## Terms of Reference (ToR)

for Technical assistance for wastewater management & related services under the project titled “Promoting Low Emission Urban Development Strategies in Emerging Economy Countries” (Urban-LEDS)

**Expert consultant for construction of Decentralized Wastewater Treatment System**

### For external use

<table>
<thead>
<tr>
<th>Task</th>
<th>Procurement, construction, commissioning, operation and maintenance of a Decentralised Wastewater Treatment System (DTS) in Rajkot city under the Urban-LEDS project</th>
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</table>

### Summary

To procure, construct, commission, operate and maintain one DTS system of 100 kLD size for treatment of sewage from an identified nallah flowing untreated into the vokhda at an identified site adjacent to the Jilla Garden in Rajkot city

### Description of the assignment, expected outcomes

Construction of a DTS system of 100 kLD size at an identified micro watershed near the Jilla garden in Rajkot which contributes to pollution of a water stream flowing in the area, subsequently conveyed to the Aji River.

A slum colony with 236 houses located adjacent to the water stream is directly discharging its raw sewage through a sewer line into the stream. Further details of the existing situation are given in Annexure 1.

The project intends to showcase successful construction and operation of 1 Decentralized Treatment System () of 100 kLD for collection and treatment of the wastewater from the slum colony to a specified standard for its discharge into the water stream.

The specific tasks to be undertaken by the Consultant

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This project is funded by the European Union. The views expressed on this document can in no way be taken to reflect the official opinion of the European Union.
under this project are listed below

- Project feasibility report and related documents prepared give an understanding of the ground realities, local conditions, assessment of the present situation, recommended technological option, adherence to discharge standards for treated effluent, and implementation plan (including construction, operation, periodic monitoring and maintenance). Contracted agency should confirm the implementation plan and provide any additional changes, to be discussed and finalized with RMC and ICLEI South Asia.

- Undertake all procurement related activities for installing and commissioning the Decentralized Waste Water Treatment System at the designated location and confirming to the specifications as proposed in Annexure 2. This includes and may not be limited to activities such as selection of appropriate supplier(s) of equipment, coordination, preparation of any additional documentation as required in line with the existing tender documents and financial budget in close consultation with RMC and ICLEI South Asia.

- Construction and commissioning of the Decentralized Treatment System at the designated location and confirming to the specifications as proposed in Annexure 4.

- Undertake operation, periodic monitoring and maintenance of the installed DTS near Jilla garden for minimum period of 5 years.

Time period for this entire activity from the receipt of work order is 4 months confirming to the Implementation Plan as proposed in Annexure 3

Annexure-1 Details of Existing situation
Annexure-2 Project Design and Key Specifications of the Decentralised wastewater Treatment System (DTS)
Annexure- 3 Implementation Timeline
Annexure- 4 Details of drawings
Annexure- 5 Tender submission form

Concrete deliverables expected

- Finalised detailed construction drawings, construction and commissioning schedule and O&M plan along with final cost estimates
<table>
<thead>
<tr>
<th>Time frame, location</th>
<th>Total time estimated: 4 months</th>
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<tbody>
<tr>
<td>• Construction and commissioning of one DTS system of 100 kLD size near Jilla garden in Rajkot city within 4 months as per implementation schedule.</td>
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<td>• Operation, periodic monitoring and maintenance of the 100 kLD DTS system for minimum period of 5 years.</td>
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<td>Available budget</td>
<td>Payment schedule for consultant</td>
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<tr>
<td>• Information gathering and site visit at Rajkot: 1 week from date of issue of work order</td>
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<tr>
<td>• Designing of system and submission of construction drawings to ICLEI South Asia: 2 weeks from issue of work order</td>
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<td>• Delivery, Installation and commissioning on site: 3.5 months from issue of work order</td>
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<td>• Operation, periodic monitoring and maintenance: 5 years from the date of commissioning</td>
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<td>Deadline for indicating interest</td>
<td>Date of Publication of Advertisement: 4th June, 2015</td>
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<td>Previous last date of acceptance of proposals: 15th June, 2015</td>
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<td>Extension of last date of acceptance of proposals: 25th June, 2015</td>
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<tr>
<td></td>
<td>Date of announcement of shortlisted firms: 30th June, 2015</td>
</tr>
</tbody>
</table>
| Contact information | Meeting with shortlisted firms: 3rd July, 2015  
Date of announcement of final selection: 6th July, 2015 |
|---------------------|---------------------------------------------------------|
| Ms. Soumya Chaturvedula, Programme Coordinator (Energy & Climate), ICLEI – Local Governments for Sustainability South Asia, Ground Floor, NSIC-STP Complex NSIC Bhawan, Okhla Industrial Estate New Delhi - 110020, India  
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Email: soumya.chaturvedula@iclei.org |
ANNEXURE 1: EXISTING SITUATION AT THE SITE ADJACENT TO JILLA GARDEN, RAJKOT

