DETAILED PROJECT REPORT FOR RECYCLING / REUSE OF WASTEWATER, TERTIARY SEWAGE TREATMENT PLANT OF 40 MLD NET OUTPUT CAPACITY AT DINDOLI TO GENERATE INDUSTRIAL GRADE WATER UNDER SMART CITY, SURAT

CONSULTANT

Bhatar Trade Center, 3rd Bldg. 3rd Floor,
Bhatar Char Rasta, Bhatar,
Surat – 395 017.
Ph.: +91 261 2265822,
Website: www.greendes.com;
email: info@greendes.com, green.des.india@gmail.com
CONTENTS

List of Tables.........................................................................................................................III
List of Figures........................................................................................................................IV
List of Annexures.....................................................................................................................V
List of Abbreviations...............................................................................................................VI
Executive Summary...............................................................................................................VII

SECTION 1 :  INTRODUCTION – SURAT..............................................................................1
  1.1 City at a glance - Geographical, Historical and Present Status.................................1
  1.2 About Surat Municipal Corporation ........................................................................3
  1.3 Scope of Work .............................................................................................................3
  1.4 Structure Of The Report .............................................................................................4

SECTION 2 :  CITY AREA AND POPULATION.....................................................................5
  2.1 City Area: Surat Municipal Corporation .................................................................5
  2.2 Revision under Population Projection .....................................................................8

SECTION 3 :  SECTOR BACKGROUND : SEWERAGE ......................................................11
  3.1 History of Sewerage Facilities ................................................................................11
  3.2 Baseline Information ...............................................................................................11
  3.3 Sewerage – Drainage Zones ....................................................................................11

SECTION 4 :  SALIENT FEATURES OF DINDOLI DRAINAGE ZONE .........................14
  4.1 Coverage .................................................................................................................14
  4.2 Land Use and Development ....................................................................................15
  4.3 Population Projection ...............................................................................................15
  4.4 Housing ..................................................................................................................16
  4.5 Existing Sewerage and Sanitation Facilities ............................................................17
  4.6 Population Projection ...............................................................................................17

SECTION 5 :  FIELD SURVEY ..........................................................................................18
  5.1 Strategy For Field Survey .......................................................................................18

SECTION 6 :  DESIGN CRITERIA .......................................................................................19
  6.1 Population Projection ...............................................................................................19
  6.2 Water Supply ...........................................................................................................21
## Recycling / Reuse of Wastewater

Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.3</td>
<td>Wastewater Generation</td>
<td>21</td>
</tr>
<tr>
<td>6.4</td>
<td>Design of Tertiary Sewage Treatment Plants</td>
<td>21</td>
</tr>
<tr>
<td>6.4.1</td>
<td>Characteristics of Sewage</td>
<td>21</td>
</tr>
<tr>
<td>6.4.2</td>
<td>Treatment Standards</td>
<td>22</td>
</tr>
<tr>
<td>6.4.3</td>
<td>Process Design Criteria</td>
<td>22</td>
</tr>
</tbody>
</table>

### Section 7: Proposed Tertiary Sewage Treatment Plant at Dindoli

<table>
<thead>
<tr>
<th>Subsection</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1</td>
<td>Location of Tertiary Sewage Treatment Plant</td>
<td>23</td>
</tr>
<tr>
<td>7.2</td>
<td>Project Scope and Component</td>
<td>23</td>
</tr>
<tr>
<td>7.2.1</td>
<td>Project objective</td>
<td>23</td>
</tr>
<tr>
<td>7.2.2</td>
<td>Dindoli Sewage Treatment Plant</td>
<td>24</td>
</tr>
<tr>
<td>7.2.3</td>
<td>Pandesara Industrial Estate</td>
<td>25</td>
</tr>
<tr>
<td>7.3</td>
<td>Tertiary Sewage Treatment Plant at Dindoli</td>
<td>26</td>
</tr>
<tr>
<td>7.3.1</td>
<td>Objective of TSTP</td>
<td>26</td>
</tr>
<tr>
<td>7.3.2</td>
<td>Treated Sewage Flow and Characteristics</td>
<td>26</td>
</tr>
<tr>
<td>7.3.3</td>
<td>Tertiary Sewage Treatment Process</td>
<td>27</td>
</tr>
</tbody>
</table>

### Section 8: Project Implementation Planning

- Project Cost

### Section 9: Project Cost

- Financial Structuring

### Section 10: Project Institution Framework

- Operation and Maintenance Cost
LIST OF TABLES

Table 2-1 : List of census wards – area and population as per census 1991, 2001 and 2011 census for the SMC area ................................................................. 5
Table 2-2 : Projected Population of Dindoli Drainage Zones (Non-agricultural area only) of SMC for the year 2048 ................................................................. 9
Table 3-1 : Details of Drainage Zones with Sewage Treatment Plants and Sewage Pumping Stations .................................................................................... 12
Table 3-2 : Details of Drainage Zones with Sewage Treatment Plants and Sewage Pumping Stations .................................................................................... 13
Table 4-1 : Details of T.P. Schemes for the Dindoli Drainage Zones .................. 15
Table 4-2 : Census Population Records for Dindoli Drainage Zone .................... 16
Table 6-1: Population Projections for Dindoli Drainage Zone .......................... 19
Table 7-1 : Treated Sewage Characteristics as per CPHEEO Manual - 2012 .......... 25
Table 7-2 : Water Demand and Supply at Pandesar – Current Status ............... 26
Table 7-3 : Tertiary Treated Water - Industrial Grade Water Characteristics ....... 27
Table 8-1 : Project Implementation Planning ...................................................... 30
Table 9-1 : Cost Estimates .................................................................................. 31
Table 10-1 : Details of the Sources of the Fund .................................................. 33
Table 12-1 : Operation and Maintenance Cost .................................................. 35
LIST OF FIGURES

