or creation of a new set of environmental conditions, adverse or beneficial, caused or induced by the action or set of actions under consideration”. Generally, environmental impacts can be classified as primary or secondary impacts. Primary impacts are those, which are attributed directly by the project while secondary impacts are those, which are induced by primary impacts and include the associated investments and changed patterns of the social and economic activities by the action.

This section identifies and assesses the potential changes in the environment that could be expected from the proposed project. The impacts have been predicted for the proposed activities assuming that the impact due to the existing activities has already been covered under base line environmental monitoring and continue to remain same till the operation of the project. The proposed project activities would create impact on the environment in two distinct phases i.e., construction and operation phases. Impacts are identified, predicted and evaluated based on the analysis of the information collected.

This section also describes mitigation measures, which have been suggested for the adverse impacts likely to be caused due to activities of both construction and operation phases of the project.

The identification of likely impacts during construction and operational phases of the proposed project has been done based on likely activities having their impact on one or another environmental parameters. The details of the activities and their impacts have been worked out in the following sections.

5.2 Impacts and Mitigation Measures

5.2.1. Topography

The impact on land environment would be mainly due to construction activities, excavation, earthwork, filling and cutting etc. The WTP of the project is proposed in the existing WTP site at Krishnankovil. Excavation of soil is required for



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the structures for WTP construction. The excavated soil will be utilized in the WTP site itself for filling the building foundations, site grading. The Sump site and GLSR/ESRs are also proposed in level lands and hence no cutting of soil is required for the construction. The soil excavated for the sump will be utilized for filling the building foundation and site grading at the respective sites itself. Most of the soil excavated for the clear water main pipelines will be utilized for filling the trenches after laying the pipes. The quantity of soil remaining after filling the trenches will be for filling up low lying area which is not a water body or pond.

Since the quantity of earthwork involved in the project is not significant, no changes in topography of the project area are anticipated due to the project.

During the excavation, suitable safety measures as summarized in the management plan shall be adopted for the safety of construction labour and local residents residing along the pipeline route.

5.2.2 Ambient Air Quality

Construction Phase

Impacts on ambient air quality due to the proposed project activities are expected during the construction phase are primarily attributed to various construction activities of the project and associated generation of air pollutants such as dust, vehicular emissions, emissions from the DG set etc. The dust levels in the Head works, WTP areas are expected to be increased substantially during construction. Similarly, the trenching work for pipe lines will generate considerable dust pollution along the pipe line routes. The Ambient air quality standards, however, are not expected to be violated in the project area as the background levels are very low and the particulates tend to settle during low wind and stable conditions. Since heavy machineries used for the project will be less, impacts on ambient air quality due to vehicular emissions will be insignificant. It is also to be noted that these impacts are temporary in nature and will have moderate impacts on the settlements along the proposed pipe line alignment. However, to minimize these minor air quality impacts measures such as periodic dust suppression measures to be implemented.



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At the WTP site, demolition of the existing treatment plant units I & II would generate dust during construction.

Operation Phase

No component of the proposed water supply system is a source of air pollution during operation except DG sets which would be operated only during power failures. No impact on Air quality is anticipated along the pumping main.

5.2.3 Noise Levels

Construction Phase

The major sources of noise pollution from the proposed project are the construction activities, movement of vehicles and operation of construction equipment and DG sets etc. The noise likely to be generated during excavation, loading and transportation of material will be in the range of 90 to 105 dB (A) and this will occur only when all the equipment operate together and simultaneously. This is however, is a remote possibility.

The demolition activity proposed for dismantling the existing WTPs I & II also are expected to generate noise in the project site. The workers in general are likely to be exposed to an equivalent noise level of 80 to 90 dB (A) in an 8-hour shift, for which all statutory precautions are taken into consideration. However, careful planning of machinery selection, operations and scheduling of operations can reduce these levels.

Similarly, some settlements are found along the alignment of the Clear Water Main. There will be an increase in the ambient noise level at these locations during the pipe laying period. The impact on sensitive areas could be mitigated by staggering the operation of construction equipment and avoiding construction during night times so that the noise levels are reduced to the permissible limits. Considering the onsite noise levels, Personal Protective Equipment (PPE) such as ear muffs, etc. to the construction workers are provided.

Operation Phase

Pumps will be working 23hours per day at both headworks and the Water Treatment Plant and hence there will be an increase in the ambient noise level at



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these locations. The operating staff and the occupants in the quarters at these locations are considered as sensitive receptors. The increase in ambient noise level will have adverse impact on these sensitive receptors. However, to contain the impacts of noise during operation, the pumps proposed to be used less noise generating pumps and in addition workers involved in the operation shall be provided with PPEs. For this purpose, pumps with low RPM have been chosen for the scheme.

At the headworks site, the quarters would be located at about 200m away from the pump house. The pump sets/motor noise levels are maintained as per norms, ie 85-90 dB at 1 mtr distance and it is reduced at the quarters. Further, plantation is proposed in the vacant space in between which would further help in reduction of noise.

In WTP site, the pump rooms are within the ULB site the extent of which is 3.56 acres. The noise levels at the boundary of the site is expected to be within limits and hence no impact on the residences which are quite far away from the source. Within the site, the operating staff are expected to be exposed to the noise impact, which would be intermittent. However in any case of requirement, the staff would be provided with PPEs while entering the pump rooms in both the headworks and WTP.

5.2.4 Water Quality

The project envisages construction of an off-take well cum pumping station on the bank of Paraliar River. No pollution causing activities are present in upstream side of the River. However, during construction of the offtake well, care shall be taken to avoid dumping of construction debris, accidental spill of hazardous materials etc. into the River.

Ground water will be extracted for construction activities of the project during the construction phase, which may lead to an insignificant reduction in ground water availability in the project area. No ground water polluting activities are envisaged during the construction or operation phase of the project. Further, the supply of adequate protected water to the project towns will reduce any



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dependence on ground water there by reducing the pressure on ground water in the region.

Further, rain water harvesting have been proposed in all the project sites including the administrative building, control rooms etc in the WTP and SR sites for recharging the ground water sources. This will be a major positive environmental impact of the project.

Coffer dams will be provided for construction of head work without any disturbance of river water flow. After completion of work, the coffer dam and other construction debris will be removed, and river bed would be restored.

Necessary Flow Diversion arrangement will be provided for construction of Pipe carrying bridges without any disturbance of river water flow. After completion of work, the flow diversion will be removed, and river bed would be restored.