The stream (Vokda in the local language) originates at Bhakthi Nagar Railway station and flows towards Aji River. Smaller Vokda from Narayannagar and Lohanagar also join the main Vokda near Jilla Garden. The stream length is about 722m. These streams carry pollution from the habitation around them and convey it to the Aji River. Municipal solid waste dumping has further compounded the vokda pollution. The micro catchment has been shown in the following figure.

**Figure 1: Micro watershed of Vokda at Jilla garden**

1.1. **Source of Pollution**

The area represents mixed development with mostly residents from economically weaker section, shops, hotels and small garages and local enterprise. Most of the residents discharge the grey water into the storm water drains which are finally connected to the Vokda.

There is a large slum colony with 236 houses adjacent to Jillah garden which is directly discharging an estimated 94 kLD of raw sewage (based on a per capita water supply of 100 lpcd) through a sewer line into the main Vokda. The colony covers an area of 0.018 sq. km.
1.2. Catchment area

The location coordinates of Jilla garden are 23° N latitude and 72° E longitude. The Vokda has a length of 722 m length. The catchment area of the micro watershed is estimated to be 0.114 sq. km, based on analyzing the data on google maps using a 50m interval.

![Catchment area diagram](image)

**Figure 2: Catchment area of Left and Right side of vokda**

1.3. Discharge in Vokda

1.3.1. Volume of wastewater

The Vokda carries the dry weather flow during non-monsoon season. This comprises mostly grey water from the communities and with some amount of black water, together with wastewater from commercial establishments like hotel, shops and small workshops and industries. In the monsoon, the vodka drains the storm water runoff.

The population of this catchment area is estimated to be 7,400 persons based on the population density of 65,000 persons per sq.km. The corresponding waste water contribution assuming 100 lpcd of water supply is about 720 KLD presently. The Rajkot Municipal Corporation (RMC) is currently undertaking the work of providing underground sewer which is expected to alleviate the problem.

1.3.2. Volume of storm water

During the monsoon, the vodka carries the storm water runoff from the catchment area. The annual rainfall in Rajkot is about 620 mm and the daily average rainfall is about 20 mm assuming 13 rainy days. The peak monthly rainfall has been 242 mm in month of July. Accordingly, the annual storm runoff is about 70.7 ML and the daily flow is estimated to be 2.2 MLD.

1.3.3. Assessment of current discharge from the wastewater nallah

Based on the measurement of the dry weather flow at the Jillah garden, the velocity of the stream is observed to be 0.37m/s and the water flows over an average area of 0.09 sq. m, implying a flow of 590 KLD which is close to the predicted value of 720KLD.
1.4. Quality of wastewater

Based on wastewater sampling conducted at four different spots where the wastewater stream flow exists, it is observed that the pollution from the Jillah garden slum (BOD~98 mg/l) is relatively more in comparison to the sewage obtained from the sewerline at Laludi Vokda (BOD ~40mg/l). In contrast the pollution from the stream at Jillah garden is relatively higher (BOD~68mg/l) than Laxmiwadi (BOD~47mg/l).

Test results of wastewater sampling are available and shall be shared with the selected Consultant.
ANNEXURE 2: PROJECT DESIGN AND KEY SPECIFICATIONS OF THE DECENTRALISED WASTEWATER TREATMENT SYSTEM (DTS)

The pilot project option shortlisted intends to intercept and convey the polluting raw sewage flows from the slum colony adjacent to Jhilah garden to a DTS for treatment to a standard as specified for discharge into the vokda. The slum colony has 236 houses (population 1180 persons). The volume of sewage is estimated at 94 KLD assuming a per capita consumption of 100 lpcd in slum areas. This flow is approximately 14% of the total pollution contribution into the vokda. The wastewater inflow is also perennial.