Figure 1 : Location of Surat City ........................................................................................................2
Figure 2 : Dindoli Drainage Zone (Dindoli Drainage Zone).................................................................14
Figure 3 : Location Map of existing Sewage Treatment Plant at Dindoli...............................67
Figure 4 : Layout Plan showing various units for the tertiary sewage treatment plant at Dindoli ........................................................................................................................................67
Figure 5 : Process Flow Diagram showing various units for the tertiary sewage treatment plant at Dindoli ........................................................................................................................................67
LIST OF ANNEXURES

Annexure 1 : Design for Tertiary Sewage Treatment Plant at Dindoli.........................37
Annexure 2 : Cost Estimates for Tertiary Sewage Treatment Plant at Dindoli.............64
Annexure 3 : Drawings for Tertiary Sewage Treatment Plant at Dindoli......................66
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli
to generate industrial grade water under SMART CITY, Surat

**LIST OF ABBREVIATIONS**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD</td>
<td>Biochemical Oxygen Demand</td>
</tr>
<tr>
<td>CASP</td>
<td>Conventional Activated Sludge Process</td>
</tr>
<tr>
<td>COD</td>
<td>Chemical Oxygen Demand</td>
</tr>
<tr>
<td>CPHEEO</td>
<td>Central Public Health and Environmental Engineering Organisation</td>
</tr>
<tr>
<td>EA</td>
<td>Extended Aeration</td>
</tr>
<tr>
<td>EPC</td>
<td>Engineering, Procurement and Commissioning</td>
</tr>
<tr>
<td>ETP</td>
<td>Effluent Transfer Pumps</td>
</tr>
<tr>
<td>F/M</td>
<td>Food to Micro organisms ratio</td>
</tr>
<tr>
<td>GPCB</td>
<td>Gujarat Pollution Control Board</td>
</tr>
<tr>
<td>GWSSB</td>
<td>Gujarat Water Supply and Sewerage Board</td>
</tr>
<tr>
<td>IGW</td>
<td>Industrial Grade Water</td>
</tr>
<tr>
<td>lpcd</td>
<td>Litres Per Capita Day</td>
</tr>
<tr>
<td>LPS</td>
<td>Litres Per Second</td>
</tr>
<tr>
<td>MBBR</td>
<td>Moving Bed Bio Reactor</td>
</tr>
<tr>
<td>MLD</td>
<td>Million Litres per Day</td>
</tr>
<tr>
<td>MLSS</td>
<td>Mixed Liquor Suspended Solids</td>
</tr>
<tr>
<td>NOC</td>
<td>No Objection Certificate</td>
</tr>
<tr>
<td>NP3</td>
<td>Non Pressure – Class 3</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Operation and Maintenance</td>
</tr>
<tr>
<td>RCC</td>
<td>Reinforced Cement Concrete</td>
</tr>
<tr>
<td>SMC</td>
<td>Surat Municipal Corporation</td>
</tr>
<tr>
<td>SOR</td>
<td>Schedule Of Rates</td>
</tr>
<tr>
<td>SPS</td>
<td>Sewage Pumping Station</td>
</tr>
<tr>
<td>SS</td>
<td>Suspended Solids</td>
</tr>
<tr>
<td>STP</td>
<td>Sewage Treatment Plant</td>
</tr>
<tr>
<td>TSTP</td>
<td>Tertiary Sewage Treatment Plant</td>
</tr>
<tr>
<td>UASB</td>
<td>Upflow Anaerobic Sludge Blanket</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY AS PER TOOLKIT

1.0 Sector Background Context and Broad Project Rationale

1.1 The city is divided into six drainage zones with a total length of more than 1700 km of sewerage network, 50 nos. of sewage pumping stations and 10 nos. of sewage treatment plants; the total sewerage collected is about 730 MLD. At present, only 159 sq. km (78%) is covered by the sewerage system out of present habitable area of 204 sq.kms of Surat. This serves around 92% of the total population.

The area of the city limits of surat city, covered under this DPR of novation of sewage treatment plant at Dindoli under Dindoli Drainage Zone is 20.68 Sq.km. The population covered under this DPR for the ultimate design year 2048 and intermediate year 2033 will be 16.76 Lacs and 14.11 Lacs respectively. The estimated sewage flow for year 2048 and 2033 will be 301 MLD and 254 MLD respectively.

1.2 At present, there is sewerage system in total 2068 hectares area of Dindoli Drainage Zone. At present, there is 66 MLD capacity sewage treatment plant at Dindoli under Dindoli Drainage Zone, which is running at 40 MLD sewage flow. However, considering the pumping station and rising main augmentation work going on at present, it is forecasted that more than 150 MLD sewage will reach the STP. Moreover, the revised and more stringent standards as per GPCB, require removal of nutrients, such as Nitrogen and Phosphorus, for compliance as well. Hence, upgradation of existing 66 MLD STP is considered under separate project report of Novation of Sewage Treatment Plant at Dindoli.