Drawal of 52.04 MLD from the source will not have any impact as the quantity is marginal compared to availability due to the minimum level of 956 mcf maintained in the Pechiparai dam which flows through Left Bank Channel of Puthendam. The Regional sustainability source finding Committee approved the source for the sustainability for Tapping of 52.04mld of water.

a) River Crossing

There are four river crossings proposed in the transmission alignment across River Palaiyar. The construction would be carried out with necessary precautions not to obstruct the flow of the channel. The design considerations made also would ensure minimum disturbance. It would be ensured that any flow diversion made to enable construction would be removed and river bed be restored upon completion of construction activities.

b) Handling of filter backwash water

Backwashing of filter media generates waste water containing debris, chemical Precipitates, straining of organic debris and plankton and residuals of excess chemical dosage etc. Filter wash water will be recycled from recirculation tank.

It is proposed to recover and reuse the filter backwash water. Recovery and reuse will be accomplished by mixing the filter wash water with the influent raw



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water before or at the rapid-mix basin. The wash water is collected in a back wash water collection sump from which it is pumped into the plant raw water inflow. Suspended solids in the wash water settle along with other solids in the plant basin. The recycling of filter wash water serves as a water conservation technique and may have economic advantages over other means of disposal.

c) Handling of Water Treatment Sludge

Water treatment sludge includes sludge from sedimentation of particulate matter in raw water flocculated and precipitated material resulting from chemical coagulation at Reactor Clarifiers, or residuals of excess chemical dosage, plankton etc.

As the raw water quality is very good, the usage of chemicals (lime and alum) and generation of sludge will be minimal in quantity. Since sludge generation will be very small in quantity which would around 1-2 tonnes per day.

Water treatment sludge will be dried in sludge drying beds and collected in Sludge pit and later disposed to Dump yard. Water collected from under drain of sludge drying bed will be sent to recirculation sump and then recirculated with raw water.

d) SCADA System

It is proposed to implement system with the following parameters to be monitored at the Head work, WTP & Service Reservoirs and at the Major tapping points or Branch point and gathering the real time data from remote locations, so as to monitor the entire components at a reduced maintenance cost. Centralized data storage and monitoring at the Master Control Room of the project is proposed at WTP.

1. Level in the offtake well.
2. Pressure at the discharge line.
3. Flow at the discharge line of pump houses.
4. Energy monitoring of each pump outlet.
5. Control valves actuator in the tender specified locations.
6. Flow at the inlet of SRs.
7. Level at each Sump and at Service Reservoirs.



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8. Data recording at the Pump houses, & WTP Major tapping points and at Reservoir.

10. Automation for controlling the wash water from wash water tank and waste water from backwash to recycling sump at Water Treatment Plant.

11. Data transfer from RTU/PLC to SCADA monitoring Master Control Room (MCR). Centralized data storage and monitoring at the Master Control Room of the project.

e) Handling of sewage from the project sites

The Head works site will be provided with sanitation facilities in the Quarters. The sewage arising from here would be disposed through septic tanks proposed. The WTP has existing facilities which dispose the sewage into septic tanks. Hence no impact is expected on either the ground water or the surface water.

5.2.5 Soil Environment

The impact on soil due to the proposed project will be in terms of loss of topsoil due to construction activities, extraction of soil from the borrow areas and soil erosion. Since no new borrow pits and quarries are envisaged for the proposed construction activities, no significant impacts are anticipated due to the project. Soil erosion may take place from the pipeline alignments if the soil is not compacted properly after filling the trenches and if the excess soil is left at the site. Pollution would take place to a negligible extent due to spillage of construction material, oil, fuel and grease around the construction sites. Care should be taken to minimize spillages of construction materials.

Sludge containing Alum from the clarification units of the Water Treatment Plant (WTP) is stored on WTP site may lead to soil contamination and loss of top soil, if not disposed off in designated landfills for that purpose. Sufficient land is available at the proposed WTP site for dewatering of sludge and the dried sludge would be sent to the sludge pit proposed within the site and will be taken away for disposal periodically and hence no impact on soil quality at WTP is anticipated.

The damaged pipes will be disposed to TSDF approved by TNPCB and in consultation with engineer concerned.



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5.2.6 Biological Environment

No forest areas, wild life sanctuaries or protected areas are present in the project influence area. The other ecological impacts of the project are discussed in the following sections.

Terrestrial Ecology

The proposed alignment of the transmission line passes along the Roads for 31.85 km for which permission is to be obtained from the concerned Department.

No tree cutting is envisaged for laying of transmission lines, but during implementation options would be reviewed and it will be ensured that tree cutting would be minimized if any cutting is required. Further it is proposed to plant around 100 new trees as part of the scheme in the project sites like HW and SR sites. The maintenance of the plants will be taken care by the local body.

However, the constructional activities may lead to inward migration of labour force in the area and thus there would be pressure on trees in the area due to increase in fuel demand. In order to prevent felling of trees in the neighbouring areas, adequate alternate fuel arranged to meet the fuel requirement of labour force. Tree plantation and landscaping proposed at the WTP and Service Reservoir locations will have a positive impact on the terrestrial ecology of the project area.

Impacts on Aquatic Ecology

The proposed offtake well will not affect the movement of fishes or any other fishery related activities. Hence no significant impacts on fish breeding or fish survival are anticipated due to the project activities. However, care taken to avoid deposition of construction waste / accidental spillage of construction material during the construction phase of the project and also by avoiding construction work during monsoon periods. Precautions would be taken also during the construction of pipe carrying bridges across the River Palayar.

5.2.7 Hydrogeology

- i) The raw water offtake cum pump house is proposed to be constructed on the bank of River Paraliar. The offtake structure has been designed for not



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to obstruct water flow in the river. It will have no impact on the river flow characteristics.

- ii) The location of the offtake is in the upstream of Puthen Dam, in between the flow of Perunchani dam and Puthen dam. The source availability has to be approved by the Water Utilization Committee of PWD for withdrawal of 52.04 MLD. It has been permitted after careful examination of water availability and the presence of other water supply schemes nearby by the Executive Engineer, PWD. The withdrawal would not exceed the permitted quantity and hence no impact is anticipated on the other schemes nearby.
- iii) Minor impacts are anticipated on the surface water drainage in the project area during the construction phase due to trenching work for pipe lines.
- iv) Precautions need to be taken during the pipe line work across canals and streams such that the flow in these water bodies is not obstructed thus affecting the cross drainage.

5.2.8 Social Environment

During construction, traffic and safety issues may arise in the places of work. These are adequately identified and necessary precautionary measures like barricading, signages, reflective lights, etc would be provided. These measures are incorporated in the environmental management measures for implementation during construction.

Regarding the establishment of the infrastructure for the scheme, the land required for constructing various project facilities such as construction of, off take well cum pump house, sump, WTP besides 11 elevated service reservoirs. These sites are owned by Rural Local Body, Public Works Department, Police, Revenue Department, Cooperative housing society and so on. Steps are being taken up by the Nagercoil Municipality and TWAD Board to obtain necessary enter upon permission for various sites.