There is vacant land available belonging to the Slum Development Board, adjacent to the sewer line wherein the DTS is proposed to be constructed. It is also proposed to utilize the biogas generated from the DTS plant at this location.

Figure 3: Concept Schematic – DTS installation

1. Proposed System

1.1. Description of the Technology

Decentralized Wastewater Treatment System (DTS)

DTS waste water treatment solution is based on the principle of making effective use of natural processes like gravity, microbiological activity and temperature. This results in a system which can work without wasting scarce energy resources and needs only minimal maintenance. In fact the system produces energy in form of methane/biogas. DTS is economically viable compared to conventional wastewater management solution. DTS enables maximum reuse of the contents of the
wastewater (water, nutrients and energy) and can therefore be considered as a viable option for ecological/sustainable sanitation.

Key attributes of the DTS solution:

- provide treatment for both - domestic and industrial sources
- are reliable, long lasting and tolerant towards shock loads and inflow fluctuation
- Simple operation and low maintenance

The DTS core system generally consists of four treatment steps:

- Step 1: Primary treatment and sedimentation
- Step 2: Secondary treatment
- Step 3: Tertiary treatment in aerobic/anaerobic media filters

The treatment steps are however designed to suit specific reuse requirements

**Step 1: Primary treatment and sedimentation**

This step is achieved using the biogas settler which can be considered as a gas tight septic tank with low hydraulic retention times. Two main treatment processes take place in the biogas settler:

- The mechanical treatment retains contaminants by sedimentation/flotation, and the wastewater from the clarified layer flows through the outlet.
- Biological treatment through anaerobic microorganisms which partially decompose the organic pollutants. The digestion process ensures that the accumulated sludge is reduced and stabilized. Storage volume for sludge is provided for 18 to 24 months, defining the desludging period.

![Figure 4 Settler](image)

Average reduction of organic content (BOD, COD) is between 25 and 40% at this stage. The biogas produced is captured and used as an energy source (direct thermal application or electricity production via gas-generator).
Step 2: Secondary Module

Secondary module consists of two modules:

The first reactor consists of a series of chambers, in which the wastewater flows up-stream. Activated sludge is located at the bottom of each chamber. The inflowing effluent is mixed with the sludge and is inoculated with bacterial mass which decompose the Pollutants. At this stage the BOD reduction rate is 90%. The pathogen reduction is in the range between 40 – 75%.

![Fluidized Bed Reactor](image5)

Figure 5 Fluidized Bed Reactor

Second reactor

The secondary reactor has an anaerobic filter which has a similar up-stream flow. Filter materials such as gravel, rocks or specially formed plastic components are used to provide additional surface area for bacteria to settle. Non-settleable and dissolved solids are treated by bringing them in close contact with a surplus of active bacterial mass fixed on filter material. The BOD removal rate at this stage is in the range of 70-90%. The surplus of activated sludge produced has to be removed in intervals of 1 to 3 years.

![Fixed Film Reactor](image6)

Figure 6 Fixed Film Reactor

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1.2. **Sludge generation and disposal**

Sludge will be produced in the primary and secondary module. The design provides integrated storage volume for a period of 18 to 24 month.

Disposal: Regular disposal through BWSSB every 18 to 24 months. An onsite processing through the installation of drying beds attached to the DTS could be an alternative option due to the fact that the sludge produced will be harmless and rich in plant nutrients.

1.3. **Design Quality**

The design concept is as per the flowchart (Refer: Wastewater treatment Process Flow chart - Figure 8). The wastewater from all 236 households is conveyed to the DTS and is treated to a standard as specified for discharge into waterbody. The flow chart is shown below.

![Wastewater Treatment Flow chart](image)

*Figure 7: Wastewater Treatment Flow chart*
2. TECHNICAL SPECIFICATION

2.1 TECHNICAL SPECIFICATION FOR CONSTRUCTION

2.1.1 EARTH WORK EXCAVATION AND FILING

Despite quantities quoted by the CONTRACTOR for excavation as per specification of the construction work, means DTS, it shall include the following:

1) Site clearance such as clearing shrubs and growth, roots and small trees brush wood, etc.