Further, as per development within the project area and as per population forecast, the STP would be receiving more than 150 MLD. Hence, considering design period of 15 years, the augmentation up to 254 MLD is required. However, the available land at Dindoli is about 20 hectares and hence, considering the future sewage generation of 301
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

MLD, the present land alone would be insufficient. Hence, part of the sewage from two sewage pumping station would be diverted to another proposed STP at Devadh and the rest four SPS would convey the sewage to Dindoli STP. Till the new STP at Devadh is constructed all the sewage will be conveyed to Dindoli STP. Hence, considering future diversion of sewage to another STP, new STP of 101 MLD is proposed with total augmentation up to 167 MLD is considered under separate project report of Novation of Sewage Treatment Plant at Dindoli.

1.3 Pandesara is a notified industrial estate which was established by GIDC and falls within SMC limits at is spread over an area of about 2 sq.km. There are about 400 industrial units operating in Pandesara estate, of which 119 units are water based industries comprising largely textile processing units and chemical industries. The size of the estate in terms of its turnover is approx Rs 4000 Crores. Current water demand at Pandesara is estimated at approximately 100 MLD, comprising about 80-85 MLD of process water requirement and 15-20 MLD of potable quality water demand. Of the total demand, nearly 40 MLD is met through SMC’s existing TSTP at Bamroli and rest 40 MLD is met through potable water supply. The remaining demand is met through private sources including borewells and water tankers.

Surat Municipal Corporation (SMC) plans to execute a project to set up another new 40 MLD capacity Tertiary Treatment Plant (TTP) to treat secondary treated water from Dindoli Sewage Treatment Plant to supply Industrial Grade Water to Pandesara Industrial Estate through Surat Municipal Corporation. The potable water supply network of 15 MLD to provide potable water in the area is executed separately by SMC. The operation maintenance period of the TSTP contract will be 10 years. This would enable SMC to reduce pressure on ground water resources in the city and free up potable water supplied to Pandesara Industrial area at present, which could be further used to supply the drinking water to the newly merged area in the city. This would also minimize the breakage of roads since, the transportation of water tanker would be turn down in the area.
1.4 No projects under sewerage sector for the reported drainage zone are put up under other schemes, other than Smart City.

1.5 Existing areas of Private Sector / Community Participation in sector for design, construction, project management and / or O & M services (including billing & Collection):

(i) The design & project management will be carried out by private consultant, who are expert in this filed.
(ii) Construction of Tertiary Sewage Treatment Plant will be carried out by the qualified contracting agencies by inviting the open tenders.
(iii) O & M services for at least ten years will be carried out by the contractor, who is awarded for construction, as per the prevailing practice of SMC. Thereafter, separate contract will be awarded for O & M services.

1.6 With the Recycling / Reuse of wastewater from the Dindoli STP, it will be able to meet the industrial grade water requirements. This will result in the reduction in potable water requirement for industrial purpose and protection of the environment of the surrounding area.

1.0 Project Definition, Concept and Scope

1.1 The land required for the construction of Tertiary sewage treatment plant is kept under reservations, under various town planning schemes and development plan. So, SMC owe the land for the execution purposes.

1.2 Since the project consists of construction of TSTP it will be executed on the existing land and no additional land is required for the project.

1.3 The following physical infrastructure components at the TSTP are considered under this DPR.

1.0 Inlet Chamber
2.0 Disc / Cloth Media Filter
3.0 Strainers
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UF-RO Shed</td>
<td>1,93,81,682.40</td>
</tr>
<tr>
<td>2</td>
<td>Product Water Tank</td>
<td>86,99,213.05</td>
</tr>
</tbody>
</table>

4.0 Ultra Filtration (UF)
5.0 Reverse Osmosis (RO)
6.0 Treated Water – UF / RO Blending tank
7.0 Reject Water Treatment
8.0 Admin / Control / Laboratory room
9.0 Miscellaneous Infrastructure works within campus

9.1 Since the project consists of recycle and reuse of wastewater, Environmental Impact Assessment and Environmental Management Plan are not required.

9.2 Since the project is to be executed within the existing STP no rehabilitation and resettlement are not required.

9.3 SMC has appointed a Project Management Consultant for the preparation of detail design, drawing and contract award as well as for daily supervision and monitoring of the project.

9.4 Other Information:

(i) Detailed survey and soil investigation is carried out for the detailed design of this project.

(ii) The land is in possession and sewage will be treated as per the requirement of industrial grade water and the reject water shall be treated up to the prescribed standards of GPCB / CPCB or as required for the creek disposal.

(iii) All the structures are designed duly considering the earthquake (IS: 1893-1984) and wind hazards (IS 875) requirements.

10.0 Project Cost:

The detail cost estimates are provided in the Annexure 2, based on the SOR of GWSSB / R&B of Govt. of Gujarat for the year 2014-2015 and Market rates.