Social Screening exercise was carried out by the TWAD Board officials along with municipal officials and observed that there are no any encumbrances in any of the above sites. The Social screening form duly filled and signed is annexed with this report as per **Annexure II**. Based on the above this sub project doesn't involve



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acquisition of private land and all the sites required for this project is free from encroachment, squatters, hawkers, hence this falls under the social category of S3 as per para 24, Table-7 of ESMF. The social impacts are assessed and details are provided separately in Social Impact Assessment Report.

5.2.9 Other Management Measures

5.2.9.1 Energy consumption and conservation

The project involves pipes of length around 500 km in undulating terrain with the gradient varying between 71m MSL and 40m MSL. The transmission main with pumping is 31.85 km. The head works for the scheme with off take well with 3 pump sets (2 working + 1 standby) of capacity 14899 lpm x 26m head.

The total power consumption for the pumping mains and other miscellaneous consumption (lighting etc) is 630kW. The pumps are selected with efficiency level of 75% which is more economic in power consumption. Also the pumps are with 950-1000 rpm selected so as to minimize the power consumption compare to the high rpm pumps. The consumption of electricity for lighting in Head works and WTP is 14 kilo watts for which energy efficient lighting has been proposed.

5.2.9.2 Management of floods

In case of any flooding due to heavy rains, any release from the dam would flow through the surplus river course and the head works is located near river bank of Paraliar. Hence no impact is envisaged during floods.

5.2.9.3 Safety in Construction Phase

- Adequate Precautions Will Be Taken To Prevent The Accidents And From The Machineries. All Machines Used Will Conform To The Relevant Indian Standards Code And Will Be Regularly Inspected By The TWAD.
- Where Loose Soil Is Met With, Shoring And Strutting Will Be Provided To Avoid Collapse Of Soil.
- Barricading Of Construction Site / Manholes At All Times In A Day With Adequate Signage.



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- Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc.
- Welder's protective eye-shields will be provided to workers' who are engaged in welding works.
- Earplugs will be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation
- The contractor will supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc to workers and staffs.
- The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labour Organization (ILO) Convention No.62 as far as those are applicable to this contract.
- The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 and adhered to.
- The contractor will not employ any person below the age of 18 years for any work and no woman will be employed on the work of painting with products containing lead in any form.

5.2.9.4 Safety Aspects of O&M

- All the sites for WTP, sump and OHTs are provided with compound wall of height 3.0m all around for safety purpose.
- The structures will be provided with easy access ladders, and handrails, interconnections between all units with proper safe walkway platforms for movement to avoid falling of human and materials. Electrical cables are laid in cable trenches. Open spaces at height will be covered with parapet walls and handrails.
- Chlorine Use in WTP

The consumption of chlorine per day is around 82 Kgs. So, the yearly consumption is 30 tonnes at the WTP works. It is proposed to use 3 Nos. in filled condition having 2.7 tonnes maximum at a time.



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The necessary safety measures for the storage and usage of Chlorine gas will be provided. The chlorine gas leak detectors will be provided to identify the leakage for immediate remedial actions. The emergency repair kit, Personal safety kit like full body cover, Oxygen kit for breathing, face mask, body shower and eye washers would be provided. For all these measures requiring separate items, and for those above in other sections cost provided in the table for EMP cost estimate.

The operating staff shall be given training as required for operation and handling chlorine gas plant. The person will be nominated to handle emergency if any.

Detailed information on the proposed safety measures in storage and handling of chlorine in WTP is provided in **Annexure – IV**.

5.2.9.5 Control of Water leakage/wastage

The quantity of water outflow will be monitored from the headworks up to the Elevated Storage Reservoirs (by Electro-magnetic flow meters (EMF), and the same will be monitored at WTP at Krishnancoil for any wastage in the transmission line. The action may be taken if any wastage/ leakage are noticed in the line. The necessary action may be taken to avoid the wastage of water. From the clear water sump, the transmission main starts and the water outflow is monitored at all the locations to avoid wastage of water.

Air valves would be provided at 500m intervals totalling 82 locations to control surge in the transmission line.



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5.2.9.6 Demolition of WTP I & II and Handling of waste

The WTP I & II units capacity are 5.68MLD and 7.08 MLD, it was constructed in 1941 & 1978 at Krishankovil. Due to leakage of Pipeline and damage of existing structure, the project envisages demolition of existing structures related to WTP units I & II. in this project.

In this proposal, the first step is to enhance the existing WTP III of 12 MLD to 18 MLD. Upon completion of this augmentation of WTP III, the inlet of WTP I & II would be connected to WTP III, to continue with the current water supply. After this, demolition of existing WTP units I & II would be carried out, where the proposed new WTP would be constructed.

During demolition of structure, care shall be taken to avoid dust and to dump the scraps of materials in the site. Use personal protective equipment (PPE) during demolition work. Inspect all stairs, passageways and ladders, illuminate all stairways. Screen is providing for surrounding area for avoiding dust pollution. The demolition of the existing treatment units would be carried out by cordoning the area from trespass and to control dust. Efficient housekeeping would be practiced during demolition and handling of waste. The demolition waste shall be disposed in line as per C&D waste management rules 2016.

5.2.9.7 Compensatory Tree Plantation Plan

No tree cuttings have been identified to be present in proximity to the proposed alignment. Construction activity to be done without Tree cutting activity if any, Compensatory plantation will be 10 times to the number of trees being cut. It is proposed to plant around 100 new trees as part of the scheme in the project sites like WTP and along municipal service road.

Table 5. 1- Proposed Plantation within project Site

S.No.	Botanical name	Common name
1	<i>Azadirachta indica</i>	Neem
2	<i>Albizia lebbbeck benth</i>	Vakai
3	<i>Polyalthia longifolia</i>	False Ashoka
4	<i>Arasa maram</i>	Ficus religiosa
5	<i>Bambusa arundinacea</i>	Mullumungil
7	<i>Thespesia populnea</i>	Portia tree, poovarasu



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8	<i>Peltophorum pterocarpum</i>	Copper pod tree
10	<i>Cassia Fistula</i>	Manjal kondrai
11	<i>Melai azadirach</i>	Malaivembu
12	<i>Mimusops elengilinn</i>	Maglim
13	<i>Poinciana pulcherrima</i>	Mayuram

5.2.9.8 Training of operation staff

Periodical training would be provided to the staffs and operators involved in the project O&M for chemical handling, emergency, SCADA O&M, line maintenance, valve operations, electrical & mechanical operations, cleaning of sumps and SRs.



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6. ENVIRONMENTAL MANAGEMENT PLAN

6.1 Objectives

Environmental Management Plan (EMP) is required to manage environmental impacts from the proposed project. It is a site specific plan developed to ensure that all necessary measures are identified and implemented in order to protect the environment. Site specific EMP is formulated to mitigate significant adverse environmental impacts that are identified and quantified in the process of baseline and impact assessment. An EMP also ensures that the resources are utilized to maximum extent, waste generation is minimized, residuals treated adequately and by-products are recycled to the extent possible.