2) Seepage and surface water bailing or otherwise removing all water which may accumulate in the excavation.

3) Getting out and throwing spoil clear off area being excavated or depositing clear of edge of foundation to avoid fall in.

4) Trimming all sides plumb or otherwise as instructed at site and square, leveling all bottoms, clearing out all loose earth etc.

5) Filling back by the sides of foundations and in plinth in layers not exceeding 150mm, watering, consolidation, dressing etc. complete.

6) Disposing SURPLUS soil as directed within the premises.

7) Dismantling, removing and stacking as directed existing water pipes, cables and/or soil pipes within the excavation portion.

2.1.2 PLAIN CEMENT CONCRETE (P.C.C)

Despite rates and quantities quoted by the CONTRACTOR for laying of P.C.C as per specification of the construction work, means DTS, it shall include the following:

1) Shuttering materials for formwork, moulds, centering & shuttering shall be of M.S. props and marine plywood or timber.

2) Adequate protection to edges and corners from damage during construction.

3) Work either straight, curved, plain, tapered or any other shape.

4) Keeping the work well watered for at least 10 days or as specified in the relevant IS code after casting.

5) Roughening / hacking concrete surface where required after removal of centering or shuttering to receive plaster.

6) Coarse graded sand shall be used for all concrete work.
7) Machine crushed coarse aggregate shall be of hard broken granite or Basalt or trap of sizes specified.

8) De-shuttering and cleaning.

2.1.3 REINFORCED CEMENT CONCRETE (R.C.C)

Despite rates and quantities quoted by the CONTRACTOR for laying of R.C.C as per specification of the construction work, means DTS, it shall include the following:

1) Shuttering:
   a. Materials for formwork, moulds, centering & shuttering shall be with M. S. props and marine plywood, steel sheet or timber.
   b. If asked for, the contractor shall submit drawing showing the scheme of form work for beams, slabs and areas which project out at various levels as indicated in the drawings.
   c. Necessary arrangements for camber in beams or slabs.
   d. The formwork shall have adequate opening for cleaning. Formwork for construction joints shall be submitted for approval.
   e. Scheme for back propping, if required shall be submitted for approval. (Intermediate props be left for full settlement time)
   f. Proper shutter releasing agents are used.

2) Adequate protection to edges & comers from damage during construction.

3) Keeping the work well watered for at least 10 days or as specified in the relevant IS code after casting.

4) Roughening / hacking concrete surface where required after removal of centering or shuttering to receive plaster.

5) Machine mixing and consolidation using needle or any other approved vibrators to avoid honeycombing in the structure.

6) Coarse graded sand shall be used for all concrete work.

7) Machine crushed coarse aggregate shall be of hard broken granite or Basalt or trap of sizes specified.

8) De-shuttering and cleaning.
9) Casting and testing cubes as specified in the IS codes with good working condition cube testing machine having sieves, slump cone, graduated cylinder and weights, scales etc. at the site. Every 3rd and 4th set of samples should be tested from an approved laboratory.

10) Use of weigh batch equipment for design mix concrete and a qualified mechanic shall be available during working hours for maintenance of weigh batch machine.

11) Honeycombing is not accepted, if occurs and accepted then it should be grouted with CM 1:3 (fine sand) under pressure as directed.

2.1.4 BRICK WORK
Despite rates and quantities quoted by the CONTRACTOR for brickwork as per specification of the construction work, means DTS it shall include the following:-

1) All scaffolding, ladders, platforms, staging & plant required for the execution of work to any height and depth.

2) Hacking & roughening of concrete or other surface in contact with masonry for bondage.

3) Racking out joints to specified depth either for plastering or pointing.

4) Leveling up & preparing top for Damp Proof Course.

5) Building in holdfasts and such other inserts.

6) Keeping the work well wetted for two weeks.

7) Work at all heights, depths, unless otherwise specified.

2.1.5 BRICK MASONRY WORK (SOLID BLOCK MASONRY)
Despite rates and quantities quoted by the CONTRACTOR for block masonry as per specification of the construction work, means DTS it shall include the following:-

1) All scaffolding, ladders, platforms, staging & plant required for the execution of work to any height and depth.