COST SUMMARY
Recycling / Reuse of Wastewater

Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli
to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Cost (₹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Backwash Waste Water Sump</td>
<td>71,88,835.81</td>
</tr>
<tr>
<td>4</td>
<td>Flash Mixer And Flocculator</td>
<td>40,06,920.01</td>
</tr>
<tr>
<td>5</td>
<td>HT Room / LT Room / Transformer Yard</td>
<td>45,29,382.03</td>
</tr>
<tr>
<td>6</td>
<td>UF Backwash Tank/ RO Feed Sump/ Pump House/MCC Room</td>
<td>1,48,35,090.95</td>
</tr>
<tr>
<td>7</td>
<td>Filter House</td>
<td>1,34,42,280.95</td>
</tr>
<tr>
<td>8</td>
<td>Chemical Dosing Shed</td>
<td>1,60,33,843.16</td>
</tr>
<tr>
<td>9</td>
<td>RO Flushing Tank and Degasser Unit</td>
<td>42,15,360.47</td>
</tr>
<tr>
<td>10</td>
<td>Administrative Building</td>
<td>53,31,522.93</td>
</tr>
<tr>
<td>11</td>
<td>ACF/Blower Foundations &amp; Misc. Work</td>
<td>38,13,745.12</td>
</tr>
<tr>
<td>12</td>
<td>RO Feed Tank</td>
<td>2,63,47,907.90</td>
</tr>
<tr>
<td>13</td>
<td>Piping Works</td>
<td>7,49,54,274.61</td>
</tr>
<tr>
<td>14</td>
<td>Mechanical Works including UF and RO</td>
<td>68,55,26,393.49</td>
</tr>
<tr>
<td>15</td>
<td>Electrical Works</td>
<td>6,32,57,204.00</td>
</tr>
<tr>
<td>16</td>
<td>Instrumentation Works</td>
<td>9,75,02,100.00</td>
</tr>
<tr>
<td></td>
<td><strong>UGSR/GSR and Pumping Main</strong></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>5 ML UGSR cost</td>
<td>2,57,93,411.67</td>
</tr>
<tr>
<td>18</td>
<td>800 mm Pumping Main Works</td>
<td>7,88,82,130.00</td>
</tr>
<tr>
<td>19</td>
<td>Mechanical works for Water Distribution Station</td>
<td>66,31,660.39</td>
</tr>
<tr>
<td>20</td>
<td>Electrical works for Water Distribution Station</td>
<td>42,60,756.00</td>
</tr>
<tr>
<td></td>
<td><strong>Total Cost for 40 MLD TTP</strong></td>
<td>1,16,46,33,714.95</td>
</tr>
<tr>
<td></td>
<td><strong>Total Cost for 40 MLD TTP(Say)</strong></td>
<td>1,16,46,34,000.00</td>
</tr>
<tr>
<td></td>
<td>1 % Labour Cess</td>
<td>1,16,46,340.00</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>1,17,62,80,340.00</td>
</tr>
<tr>
<td></td>
<td>2% Administrative Charges</td>
<td>2,35,25,606.80</td>
</tr>
<tr>
<td></td>
<td>5% Contingency Charges</td>
<td>5,88,14,017.00</td>
</tr>
<tr>
<td></td>
<td><strong>Grand Total</strong></td>
<td>1,25,86,19,963.80</td>
</tr>
<tr>
<td></td>
<td><strong>Say Grand Total</strong></td>
<td>1,25,86,20,000.00</td>
</tr>
</tbody>
</table>

11.0 Project Institution Frame Work (For Construction)

4.1 Roles of different institutions involved in the construction phase of the project.

- The SMC will be implementing agency. SMC has appointed a Project Management Consultant for the preparation of detail design, drawing and contract award as well as for daily supervision and monitoring of the project including quality assurance. SMC will invite the tender on turnkey basis, keeping the alternative technical option open, on approval of the DPR and appoint the agency for construction and O&M.
4.2 Manner of undertaking construction works

- The SMC will invite the tender on approval of the DPR and appoint the agency for construction and O&M, under its own management.

4.3 Involvement of the construction entity in the subsequent O & M activities:

As per the prevailing practice in the SMC, the agency appointed for the construction of tertiary sewage treatment plant will be awarded the contract for O&M for the period of 10 years thereafter.

4.4 Areas of involvement of the private sector in the construction phase:

| I. | Project feasibility study | ✓ |
| II. | Project Engineering Design | ✓ |
| III. | Specialized Survey | ✓ |
| IV. | Construction Works | ✓ |
| V. | Supervision Consultants | ✓ |
| VI. | Quality Assurance Consultants | ✓ |
| VII. | Material Testing & Inspection | ✓ |

12.0 Project Financial Structuring

The sources and composition of the funds required for the execution of the Sewerage Projects is presented below.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Project Contribution Source</th>
<th>% Share by Govt. entity</th>
<th>Amount (Rs. Lacs)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Government of India</td>
<td>33</td>
<td>415344600</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Government of Gujarat</td>
<td>37</td>
<td>465689400</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Surat Municipal Corporation</td>
<td>30</td>
<td>377586000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Amount</td>
<td>100</td>
<td>1258620000</td>
<td></td>
</tr>
</tbody>
</table>

13.0 Project Phasing

13.1 Schedule for tendering / selection for procurement of services
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>Approval of DPR</th>
<th>Upto April 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>Invitation of Tender</td>
<td>April 2017</td>
</tr>
<tr>
<td>Fixing agency</td>
<td>June 2017</td>
</tr>
<tr>
<td>Execution of various packages covered under this DPR</td>
<td>24 Months from June 2017</td>
</tr>
</tbody>
</table>

13.2 Schedule for obtaining all Clearances: Not required.

13.3 Schedule for shifting utilities: Not required.

13.4 Project Infrastructure Component-wise implementation

The detailed bar chart is given under SECTION 8 : PROJECT IMPLEMENTATION PLANNING.