6.2 Environmental Management Plan for Pre-Construction Phase

Environmental Management Plan (EMP) during Pre - Construction, Construction and operation phase is given under **Table 6.1**.



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Table 6.1: Environmental Management Plan for Pre- Construction, Construction and Operation

Sl. No.	Potential Negative Impacts	Mitigation Measures	Time frame	Responsible agencies
Pre- Construction				
1	Clearances	All clearance required during construction will be ensured and made available before start of work. Permissions will be obtained from the concerned authority.	Before start of construction	TWAD
2	Tree cutting	Construction activity to be done without Tree cutting activity if any, Compensatory plantation will be 10 times to the number of trees being cut.	During construction	TWAD
3	Utility Relocation	Identify the common utilities to be affected such as: telephone cables, electric cables, electric poles, water pipelines, public water taps etc. Affected utilities will be relocated with prior approval of the concerned agencies before construction starts	Before start of construction	TWAD Board / Contractor
4	Permissions from other departments	State High ways, National High Ways, other district highways, and Railway crossing for which permission was applied for a length of approximately 62 km.PWD approval for the withdrawal of 52.04MLD and pipe carrying bridge for river crossing will be constructed at three locations for a length of 40m, 20m, 30m & 60m.	Before start of construction	TWAD
5	Design Criteria	All the units of Head Works, treatment plant, Sump, and Pump Rooms will be designed in such a way that it can withstand maximum load and without compromising performance. The design will take into consideration all the measures identified.	Before start of construction	TWAD



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During Construction				
1	Baseline parameters	Adequate measures will be taken and checked to control the Baseline parameters of Air, Water and Noise pollution. Base line parameters recorded will be used for monitoring and conformance be ensured.	During Construction	TWAD/Contractor
2	Planning of temporary traffic arrangements	The activities are limited to the project sites and right of way. During execution of works, as per the need in the site, necessary permissions for temporary diversion will be obtained. Signages and safety measures including flagmen are provided at the site.	During construction	TWAD/Contractor
3	Storage of materials	The contractor will identify site for temporary use of land for construction sites / storage of construction materials, etc.	Before start of construction	Contractor/TWAD
4	Construction of labour camps	<p>i) Contractor will follow all relevant provisions of the Factories Act, 1948 and the Building and the other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 for construction and maintenance of labour camp).</p> <p>ii) The location, layout and basic facility provision of each labour camp will be submitted to Engineer prior to their construction.</p> <p>The construction will commence only upon the written approval of the Engineer.</p> <p>The contractor will maintain necessary living accommodation and ancillary facilities in functional and hygienic manner and as approved by the Engineer.</p> <p>All temporary accommodation must be constructed and maintained in such a fashion that uncontaminated water is available for drinking, cooking and washing. In case of women labourers, exclusive bathing and toilet facilities shall be provided.</p> <p>The sewage system for the camp must be planned and safely disposed.</p> <p>Necessary arrangement shall be made for collection of solid wastes and disposal shall be in co-ordination with the municipality. Adequate health care is to be provided for the work force.</p> <p>The layout of the construction camp and details of the facilities provided will be</p>	During construction	Contractor



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		<p>prepared and will be approved by the Engineer.</p> <p>Awareness about HIV/AIDS will be provided, grievance redressal mechanism for the camps, [only suggestion]</p>		
5	Safety Aspects	<p>Adequate precautions will be taken to prevent the accidents and from the machineries. All machines used will conform to the relevant Indian standards Code and will be regularly inspected by the TWAD.</p> <p>Where loose soil is met with, shoring and strutting will be provided to avoid collapse of soil.</p> <p>Barricading of construction site / manholes at all times in a day with adequate signage.</p> <p>Protective footwear and protective goggles to all workers employed on mixing of materials like cement, concrete etc.</p> <p>Welder's protective eye-shields will be provided to workers' who are engaged in welding works.</p> <p>Earplugs will be provided to workers exposed to loud noise, and workers working in crushing, compaction, or concrete mixing operation</p> <p>The contractor will supply all necessary safety appliances such as safety goggles, helmets, safety belts, ear plugs, mask etc to workers and staffs.</p> <p>The contractor will comply with all the precautions as required for ensuring the safety of the workmen as per the International Labour Organization (ILO) Convention No.62 as far as those are applicable to this contract.</p> <p>The contractor will make sure that during the construction work all relevant provisions of the Factories Act, 1948 and the Building and other Construction Workers (regulation of Employment and Conditions of Services) Act, 1996 and adhered to.</p> <p>The contractor will not employ any person below the age of 18 years for any work and no woman will be employed on the work of painting with products</p>	During construction	Contractor



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		containing lead in any form.		
6	Disposal of construction debris and excavated materials	A suitable site identified for safe disposal, in low lying areas within the project area, away from the water bodies as approved by the Engineer in charge and to other low lying area in consultation with engineer concerned and local body.	Pre-construction and Construction	Contractor / TWAD
7	Barricading site	The activities would be restricted to project sites and right of way for alignment. Barricading with adequate marking, flags, reflectors etc. will be provided along the alignment for safety of restricted traffic movement and pedestrians.	During construction	Contractor
8	Clearing of construction camps and restoration	Contractor to prepare site restoration plans, the plan is to be implemented by the contractor prior to demobilization On completion of the works, all temporary structures will be cleared away, all rubbish cleared, excreta or other disposal pits or trenches filled in and effectively sealed off and the site left clean and tidy, at the contractor's expenses, to the entire satisfaction of the engineer.	After completion of Construction	Contractor
9	Pollution from Fuel and Lubricants	The contractor will ensure that all construction vehicle parking location, fuel / lubricants storage sites, vehicle, machinery and equipment maintenance and refuelling sites will be located at least 500m from rivers and irrigation canal / ponds All location and layout plans of such sites will be submitted by the Contractor prior to their establishment and will be approved by the Engineer Contractor will ensure that all vehicle / machinery and equipment operation, maintenance and refuelling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground. Contractor will arrange for collection, storing and disposal of oily wastes to the pre-identified disposal sites (list to be submitted to Engineer) and approved by the Engineer. All spills and collected petroleum products will be disposed off in accordance with MoEF and state PCB guidelines.	During Construction	Contractor