2) Hacking & roughening of concrete or other surface in contact with masonry for bondage.

3) Racking out joints to specified depth either for plastering or pointing.

4) Leveling up & preparing top of masonry for Damp Proof Course.

5) Building in holdfasts and such other inserts.

6) Keeping the work well wetted for two weeks.

7) Work at all heights, depths, unless otherwise specified.
8) The mortar used for plastering is 1:4

2.1.6 PLASTERING

Despite rates and quantities quoted by the CONTRACTOR for plastering as per specification of the construction work, means DTS it shall include the following:-

1) Hacking, Racking or scarifying concrete and other surfaces to be plastered
2) Preparation of surfaces by raking out joints, wetting the surface etc.
3) Providing grooves at the junction between masonry and concrete elements and any dissimilar materials and also wherever necessary.
4) Work at all heights and depths.
5) Providing drip moulds wherever necessary.
6) Curing for at least 7 days for plastering.
7) Necessary Single or Double scaffolding, ladder, platform for any height & depth.
8) Neat finishing of junctions of plaster & skirting.
9) If the thickness of the plaster is 12 mm with a mix of 1:4 mortar.

2.2 TECHNICAL SPECIFICATION FOR LAYING OF SEWER LINES, INSPECTION CHAMBERS

2.2.1 TECHNICAL SPECIFICATION FOR LAYING OF SEWER LINES UNDERGROUND TRENCHES

2.2.1.1 ALIGNMENT AND GRADE

The drains are to be laid to correct alignment and grade shown in the drawings but subject to such modifications as necessary to meet the requirements of the works. No deviations from the lines, depths of cutting or gradients of sewers shown in the plans and sections shall be permitted except by the express directions in writing of the CONSULTANT.

2.2.1.2 OPENING OUT TRENCHES

In excavating the trenches, the road metal, pavement curb, etc., are to be placed on one side and preserved for reinstatement and the trench or other excavation shall be filled up and laid back to original condition at no extra cost.

Before any road metal is replaced, it shall be carefully shifted. The surface of all trenches and holes shall be restored and maintained to the satisfaction of the EMPLOYER, the CONTRACTOR shall not cut or break down any live fence or trees in the line of the proposed works but shall tunnel under
them unless the EMPLOYER orders to the contrary. The CONTRACTOR shall scrub up and clear the surface over the trenches and other excavations of all stumps, roots and other encumbrances affecting execution of the work and shall remove from the site to the approval of the EMPLOYER.

2.2.1.3 EXCAVATION TO BE TAKEN TO PROPER DEPTH

The trenches shall be excavated in all conditions of soil and to such a depth that the sewers shall reset as described in the several clauses relating thereto and so that the inverts may be at the levels given on the section. In bad ground, the CONSULTANT may order the CONTRACTOR to excavate to a greater depth than shown in the drawings and to fill up the excavation to the level of the sewer with concrete, sand, gravel, or other materials.

2.2.1.4 RE-FILLING

After the sewer or other work has been laid and proved to be watertight, the trench or other excavation shall be refilled. Utmost care shall be taken in doing this, so that no damage shall be caused to the sewer and other permanent works. Above the crown of the sewer shall consist of the finest selected materials placed carefully and consolidated. After this has been laid, the trench and other excavation shall be refilled carefully in layers of 150mm with materials taken from the excavation, each layer being watered and consolidated.

2.2.1.5 RESTORATION OF SETTLEMENT AND DAMAGES

The CONTRACTOR shall at his own cost make good promptly, during the whole period the works are in hand, any settlement that may occur in the surfaces or roads, berms, footpaths, gardens, open spaces, etc. whether public or private caused by his trenches or his other excavation and he shall be liable for any accidents caused thereby. He also shall, at his own expense and charges, repair and make good any damage done to the buildings and other properties.

2.2.1.6 DISPOSAL OF SURPLUS EARTH

The CONTRACTOR shall at his own cost dispose within the site or as directed all surplus excavated materials not required on the works.