14.0 Project O & M Planning

14.1 Institution framework (organization and operation) strategy

As per the prevailing practice in the SMC, the agency appointed for the construction of tertiary sewage treatment plant will be awarded the contract for O&M for the period of 10 years thereafter.

14.2 Tariff and User Cost Recovery

SMC has already implemented industrial grade water charges to recover full Operation and Maintenance cost for Pandesara GIDC area. O&M cost per year, with calculation is given in SECTION 12 : OPERATION AND MAINTENANCE COST.

15.0 PROJECT BENEFIT ASSESSMENT

15.1 It reduces diversion of drinking water for non-potable purposes in the long term.

15.2 It reduces dependence of Pandesara Industrial Units on unauthorized bore-wells and private tanker operators

15.3 It facilitates recycling of wastewater, an environmentally sound and progressive practice.
15.4 It protects the current revenues of SMC from sale of water for industrial purpose in the short term.

15.5 It assures more stability in level of water supply to industrial units by providing supplementary source of water in addition to drinking water.

15.6 It involves no investment or O&M cost to Surat Municipal Corporation

15.7 It offers opportunity to private sector to contribute to invest in infrastructure sector within a regulated frame-work.

15.8 A list of Negative externalities from social perspective

All the projects have its merits and demerits. Similarly, there could be certain negative externalities adverse impacts due to implementation of this project; but their effect can be taken care off to the level achievable by adopting some countermeasures at proper time.

<table>
<thead>
<tr>
<th>Negative Externalities</th>
<th>Possible Countermeasures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollution, environmental distortion</td>
<td>The efficient working of treatment system by vigilant operation and maintenance. It will prevent the untreated sewage flow in to the industries or open ground or even in the creek.</td>
</tr>
<tr>
<td>Reduced green cover</td>
<td>The land for the tertiary sewage treatment plant shall be open / unused / barren land. On the contrary, the treated effluent shall be reused for industrial purposes.</td>
</tr>
<tr>
<td>Disruption in livelihood</td>
<td>The care shall have to be taken for the people living or working near by the project area shall have minimum disturbances, noise and dust trouble etc. in their routine work and life.</td>
</tr>
<tr>
<td>Displacement of inhabitant</td>
<td></td>
</tr>
<tr>
<td>Possible haphazard development around project site</td>
<td>As SMC has prepared the town planning schemes, the onward developments shall be as per the development control regulations.</td>
</tr>
</tbody>
</table>

Page XIV
SECTION 1: INTRODUCTION – SURAT

1.1 City at a glance - Geographical, Historical and Present Status

The city of Surat is the commercial capital of the state and is of significant importance to the country (Figure 1), situated on the broad gauge railway track on the Mumbai - Delhi and Mumbai – Ahmedabad routes. It is also well connected by National Highway No. 8 and airways to most parts of Western India. The city is located on the River Tapi and the Arabian Sea is to its west at a distance of about 22 kilometres along the Tapi and about 16 kilometres by road. Surat lies on the 21° 12’ N Latitude and 72° 52’ E Longitude. The location map of Surat city in Gujarat and India is shown in Figure 1. The city lies at a bend of the River Tapi, where its course swerves suddenly from the north-east to south-west. With the walled city at its centre, the city forms an arc of a circle, the bends enclosed by its walls stretching for about a mile and a quarter along the bank. From the right bank of the river, the ground rises slightly towards the north, but the height above mean sea level is only 13 meter. The topography is controlled by the river and the general slope is from north-east to south-west. The summers are quite hot with temperatures ranging from 37.78°C to 44.44°C. The climate is pleasant during the monsoon while autumn is temperate. The winters are not very cold but the temperatures in January range from 10°C to 15.5°C. The average annual rainfall of the city has been 1143 mm, which is spread of 3 to 4 months.

The city of Surat has glorious history that dates back to 300 BC. The origin of the city can be traced to the old Hindu town of Suryapur, during 1500 – 1520 A.D., which was later colonised by the Brigus or the King from Sauvira on the banks of River Tapi. In 1759, The British rulers took its control from the Mughals till the beginning of the 20th century. Surat became the most important trade link between India and many other countries and was at the height of prosperity till the rise of Bombay port in the 17th and 18th centuries. Surat was also a flourishing centre for ship building activities. The whole coast of Tapi from Athwalines to Dumas was specially meant for ship builders who were usually Rassis. After the rise of the port at Bombay, Surat faced a severe blow and its ship building industry also declined. During the post-independence period,
Surat has experienced considerable growth in industrial activities (especially textiles) along with trading activities. Concentration of these activities combined with residential developments has resulted in considerable expansion of the city limits.

**Figure 1: Location of Surat City**

The evolution of the power loom and handloom sectors led to gradual growth of textile industries gradually. Another important addition since the 1950's is the diamond cutting and polishing industry. In the last two decades, especially during the eighties large-scale industries have come up in Surat and its peripheries. This increased the importance of Surat in the regional context, along with Vadodara and Ahmedabad, specifically due to its location at the core of what is called the "Golden Corridor" of industrial development.

The southern part of the city houses the industrial complexes of Gujarat Industrial Development Corporation at Sachin and Diamond Nagar. Besides industrial potential, the city has fertile agricultural land irrigated by an intensive canal network. The combined effect of all these on the economic activities in the city and its outskirts have
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

changed the otherwise small and quiet town into a bustling metropolis.