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10	Pollution from Construction Wastes	All waste arising from the project is to be disposed off in the manner in consultation with TWAD Engineer	During Construction	Contractor
11	Storage of chemicals and other hazardous materials	Site identified for safe storage and handling of chemicals and other hazardous materials provided with proper display of requirements and marking as protected area.	During Construction	Contractor
12	Informatory signs and Hoardings	The contractor will provide, erect and maintain informatory/ safety signs hoardings written in English and local language, wherever required or as suggested by the Engineer	During Construction	Contractor
13	First Aid	The contractor will arrange for: A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone. Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital	During Construction	Contractor
14	Risk from Electrical Equipments	The contractor will take all required precautions to prevent danger from electrical equipment and ensure that- No material will be so stacked or placed as to cause danger or inconvenience to any person or the public All necessary fencing and lights will be provided to protect the public in construction zones. All machines to be used in the construction will conform to the relevant Indian Standard (IS) codes, will be free from patent defect, will be kept in good working order, will be regularly inspected and properly maintained as per IS provision and to the satisfaction of the Engineer	During Construction	Contractor
15	Waste Disposal	The contractor will provide garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the	During construction	Contractor



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		<p>Comprehensive Solid Waste Management Plan approved by the Engineer.</p> <p>Unless otherwise arranged by local sanitary authority, arrangements for disposal of night soils (human excreta) suitably approved by the local medical health or municipal authorities or as directed by Engineer will have to be provided by the contractor</p>		
16	Environmental Monitoring	The water, air, soil and noise quality will be monitored in pre-construction and Construction phase as detailed in Table 6.2 in EIA Report.	Pre-construction & Construction	TWAD & Contractor.
17	First Aid	<p>The contractor will arrange for:</p> <p>A readily available first aid unit including an adequate supply of sterilized dressing materials and appliances as per the Factories Rules in every work zone.</p> <p>Availability of suitable transport at all times to take injured or sick person(s) to the nearest hospital</p>	During construction	Contractor
18	Rainwater harvesting	Rainwater harvesting arrangements shall be provided in WTP, and Sump for collecting and storing rainwater from rooftops and recharging ground water through pits.	Construction Phase	Contractor and TWAD
19	Protection of sites	Compound wall of 3.0 m height shall be provided at Headworks and service reservoirs except Krishnankovil, for protection. WTP Plant and krishnancovil reservoir already provided 3.0m Height.	Construction Phase	Contractor and TWAD
20	Accessibility to sites	Adequate road facilities have been provided in WTP for movement of vehicle and unloading of chemicals without disturbing of existing features and activities. OHTs are strategically located to have direct access and without disturbing existing structures in the identified site.	Construction Phase	Contractor and TWAD
21	Demolition of existing structures related to WTP units I & II AT	<p>Complete augmentation of the WTP III and connect the inlet of WTP I & II to WTP III prior to start of demolition of WTP I & II.</p> <p>During demolition of structure WTP I & II, care shall be taken to avoid dust and to dump the scraps of materials in the site.</p> <p>Use personal protective equipment (PPE) during demolition work. Inspect</p>	Construction Phase	Contractor and TWAD



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	krishankovil WTP Site	<p>all stairs, passageways and ladders, illuminate all stairways. Screen is providing for surrounding area for avoiding dust pollution.</p> <p>The demolition of the existing treatment units would be carried out by cordoning the area from trespass and to control dust. Efficient housekeeping would be practiced during demolition and handling of waste. The demolition waste shall be handled in line as per C&D waste management rules 2016.</p>		
Head Works / WTP/ ESR				
1	Protection of top soil & Environmental enhancing	Top soil from the Head works area will be stored in stock piles and that can be used for gardening purposes at Head works site which will be an environmental enhancing measure	During construction	Contractor
2	Construction of Head work	<p>Coffer dams will be provided for construction of head work without any disturbance of river water flow.</p> <p>After completion of work, the coffer dam and other construction debris will be removed, and river bed would be restored.</p>	During construction	Contractor/ TWAD/ PWD
3	Water treatment plant	<p>Adequate road facility has been provided inside of treatment plant for movement vehicles and heavy vehicles for unloading of chemical.</p> <p>Rain water harvesting will be provided for recharging of ground water through pit.</p> <p>Display boards on safety measures and emergency measures to be installed.</p> <p>Regular training for the staffs operating the units of WTP with various aspects of maintaining water quality and safety.</p> <p>Providing equipments like ear plugs to workers near the noise source.</p> <p>Adequate stack height is given in D.G Set as per CPCB norms.</p>	During construction	TWAD / Contractor.



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4	Downstream users (impacts arising due to coffer dams, etc.)	Ensure that the flow stream is not obstructed during construction of coffer dam as directed by Engineer in charge so that there is no impact on the downstream users.	During construction	Contractor
5	Permissions from other departments	Permissions from Southern Railways, National and state Highways, TNPWD, and Revenue Department etc., will be obtained.	During implementation	TWAD
6	Restoring river bed / water source	Ensure the restoring of river bed to its natural shape free from any debris or construction junk material that may obstruct the flow.	Prospective contractor	construction and operation
7	Disposal of construction debris and excavated materials.	<p>The contractor shall identify the sites for debris disposal and should be finalized prior to start of the earthworks; taking into account the following</p> <p>(a) The dumping does not impact natural drainage courses (b) no endangered / rare flora is impacted by such dumping (c) Settlement area located at least 1.0 km away from the site. (d) Should be located in non residential areas located in the down wind side (e) located at least 100m from the designated forest land. (f) avoid disposal on productive land. (g) should be located with the consensus of the local community, in consultation with the engineer and upon approval by the local body.</p> <p>Minimize the construction debris by balancing the cut and fill requirements. Wherever feasible, the construction debris shall be provided for reuse.</p>	Pre-construction and operation.	Contractor/ TWAD/ Nagercoil Municipality
7	Tree plantation	The project does not envisage tree cutting in any of the project sites or alignment. However, as an enhancement measure, trees will be grown in the head work and SR sites etc. Proposed list of trees is given in Table 5.1 of the EIA report.	During construction	TWAD / Contractor



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Safety in Sites				
8	Additional safety measures	<p>The structures will be provided with easy access ladders, and handrails, interconnections between all units with proper safe walkway platforms for movement to avoid falling of human and materials.</p> <p>Electrical cables are going to be laid in cable trenches.</p> <p>Open spaces at height will be covered with parapet walls and handrails.</p>	During construction	Contractor.
Construction of Pumping Mains /Transmission Mains				
1	Protection of top soil	<p>The top soil to be protected and compacted after completion of work, where the pipelines run.</p>	During construction	Contractor
2	Laying of pipeline	<p>Adequate precautions will be taken while laying the water supply mains to avoid the possibility of cross connection with sewer drains.</p> <p>Surge protection arrangements have been provided in the clear water main at three locations in order to avoid line bursts to prevent wastage.</p> <p>Air valve is provided at an interval of 500m in all transmission main to prevent leakage.</p> <p>Utilities like street light etc. will be relocated without disturbing existing power lines and obtaining prior permission from concerned department.</p> <p>In the event of any damaged pipes found in the distribution system it will be disposed to TSDf approved by TNPCB.</p> <p>Pipe carrying bridges: Necessary Flow Diversion arrangement will be provided for construction of Pipe carrying bridges without any disturbance of river water flow.</p> <p>After completion of work, the flow diversion will be removed, and river bed would be restored.</p>	During construction	TWAD/ Contractor