2.2.1.7 CONCRETING

All pipes at shallow road crossings and made up ground shall be laid on a bed of 6" (150mm) concrete with one part of cement, four parts of sand and eight parts of stone metal of 3/4" (20mm) down grade properly consolidated. Concrete shall be laid to the full width of the trench and also in haunches.

Single under reamed piles of specified diameter of 1:2:4 cement concrete used in certain intervals which includes boring, under reaming in all sorts of soils, filling the bulb and stem with C.C 1:2:4 mix as per specification

2.2.1.8 CONSTRUCTION ACROSS ROADS

All works across the roads shall be carried out as per the directions of the EMPLOYER.
2.2.2 TECHNICAL SPECIFICATION FOR CONSTRUCTION OF INSPECTION CHAMBERS

2.2.2.1 LOCATION AND SIZES

The sizes given in the drawings shall be internal size of chamber. Unless otherwise specified, manholes and inspection drains, at all changes of direction of drains and where branch drain meets the Main drain. Chambers shall be of such size as to allow necessary examination and clearance of drains. The minimum internal sizes shall be taken as per details drawings to be supplied by the CONTRACTOR.

2.2.2.2 BED CONCRETE

Shall be in 1:4:8 cement concrete of 150mm thickness for inspection chambers, 230mm for depths up to 2.1m and 300mm for greater depths in case of manholes.

2.2.2.3 SOLID BLOCK MASONRY

Solid block shall be with best quality blocks in 1:4 cement mortar as per the specification for concrete solid block masonry.

2.2.2.4 CHAMBER / MANHOLE COVER

Covers shall be of heavy duty C.I lid with lifting hooks as per the details given in the drawing to be supplied by the CONTRACTOR and fixed on the frame embedded in concrete. Cover placed on the frame shall be airtight. The weight of frame and cover shall be as per bill of quantities.

2.3 TECHNICAL SPECIFICATION OF DTS

The WORK is composed of activities as described in article 2.7

2.3.1 COLLECTION SYSTEM (SEWER LINES)

1) New sewer lines shall be laid with PVC pipes of 4 kg/sqm rating. Manholes shall be provided at all deviations, and at intervals not exceeding 30m. The slope shall be as indicated by the CONSULTANTS

2) All the existing sewer lines have to be checked. If the condition is not satisfactory it has to be rebuilt and properly connected with the treatment system as per CONSULTANTS drawing and specification given in the B.O.Q.

3) All the inspection chambers have to be checked. If the condition is not satisfactory it has to be rebuilt as per CONSULTANTS drawing and specification given in the B.O.Q.
2.3.2 TREATMENT SYSTEM

The main purpose of the treatment system is to treat the wastewater collected, in order to reuse the treated wastewater for irrigation purposes/flushing needs. Therefore the whole system must be watertight. The hydraulic of the system is complicated and there is an interrelation of the levels of each part. Therefore exact levels have to be maintained.

1) The sizes of the chambers/compartments shown is a clear finished opening size

2) All the dimensions shown in the drawing should match with the final construction.

3) The external wall and other wall are made up of solid block masonry structure with necessary structural elements as per specification given in the B.O.Q. Internal walls and partition wall are made of 200mm thick Solid concrete blocks as shown in drawings. All external walls and settler walls are of 345 mm thickness. The structure should be watertight by using waterproofing material. All intersections are plastered with a chamfer.

4) Inlet channel are made of R.C.C structure with necessary structural elements as per specification given in the B.O.Q. The structure should be plastered with 12mm thick cement mortar 1:4 with waterproofing material and finished smooth with a floating coat of neat cement.

5) All the pipes provided should be good quality, which can withstand continuous pressure of 4.0 Kg/sq. cm. The pipe should be placed at the indicated locations and levels as per drawings and DTS norms.

6) Slope as indicated in the drawings should be provided to make a good water flow as shown in the drawing.

7) Manhole covers shall be gas tight. If required they shall be sealed with good quality clay.

2.3.2.1 COLLECTION TANKS

1) The sizes of the chamber shown is a clear opening size, which excludes plastering thickness

2) All the dimensions shown in the drawing should match with the final construction.

3) The sidewalls are made up of Block masonry structure with necessary structural elements as per specification given in the B.O.Q. The structure should be watertight by using waterproofing material.