1.2 About Surat Municipal Corporation

The area of the City at the time of formation of Gujarat State was 8.18 sq. km, which increased to 33.85 sq. km. during the 8th decade (1970’s), to 55.56 sq. km during the 9th decade (1980’s) and to 111.16 sq. km during the 10th decade (1990’s), subsequently, to the present area of 327.12 sq. km (2007). The City received the status of Municipal Corporation (SMC) on 1-10-1966 with a total of 12 members. The first election was held in the year 1983-84. At present, there are 34 election wards in the city area. The City has about 2000 km of road network and is administratively divided into 7 zones. In order to regulate the growth of the City and achieve planned development, the state government has constituted an Urban Development Authority (SUDA) as per the provisions laid down in Gujarat Town Planning and Urban Development Act 1976. SUDA has published its revised development plan in year 2006. SMC implements the proposals of the development plan and also makes micro level planning. The present study conceives to have proposals for the areas recently merged in the Corporation limits. The present population of the City as per census 2011 is around 45 Lac.

1.3 Scope of Work

The project for recycling / reuse of wastewater - Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat broadly covers as followings:

- Review of the existing and proposed sewage treatment plant, Biogas Based Power Plant and disposal line.
- Review of current and future industrial grade water requirement.
- Soil Investigations, as required.
- Land requirement assessment and justification report of the requirements.
- Inlet secondary treated sewage flow assessment
- Basic process design and drawing
- Preparation of detail design including hydraulic, civil and electro-mechanical design as required and Block Estimates for the project.
- Preparation of drawings.
- Preparation of line diagrams for the various components of the projects.
• Preparation of detail project report (DPR)
• Preparation of Draft Tender Papers
• Project Management Services including quality assurance
• Proof checking of all drawings as submitted by the contractor

1.4 **Structure Of The Report**

The present report deals with the detailed design and cost estimate of tertiary sewage treatment plant at existing Dindoli STP, Surat.

For convenience in reading and understanding, the report is presented in following main chapters.

**SECTION 1 : INTRODUCTION – SURAT**
**SECTION 2 : CITY AREA AND POPULATION**
**SECTION 3 : SECTOR BACKGROUND : SEWERAGE**
**SECTION 4 : SALIENT FEATURES OF DINDOLI DRAINAGE ZONE**
**SECTION 5 : FIELD SURVEY**
**SECTION 6 : DESIGN CRITERIA**
**SECTION 7 : PROPOSED AUGMENTATION FOR DINDOLI SEWAGE TREATMENT PLANT**
**SECTION 8 : PROJECT IMPLEMENTATION PLANNING**
**SECTION 9 : PROJECT COST**
**SECTION 10 : FINANCIAL STRUCTURING**
**SECTION 11 : PROJECT INSTITUTION FRAMEWORK**
**SECTION 12 : OPERATION AND MAINTENANCE COST**
SECTION 2 : CITY AREA AND POPULATION

2.1 City Area: Surat Municipal Corporation

The city limit of extended city area of Surat Municipal Corporation is 326.51 sq.km. It comprises of total 101 wards, as shown in Table 2-1. The city area of SMC is divided into 12 different sewerage zones, according to its topographical features; vide its natural boundaries such as rivers, creeks, railway tracks. The populations in the city as per census 1991, 2001 and 2011 are provided in Table 2-1. The different sewerage zones are as shown in Error! Reference source not found..

Table 2-1 : List of census wards – area and population as per census 1991, 2001 and 2011 census for the SMC area