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3	Shifting of common utilities	Ensure community consensus and minimum impact to common utilities like telephone cable, electric cables, electric poles, water taps and etc., Proper clearance to be obtained from the concerned authorities before commencement of works.	Pre-construction & construction phase	Concerned departments / TWAD
4	Traffic diversion	<p>Before taking up of construction activity, a Traffic Control Plan will be devised and implemented to the satisfaction of the Engineer.</p> <p>Construction will be taken phase-wise so that sections are available for traffic</p> <p>Temporary diversion will be provided with the approval of the engineer. The Detailed traffic management plans prepared and submitted to the engineers for approval one week prior to commencement of works will contain details of temporary diversion, details of arrangements for construction under traffic, details of traffic arrangement after cessation of work each day, SIGNAGES, safety measures for transport of hazardous materials and arrangements of flagmen.</p> <p>The arrangement for the temporary diversion of the land will ensure to minimize the environmental impacts like loss of vegetation, productive lands etc., prior to the finalization of diversion and detours. Special consideration will be given to the preparation of the traffic control plan for safety of pedestrians and workers at night.</p> <p>The contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. He will inform local community of changes to traffic routes, conditions and pedestrians access arrangements. This plan will be periodically reviewed with respect to site conditions.</p> <p>The temporary traffic detour will be kept free of dust by frequent application of water.</p>	During construction	TWAD / Contractor
5	Temporary flooding due to excavation	Excavation during the laying of mains should be carried out with proper drainage arrangements to avoid the overflowing of existing drains.	During construction	TWAD / Contractor
6	Using of modern	Using of modern machineries such as JCBs, backhoes etc, will be used to minimize	During	Contractor



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	machineries	the construction period, it will reduce the construction period impacts to the nearby residents	construction	
7	Dust pollution near settlements	<p>All earth work will be protected in manner acceptable to the engineer to minimize generation of dust. Area under construction will be covered & equipped will dust collector.</p> <p>Construction material will be covered or stored in such a manner so as to avoid being affected by wind direction.</p> <p>Unpaved haul roads near / passing through residential and commercial areas to be watered thrice a day</p> <p>Trucks carrying construction material to be adequately covered to avoid the dust pollution and to avoid the material spillage</p>	During construction	Contractor
8	Protection of residential sensitive receptors	<p>Noisy construction operations in residential and sensitive areas will be done only between 7.30 am and 6.00 pm</p> <p>Preventive maintenance of construction equipment and vehicles to meet emission standards and to keep them with low noise</p> <p>Provision of enclosing generators and concrete mixers at site.</p> <p>Sound barriers in inhabited areas will be installed during the construction phase.</p> <p>Adequate barricading / other measures to protect dust pollution near sensitive receptors like schools and hospital etc. to be ensured</p>	During construction	Contractor
9	Vehicular noise pollution at residential / sensitive receptors	<p>Idling of temporary trucks or other equipment should not be permitted during periods of loading / unloading or when they are not in active use. The practice must be ensured especially near residential / commercial / sensitive areas.</p> <p>Stationary construction equipment will be kept at least 500 m away from sensitive receptors.</p> <p>All possible and practical measures to control noise emissions during drilling will be employed. The TWAD may direct to take adequate controls measures depending on site conditions.</p>	During construction	Contractor
10	Noise from	Servicing of all construction vehicles and machinery will be done regularly	During	Contractor



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	vehicles, plants and equipments	and during routine servicing operations, the effectiveness of exhaust silencers will be checked and if found defective will be replaced. Maintenance of vehicles, equipment and machinery will be regular and up to the satisfaction of the Engineer to keep noise levels at the minimum.	construction	
11	Storage of construction materials	Site for storage of pipes and construction materials to be identified, without affecting the traffic and other common utilities	During construction	Contractor
12	Pollution from Construction wastes	The Contra will take all precautionary measures to prevent the wastewater generated during construction (e.g., during the testing of pipeline) from entering into streams, water bodies.	During construction	Contractor
13	Environmental Health and Safety.	EHS guidelines of World Bank will be complied with during construction.	During construction and post-construction	Contractor
IN OPERATION PHASE				
1	Noise Management	The pumps will adhere to the standards of noise. Regular maintenance will be carried out to restrict the noise levels. Provided noise control measures and Staffs entering the pump room will be provided with PPEs. Noise monitoring will be carried out at WTP and Head Works periodically near the noise generating units like the pump operations and D.G.Sets. Green belt is provided in WTP and SR sites for reduction of noise level.	During operation	Contractor/ TWAD
2	Water Management	Control valves would be provided in the inlet of sump and service reservoirs to control the flow. It can be used to stop the flow until the leakage is rectified. Water meters at pumping stations are used to measure and monitor the flow. In this project, monitoring and controlling the flow in the system will be done with	During operation	TWAD/ Contractor



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		<p>flow control valve with the help of SCADA system.</p> <p>The backwash water is collected in the recycle sump and re-circulated with raw water.</p> <p>Drained Water collected from sludge drying bed will be re-circulated with raw water.</p> <p>SCADA system will be provided for monitoring the water treatment plant.</p> <p>The details on SCADA system is given in Chapter 5.2.4 in EIA report.</p>		
3	Soil Management	The dry sludge from the treatment plant will be stored in sludge pit and utilized for filing in low laying area in consultation with the Engineer.	During operation	Contractor/TWAD
4	Air Management	<p>Automatic chlorine leak detection and related alarm equipment to be installed at chlorine storage room in WTP. It is connected to a remote audible and visual alarm system and checked on a regular basis to verify proper operation.</p> <p>Separate storage room provided for full, partial, or empty chlorine cylinders.</p> <p>Diesel generators will be operated only for emergency power backup. The emission source diesel generators will have adequate stack height as per the norms of CPCB and regular maintenance of diesel engines has to be ensured in the Treatment Plant.</p>	During operation	Contractor/TWAD
5	Transportation and storage of hazardous chemicals	Guidelines and procedures in Motor vehicle Act 1986 for transportation; Manufacture, Storage and import of Hazardous Chemicals Rules 1989 to be followed for storage and handling of Hazardous chemicals: Insurance covers to be taken for accidents and cost of clean-up operations.	During operation	Contractor
6	Handling of Chemicals	<p>The unit will be provided necessary safety measures for the storage of Alum & Chlorine cylinders and provide emergency repair kit and personal safety kit like full body cover, face mask, body and eye shower etc. at the site.</p> <p>Eye showers will be provided in WTP. The unit will install Chlorine gas leak detector system (Chlorine Gas Sensor) at the site.</p>	During operation	Contractor
7	Environmental	The water, air noise and soil quality will be monitored periodically.	During	TWAD &