4) All the pipes provided should be good quality, which can withstand continuous pressure of 4.0 Kg/sq. cm. The pipe should be placed in a indicated locations and levels as per drawings and DTS norms.
2.3.3 INTERLINKING OF TREATMENT UNITS AND INSPECTION CHAMBERS

Interlinking of all the treatment units and registers shall be executed according to the indicated level and specification shown in the drawing issued by the CONSULTANT.

2.4 POLISHING OF WATER (optional)

The dual media filter comprising of sieved sand and activated carbon shall be erected as per manufacturers specification. The treated water from the collection tank shall passed through the media filter and then chlorine dosing carried out for disinfection. The installation shall be carried out as per the CONSULTANTS advice.

2.5 DTS CONSTRUCTION NORMS

The norms for the construction of the DTS plant should be strictly followed as per CONSULTANT instructions given below:

1) Volume of tanks shall be strictly restricted to CONSULTANT drawings and specification. Deviations of more than 3% shall not be accepted.

2) Dimensions of tanks shall be strictly restricted to CONSULTANT drawings and specification. Deviations of more than 1% shall not be accepted.

3) The location and orientation of the tanks shall be strictly restricted to CONSULTANT drawings and specification. Approval of any deviation shall be taken from the CONSULTANT in writing.

4) The wall levels, the slab levels and wall opening levels shall be maintained exactly as per CONSULTANT specification. Deviation of more than 5 mm will not be accepted.

5) The pipe levels shall be maintained exactly as per CONSULTANT specification. Deviation of more than 3 mm will not be accepted.

6) The quality of material and work shall conform to the specification given in the drawings.

7) All the tanks shall be perfectly watertight and the water tightness has to be proved.

8) Benchmark and bench line shall be a permanent structure. All levels, depth references shall be determined from the bench line.

9) Any deviation from the above norms will not be accepted and corrective action of rebuilding the deviated segment will have to be undertaken by the CONTRACTOR at his own cost.

The CONTRACTOR is aware that the hydraulic flow designed (accordingly the levels), the output of the inflowing wastewater (accordingly the water tightness) as well as the quality of the construction
(exactly as per specification) determines the operation of the system. Even a small deviation will result in a non-operative system. The completion certificates will be given only after the system is tested according to the above norms.

2.6 Proposed DTS Specifications

The wastewater stream is conveyed to a DTS unit comprising of a settler integrated with an anaerobic fluidized bed reactor and a tertiary fixed film reactor with a combined retention time (HRT) of 57.8 hours.

The design detail of DTS is as given in table below:

<table>
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<th>Table 1 : Design details of DTS</th>
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<tr>
<td>Total waste water – 100 KL/day</td>
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<tr>
<td>Peak hours – 8</td>
</tr>
<tr>
<td>Inlet COD – 800mg/l</td>
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<tr>
<td>Inlet BOD – 400 mg/l</td>
</tr>
<tr>
<td>Outlet COD &lt; 100 mg/l</td>
</tr>
<tr>
<td>Outlet BOD – &lt;20 mg/l</td>
</tr>
</tbody>
</table>

Dimensions of the treatment modules are as follows:

1. Primary Module – 12.2 m Length x 2.1 m Width x 1.8m Depth
2. Secondary Module – 12.5 m Length x (1*6 Nos.) m Width x 1.8m Depth
3. Tertiary Module – 12.5 m Length x (1.5 *4 Nos.) m Width x 1.8m Depth
### ANNEXURE 3: PROJECT IMPLEMENTATION SCHEDULE