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nanpura</td>
<td>1.28</td>
<td>49614</td>
<td>388</td>
<td>51749</td>
<td>404</td>
<td>53502</td>
<td>418</td>
</tr>
<tr>
<td>2</td>
<td>Sagrampura</td>
<td>1.31</td>
<td>66467</td>
<td>507</td>
<td>77316</td>
<td>590</td>
<td>81001</td>
<td>619</td>
</tr>
<tr>
<td>3</td>
<td>Salabatpura</td>
<td>0.84</td>
<td>59940</td>
<td>714</td>
<td>55675</td>
<td>663</td>
<td>54512</td>
<td>649</td>
</tr>
<tr>
<td>4</td>
<td>Begumpura</td>
<td>0.93</td>
<td>52460</td>
<td>564</td>
<td>45830</td>
<td>493</td>
<td>41118</td>
<td>443</td>
</tr>
<tr>
<td>5</td>
<td>Haripura</td>
<td>0.23</td>
<td>14922</td>
<td>649</td>
<td>12564</td>
<td>546</td>
<td>15008</td>
<td>653</td>
</tr>
<tr>
<td>6</td>
<td>Mahidharpura</td>
<td>0.36</td>
<td>23594</td>
<td>655</td>
<td>19817</td>
<td>550</td>
<td>29556</td>
<td>821</td>
</tr>
<tr>
<td>7</td>
<td>Saiyadpura</td>
<td>1.69</td>
<td>59270</td>
<td>351</td>
<td>55179</td>
<td>327</td>
<td>58854</td>
<td>349</td>
</tr>
<tr>
<td>8</td>
<td>Gopipura</td>
<td>0.22</td>
<td>22032</td>
<td>1001</td>
<td>19310</td>
<td>878</td>
<td>19995</td>
<td>909</td>
</tr>
<tr>
<td>9</td>
<td>Wadifalia</td>
<td>0.14</td>
<td>12541</td>
<td>896</td>
<td>9552</td>
<td>682</td>
<td>10015</td>
<td>716</td>
</tr>
<tr>
<td>10</td>
<td>Sonifalia</td>
<td>0.24</td>
<td>16402</td>
<td>683</td>
<td>14426</td>
<td>601</td>
<td>12104</td>
<td>505</td>
</tr>
<tr>
<td>11</td>
<td>Nanavat</td>
<td>0.46</td>
<td>21463</td>
<td>467</td>
<td>19754</td>
<td>429</td>
<td>19987</td>
<td>435</td>
</tr>
<tr>
<td>12</td>
<td>Shahpor</td>
<td>0.39</td>
<td>25648</td>
<td>658</td>
<td>23265</td>
<td>597</td>
<td>23965</td>
<td>615</td>
</tr>
<tr>
<td>13</td>
<td>Athwa</td>
<td>0.72</td>
<td>7324</td>
<td>102</td>
<td>7726</td>
<td>107</td>
<td>8152</td>
<td>114</td>
</tr>
<tr>
<td>14-26</td>
<td>Rander</td>
<td>5.12</td>
<td>59549</td>
<td>116</td>
<td>86047</td>
<td>168</td>
<td>114927</td>
<td>225</td>
</tr>
<tr>
<td>27</td>
<td>Adajan</td>
<td>6.73</td>
<td>62620</td>
<td>93</td>
<td>152274</td>
<td>226</td>
<td>191587</td>
<td>285</td>
</tr>
<tr>
<td>28</td>
<td>Nanavarachha</td>
<td>0.025</td>
<td>71</td>
<td>28</td>
<td>173</td>
<td>69</td>
<td>290</td>
<td>116</td>
</tr>
<tr>
<td>29</td>
<td>TPS-1 Rampura Laldarwaja</td>
<td>0.4</td>
<td>9324</td>
<td>233</td>
<td>12514</td>
<td>313</td>
<td>13546</td>
<td>339</td>
</tr>
<tr>
<td>30</td>
<td>TPS-2 Nanpura</td>
<td>0.8</td>
<td>8186</td>
<td>102</td>
<td>9204</td>
<td>115</td>
<td>9142</td>
<td>115</td>
</tr>
<tr>
<td>31</td>
<td>TPS-3 Katargam Gotalawadi</td>
<td>1.76</td>
<td>65118</td>
<td>370</td>
<td>70500</td>
<td>401</td>
<td>72489</td>
<td>412</td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>32</td>
<td>TPS-4 Ashvanikumar Navagam</td>
<td>2.11</td>
<td>43411</td>
<td>206</td>
<td>68039</td>
<td>322</td>
<td>59996</td>
<td>285</td>
</tr>
<tr>
<td>33</td>
<td>TPS-5 Athwa - Umara</td>
<td>1.7</td>
<td>23809</td>
<td>140</td>
<td>31365</td>
<td>185</td>
<td>31125</td>
<td>184</td>
</tr>
<tr>
<td>34</td>
<td>TPS-6 Majura - Khatodara</td>
<td>2.32</td>
<td>48928</td>
<td>211</td>
<td>63217</td>
<td>272</td>
<td>60125</td>
<td>260</td>
</tr>
<tr>
<td>35</td>
<td>TPS-7 Anjana</td>
<td>1.91</td>
<td>47868</td>
<td>251</td>
<td>78344</td>
<td>410</td>
<td>107682</td>
<td>564</td>
</tr>
<tr>
<td>36</td>
<td>TPS-8 Umarwada</td>
<td>1.66</td>
<td>51227</td>
<td>309</td>
<td>61170</td>
<td>368</td>
<td>81936</td>
<td>494</td>
</tr>
<tr>
<td>37</td>
<td>TPS-9 Majura</td>
<td>1.1</td>
<td>12675</td>
<td>115</td>
<td>21960</td>
<td>200</td>
<td>27332</td>
<td>249</td>
</tr>
<tr>
<td>38</td>
<td>Tunki</td>
<td>1.87</td>
<td>13738</td>
<td>73</td>
<td>30335</td>
<td>162</td>
<td>50634</td>
<td>271</td>
</tr>
<tr>
<td>39</td>
<td>Singanpor</td>
<td>2.62</td>
<td>3337</td>
<td>13</td>
<td>7215</td>
<td>28</td>
<td>34356</td>
<td>132</td>
</tr>
<tr>
<td>40</td>
<td>Dabhali</td>
<td>2.54</td>
<td>3274</td>
<td>13</td>