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	Monitoring	<p>The water quality will be monitored at various points prior to distribution – head work, treatment plant, sump, SR sites.</p> <p>Monitoring of noise levels will be carried out at head work, WTP and Sump.</p> <p>Detailed monitoring record will be maintained. Periodical report will be send to the Engineer. The frequency and parameters for Environmental Monitoring detail is given in Table 6.3 of the EIA report.</p>	operation	Contractor.
8	Other Management measures at Sites	<p>Providing equipments like ear plugs to workers near the noise source.</p> <p>Providing PPEs for safe working of personnel in critical areas like chlorination plant will be ensured.</p> <p>Display boards on safety measures and emergency measures to be installed.</p> <p>Regular training for the staffs operating the Head Works with various aspects of maintaining water quality and safety in operation maintenance and chemical handling.</p> <p>PPEs for the workers exposed to high noise.</p> <p>Regular maintenance of the greenbelt and landscaping made at the project sites with watering, manuring, pruning etc.</p>	During operation	TWAD & Contractor
9.	Online Monitoring System through SCADA	<p>Installation of SCADA System for online monitoring at the Head works, WTP sump, Service Reservoirs gathering the real time data from remote locations. The detail of SCADA is given in Chapter 5.3.7 in EIA report..</p>	Operation Phase	TWAD/Contractor
10	Training for staff	<p>Periodical training would be provided to the staffs and operators involved in the project O&M for chemical handling, emergency, SCADA O&M, line maintenance, valve operations, electrical & mechanical operations, cleaning of sump and SRs.</p>	During Operation	TWAD / Contractor.



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11	O&M Measures	Rain water harvesting structures, sludge drying pits, Sump and WTP units shall be cleaned periodically. Periodically inspection of Pump/motor, Wear ring, impeller and lubrication, alarm systems. Repair and renewal of Mechanical & electrical equipments, civil works etc.,	During Operation	Contractor/T WAD
12	Water Treatment Plant	The backwash water is collected in the recycle sump and re-circulated with raw water. On-line monitoring through SCADA is proposed which would prevent overflow and wastage water. Dried Sludge will be stored in sludge pit and utilized for filing in low laying area.	During Operation	Contractor/T WAD
13	Disposal of sludge	The sludge from the treatment plant after drying in the sludge drying bed shall be disposed in the pit constructed within the site.	During Operation	Contractor/T WAD

6.3 Environmental Monitoring Plan

Environmental Monitoring Plan of construction and operation phase is given in **Table 6.2 & 6.3**.

Table 6.2: Environmental Monitoring Plan Pre-Construction & Construction Phase

Attributes	Parameters	Frequency	Location	Responsible Agency
Pre-Construction & Construction Phase				
Air Quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , CO and Pb (standards as per CPCB)	Seasonal Sampling	Head work -1 No Treatment Plant- 1 No	Contractor through approved monitoring agencies
Water Quality	Drinking water standards as per IS 10500:2012.	Seasonal Sampling	Head works -1 No WTP – inlet and outlet-1 No	Contractor through approved monitoring agencies



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Noise Level	Noise level on dB (A) scale noise levels on dB (A) scale (as per MoEF Noise Rulers, 2000)	Seasonal Sampling	Treatment Plant-1 No Head work -1 No	Contractor through approved monitoring agencies
Soil Quality	Monitoring of Pb, sar and Oil & Grease (standards as per TNPCB)	Seasonal Sampling	Treatment Plant- 1No	Contractor
Health	All relevant parameters including HIV	Regular check-ups as per Factories Act		Contractor

Table 6.3: Environmental Monitoring Plan Operation Phase

Attributes	Parameters	Frequency	Location	Responsible Agency
Operation Phase				
Air Emissions	PM ₁₀ , PM _{2.5} , SO ₂ , NO _x , CO and Pb (standards as per CPCB) Stack monitoring for D.G.Sets	Seasonal Sampling (3 times a year)	Head work -1 No Treatment Plant- 1 No	TWAD
Water Quality	Drinking water Standards as per IS 10500:2012.	Seasonal Sampling (4 times a year)	Head works -1 No WTP – inlet and outlet-1 No	TWAD



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Noise Level	Noise level on Db (A) scale noise levels on dB (A) scale (as per MoEF Noise Rulers, 2000)	Seasonal Sampling (4 times a year)	Treatment Plant-1 No Head work -1 No	TWAD
Soil quality	Monitoring of Pb, sar and Oil & Grease	Seasonal Sampling (4 times a year)	Treatment Plant- 1No	TWAD
Health	All relevant parameters (BP, Sugar, chest X-ray, Eye vision, etc.)	Regular checkups as per factories act.		TWAD
Safety Monitoring	First Aid, replacement of PPE	Yearly	Treatment Plant	TWAD
Green Belt Development	No. of plants, species, survival status	Once a year	Head work and SR sites	TWAD



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6.4 EMP Cost

Table 6.4: EMP Cost of the Project

S.No	Management measure	Group Code	Description	Cost Estimate	Reference
1.	Tree plantation	A	1000 trees at Rs100/tree and tree guard at Rs. 800 for 1000 trees.	Rs.1,09,600/=	Included in cost estimate
		A	Maintenance arrangement with watering	Included in above cost	
2	Removal of coffer dam in Offtake works and restoration of river bed	A	Construction and removal of Cofferdam for construction of Offtake structures.	Included in BOQ	Included in BOQ
3	Barricading trenches	A		Included in BOQ	Included in BOQ
4	Recirculation arrangements, Sludge drying bed and sludge pit	A	Included in specifications under Sludge	Included in BOQ	Included in BOQ
6	Disposal of sludge	B	Rs.2500/trip/tipper /5tonnes/month	Rs.60,000/ Annum	Required from operation stage
7	Chlorine Leak Detection/Alarm eye showers Mask with Cylinder	A	-	-	Included in Technical Specification for Chlorinators
8	Construction of Compound wall	A	Head works, 10 SRs with 3 mtrs height.	Included in BOQ	Included in BOQ
9	Septic Tank and Pipe connection works to existing sewerage	A	At Headworks, WTP sites and SR sites		Included in BOQ
10	Rain water Harvesting Structures				Included in BOQ
11	Energy Efficient Lighting	A	Lighting fixtures in project sites	Included in BOQ	Included in BOQ
12	Disposal of excavated excess earth and construction	A			Included in BOQ