**Project implementation schedule for Month-1**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Month-1</th>
</tr>
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<tbody>
<tr>
<td>1 DTS Location finalizing and marking the site</td>
<td>1</td>
</tr>
<tr>
<td>2 Earthwork for DTS</td>
<td>2 3</td>
</tr>
<tr>
<td>3 PCC for DTS</td>
<td>4</td>
</tr>
<tr>
<td>4 Bottom slab reinforcement for DTS</td>
<td>5 6 7 8 9</td>
</tr>
<tr>
<td>5 Bottom slab RCC</td>
<td></td>
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<p>|   | Description                                                                 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |
|---|----------------------------------------------------------------------------|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 17| Horizontal pipe for baffle pipe (PVC pipe)                                 |   |   |   | 5 | 6 | 7  |    |    |    |    |    |    |    |    |    |    |    |    |
| 18| Core cutting in the settler for baffle pipe                                |   |   |   |   |   |    |    |    |    | 7  |    |    |    |    |    |    |    |    |
| 19| Brick masonry till roof level                                              |   |   |   | 8 | 9 | 1 0| 1 1| 1 2| 1 3|    |    |    |    |    |    |    |    |    |
| 20| Plastering inside the wall                                                 |   |   |   | 1 | 4 | 1 5| 1 6|    |    |    |    |    |    |    |    |    |    |    |
| 21| RCC top slab shuttering                                                    |   |   |   | 1 | 7 | 1 8| 1 9|    |    |    |    |    |    |    |    |    |    |    |</p>
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ANNEXURE 4: DETAILED DRAWINGS FOR DTS
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Cross Section A-A

150mm Thick RCC

225mm Thick RCC

345mm Solid Block Masonry

150mm RCC Slab

NOTE:
1. ALL DIMENSIONS ARE IN METERS.
2. DO NOT MEASURE THE DRAWING AND FOLLOW THE DIMENSION MENTIONED.
3. ALL RCC SHALL BE 150MM THICK, OF GRADE MTS UNLESS OTHERWISE SPECIFIED.
4. THE STRUCTURAL DESIGN FOR DRY CONDITION ONLY ASSUMING THE DRY DENSITY OF SOIL AS 1800Kg/m³.
5. SSOC OF SOIL IS ASSUMED AS 2000Km²/m³.
6. ANY VARIATION IN THE SRC VALUE AND WATER TABLE AT SITE SHALL BE Brought INTO THE NOTICE OF ENGINEER IN CHARGE BEFORE EXECUTION OF WORK.
7. GRADE OF CONCRETE FOR RCC WORK SHALL BE MTS.
8. GRADE OF STEEL SHALL FE-415.
9. CLEAR COVER TO REINFORCEMENT SHALL BE
   a) FOR BASE SLAB - 40MM
   b) FOR WALLS - 25MM
   c) FOR ROOF SLAB - 20MM
10. TOP SLAB IS DESIGNED FOR LIVE LOAD OF 40Kg/m².
11. ALL MANHOLES SHOULD BE PLACED NEAR TO THE INLET WALL OF THE CHAMBER (500MM SPACING).

REF DRAWING:

ecoparadigm
Paradigm Environmental Strategies (P) Ltd.
Bangalore-560075

PROJECT: ECO-NK

DATE: 10/06/2015

CHECK: TP
REVISION: 1

Scale: 1:50

Cross section of settler
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ANNEXURE 5: TENDER SUBMISSION FORM

To

Programme Coordinator (Energy and Climate)
ICLEI South Asia
New Delhi

Madam,

Name of Project: Decentralised Wastewater Treatment System (DTS) for Sewage treatment of Flow into Vokda at Jilla Garden, Rajkot Municipal Corporation, Gujarat

Category of Works: Civil Works

I/We, the undersigned, do hereby tender and undertake to perform, provide, execute and do all the works, materials, matter and thing described or mentioned in the Tender Documents namely Notice Inviting Tender, Institutions for Filling the Tender, General Conditions of Contract, Special Conditions of contract, general Specifications of works, Schedule of Items and Quantities & Tenders Drawings (which have been produced to me/us and carefully examined by me/us) in strict accordance with and subject to the terms , provisions and conditions set forth or mentioned in the Tender Documents at the rates given and as stated in the Schedule of Items and Quantities.

I/we further undertake & agree to execute at my/our cost the Agreement (to be shared upon selection) within 3 days from the date of issue of the Work Award Letter issued after due acceptance with or without modifications of my/our Tender.

I/we hereby undertake to complete the whole of the works within the time stipulated in the Appendix to Notice Inviting Tender.

I/we undertake & agree to abide by this tender until 60(sixty) days from the due date of Tender and I/we shall keep this tender open till the expiry of the said 60(sixty) days.

I/we also agree that the words importing the singular also include the plural & vice versa wherever the context so requires.

Place: 

Signature of Tenderer

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