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	debris				
13	Environmental Monitoring	B	Noise	Rs.30,000/Annum	Required from operation stage
		B	Raw Water quality (Seasonal)	Rs.4000/ annum	Required from operation stage
		B	Clear Water quality – Minimum 5 locations Monthly testing (Rs.1000/test)	Rs.60,000/ annum.	Required from operation stage
		B	Sludge – 1 location Monthly (Rs.1000/test)	Rs.12000/annum	Required from operation stage
10	PPEs for O&M	C	Included in BOQ for O&M Period	Rs.25000/annum	Required after 5 years of O&M
11	Safety Training	C	Included in BOQ for 1 year of O&M	Rs.20000/annum after completion of O&M	Required after 1 year of O&M
TOTAL (A) – During Construction				Rs.1,09, 600	
TOTAL (B) – Yearly recurring cost from operation stage				Rs.1,66,000	
TOTAL (B + C) – Yearly cost after completion of contractor's O&M				Rs.2,11,000	



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7. PUBLIC CONSULTATION

As per the World Bank policy on access to information and disclosure, the proposed project attracts Public Hearing. The Public Hearing was arranged by TWAD Board officials at beneficiary Municipality. The concerned persons having plausible stake in environment aspects were requested to attend the meeting.

Information on Public Consultation were informed explicitly to the stake holders/beneficiaries concerned in the municipality notifying the date and time in newspapers, pamphlets, issuing notices door to door and keeping displays etc.,

The public consultations were presided over by Municipal Authority. The members from TWAD Board explained the salient aspects of the proposed project during the meeting. The stake holders/beneficiaries were asked to offer their views on the proposed project.

ULB public consultation was conducted at Nagercoil on 5.5.17. Subsequently, one more ULB and public consultation is held on 16.04.2021 at Nagercoil Corporation office. The Canvassing Photos and Newspaper notification and Minutes of the meetings held at Nagercoil Corporation office is given below. The details of public consultation are given in **Annexure V**.

7.1 Outcome of Public Consultation

The Participants at the public consultation were keen on the following aspects:

- Time frame of the proposed project and date of commissioning
- Amount to be paid as water tax after the implementation
- Maintenance during operation of the proposed project
- Various components of the proposed water supply scheme

It was evident from the public consultation that the people are eagerly awaiting for the early implementation of the project. The public also expressed their grievances on present water scarcity and assured complete support during the implementation of this much awaited water supply scheme in their respective Municipality.



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8. IMPLEMENTATION AND INSTITUTIONAL ARRANGEMENTS

The proposed project is to provide Water Supply Scheme to Nagercoil Municipality in Kannayakumari district, with River Paraliar as source. This project will be implemented by TWAD under the scheme of Tamil Nadu Sustainable Urban Development Project (TNSUDP) at an estimating cost of Rs. 251.43 Crores.

The project is being implemented by TWAD through Prospective contractor. The environmental management plan identified for the construction has been included in the bid documents for ensuring implementation of the environmental safeguards. Implementation of the management measures by the contractor will be ensured by TWAD Board and report on ESMF compliance is being submitted to TNUIFSL periodically.

The management measures identified for operation/construction phase has been taken up by the Prospective contractor upto maintenance period and beyond that by TWAD Board/ Nagercoil Municipality.

8.1 Grievance Redressal Mechanism

TWAD Board has proposed to provide a Water Supply Scheme to Nagercoil Municipality in Kanyakumari district. The management measures identified for the operation phase will be taken up by the TWAD Board upon completion of construction activities. The TWAD Board have Grievance Redressal mechanisms to handle the grievances of the project. A project level grievance Redressal committee has been set up and the members are as follows (preferably one of them as women)

1. Executive Engineer (Projects –TWAD Board)
2. Commissioner / Nagercoil Municipality
3. A person who is publicly known in the local area

Step by step approach will be followed for redressing grievances. First, the aggrieved person shall approach the GRC in the first stage and the grievance committee will look into the grievances and resolve the issues. The proceedings of GRC will be documented.



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If not satisfied with the resolution provided by GRC, then the complainants can appeal to the grievance redressal mechanisms available at the office of CMA/TWAD Board.

This has been constituted and contact details of the members have been intimated to the general public during the implementation of the project. TWAD Board submits monthly reports on the status of compliance with the ESMF requirements to TNUIFSL.



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9. PROJECT BENEFITS

9.1 Present Scenario

The existing sources three water supply schemes (Mukkadal Dam and Ananthanar Channel) of Nagercoil Municipality are inadequate to draw the additional requirement. At present the level of supply of water to Nagercoil Municipality is 85 lpcd and supply once in five days. Considering the Population growth and as per present norms, it has been proposed to step up the service level from 90 lpcd to 135 lpcd taking into account of proposed UGSS in Nagercoil Municipality.

9.2 Project Benefits

The proposed water supply scheme is provided to Nagercoil municipality in Kanyakumari district with River of Paraliar (Puthen Dam) as source.

The detailed water requirement and proposal to each of them are as follows:

Nagercoil Municipality

At present 85LPCD of water is being supplied through 12 existing service reservoirs. It is proposed to construct 11 Nos. of service reservoirs additionally in the following places:

Sl.No	Location	Capacity
1.	Krishnancoil	7.50 LL - 1 No.
2.	Aseervatham Nagar	2.40 LL - 1 No.
3.	Asaripallam (Near Medical College)	8.80 LL - 1 No.
4.	Gnanamnagar	2.50 LL - 1 No.
5.	Kottar	8.80 LL - 1 No.
6.	Kariamanickapuram	2.20 LL - 1 No.
7.	V.N colony	9.10 LL - 1 No.
8.	Sarakkalvilai(Near NGO Colony)	5.00 LL - 1 No.
9.	Ponnappanadar colony	8.00 LL - 1 No.
10.	North Soorankudi	1.10 LL - 1 No.
11.	Nesamanynagar	5.00 LL - 1 No.

After the implementation of the scheme in this region, it is proposed to supply the balance requirement of 41.12 MLD for the intermediate year (2032) and 52.04 MLD for ultimate year (2047).



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The Water supply in the study area continues to be inadequate, despite longstanding efforts by the various levels of government and communities at improving coverage. The proposed project is an innovative and demand-driven approach to improve the water supply in the study area. Hence the implementation of this project will definitely assure improved access to water in the water scarce area.



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10. CONCLUSION

The proposed project envisages water supply to Nagercoil Municipality throughout the day with source as River Paraliar. Water treatment plant at Krishnankovil is proposed to make it more acceptable as per drinking water standards. The treated water has to be taken to Service Reservoirs through distribution networks connecting them. The implementation and maintenance of the project has no major adverse impact on environmental components either in planning or during the constructional phase. The likely impact arising out of the project is discussed in depth and recommended for mitigation.

In general, the project as a whole is a warm welcoming scheme and have positive impact on the people of the area who were longed for the dependable and potable water.