<td>7968</td>
<td>31</td>
<td>22536</td>
<td>89</td>
</tr>
<tr>
<td>41</td>
<td>Ved</td>
<td>2.84</td>
<td>4338</td>
<td>15</td>
<td>5004</td>
<td>18</td>
<td>8925</td>
<td>32</td>
</tr>
<tr>
<td>42</td>
<td>Katargam</td>
<td>7</td>
<td>71128</td>
<td>102</td>
<td>192590</td>
<td>275</td>
<td>325210</td>
<td>465</td>
</tr>
<tr>
<td>43</td>
<td>Fulpada</td>
<td>3.25</td>
<td>95753</td>
<td>295</td>
<td>169476</td>
<td>521</td>
<td>195600</td>
<td>602</td>
</tr>
<tr>
<td>44</td>
<td>Kapadra</td>
<td>1.68</td>
<td>12564</td>
<td>75</td>
<td>47464</td>
<td>283</td>
<td>66450</td>
<td>396</td>
</tr>
<tr>
<td>45</td>
<td>Nanavarachha</td>
<td>3.33</td>
<td>13461</td>
<td>40</td>
<td>40537</td>
<td>122</td>
<td>78967</td>
<td>238</td>
</tr>
<tr>
<td>46</td>
<td>Karanj</td>
<td>1.85</td>
<td>111732</td>
<td>604</td>
<td>198482</td>
<td>1073</td>
<td>198482</td>
<td>1073</td>
</tr>
<tr>
<td>47</td>
<td>Umarwada (Part)</td>
<td>0.31</td>
<td>174</td>
<td>6</td>
<td>1023</td>
<td>33</td>
<td>650</td>
<td>21</td>
</tr>
<tr>
<td>48</td>
<td>Magob (Part)</td>
<td>0.53</td>
<td>2160</td>
<td>41</td>
<td>21961</td>
<td>414</td>
<td>57505</td>
<td>425</td>
</tr>
<tr>
<td>49</td>
<td>Dumbhal</td>
<td>1.71</td>
<td>7765</td>
<td>45</td>
<td>25802</td>
<td>151</td>
<td>59815</td>
<td>200</td>
</tr>
<tr>
<td>50</td>
<td>Anjaja (Part)</td>
<td>0.04</td>
<td>3491</td>
<td>873</td>
<td>4435</td>
<td>1109</td>
<td>7435</td>
<td>1109</td>
</tr>
<tr>
<td>51</td>
<td>Mota Varachha</td>
<td>4.77</td>
<td>70784</td>
<td>132</td>
<td>91488</td>
<td>170</td>
<td>131118</td>
<td>275</td>
</tr>
<tr>
<td>52</td>
<td>Dindoli (Part)</td>
<td>2.25</td>
<td>20539</td>
<td>91</td>
<td>84898</td>
<td>377</td>
<td>145879</td>
<td>549</td>
</tr>
<tr>
<td>53</td>
<td>Bhedvad</td>
<td>1.68</td>
<td>7485</td>
<td>45</td>
<td>8219</td>
<td>49</td>
<td>15782</td>
<td>94</td>
</tr>
<tr>
<td>54</td>
<td>Bhestan</td>
<td>6.91</td>
<td>12938</td>
<td>19</td>
<td>25616</td>
<td>37</td>
<td>55186</td>
<td>80</td>
</tr>
<tr>
<td>55</td>
<td>Pandesar</td>
<td>2.82</td>
<td>21242</td>
<td>75</td>
<td>52389</td>
<td>186</td>
<td>76442</td>
<td>272</td>
</tr>
<tr>
<td>56</td>
<td>Udhana</td>
<td>6.8</td>
<td>105281</td>
<td>155</td>
<td>186860</td>
<td>275</td>
<td>259628</td>
<td>382</td>
</tr>
<tr>
<td>57</td>
<td>Bamroli (Part)</td>
<td>1.57</td>
<td>8889</td>
<td>57</td>
<td>45354</td>
<td>289</td>
<td>109900</td>
<td>700</td>
</tr>
<tr>
<td>58</td>
<td>Majura</td>
<td>1.25</td>
<td>4992</td>
<td>40</td>
<td>10140</td>
<td>81</td>
<td>17250</td>
<td>138</td>
</tr>
<tr>
<td>59</td>
<td>Bhatar</td>
<td>2.3</td>
<td>8679</td>
<td>38</td>
<td>28622</td>
<td>124</td>
<td>48091</td>
<td>210</td>
</tr>
<tr>
<td>60</td>
<td>Althan</td>
<td>3.23</td>
<td>10900</td>
<td>34</td>
<td>28510</td>
<td>88</td>
<td>57000</td>
<td>177</td>
</tr>
<tr>
<td>61</td>
<td>Umara</td>
<td>4.56</td>
<td>12776</td>
<td>28</td>
<td>31212</td>
<td>68</td>
<td>56812</td>
<td>125</td>
</tr>
<tr>
<td>62</td>
<td>Piplod</td>
<td>1.92</td>
<td>2668</td>
<td>14</td>
<td>8871</td>
<td>46</td>
<td>19251</td>
<td>101</td>
</tr>
<tr>
<td>63</td>
<td>Jahangirabad</td>
<td>4.16</td>
<td>3329</td>
<td>8</td>
<td>9288</td>
<td>22</td>
<td>29158</td>
<td>71</td>
</tr>
<tr>
<td>64</td>
<td>Jahangirpura</td>
<td>2.92</td>
<td>1027</td>
<td>4</td>
<td>1120</td>
<td>4</td>
<td>2450</td>
<td>9</td>
</tr>
<tr>
<td>65</td>
<td>Pisad</td>
<td>0.696</td>
<td>244</td>
<td>4</td>
<td>1751</td>
<td>25</td>
<td>5146</td>
<td>74</td>
</tr>
<tr>
<td>66</td>
<td>Vadod</td>
<td>0.428</td>
<td>499</td>
<td>12</td>
<td>235</td>
<td>5</td>
<td>2089</td>
<td>49</td>
</tr>
<tr>
<td>67</td>
<td>Pal</td>
<td>6.045</td>
<td>4459</td>
<td>7</td>
<td>11165</td>
<td>18</td>
<td>15951</td>
<td>27</td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli
to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>Palanpor</td>
<td>3.008</td>
<td>1712</td>
<td>6</td>
<td>11496</td>
<td>38</td>
<td>12120</td>
<td>41</td>
</tr>
<tr>
<td>69</td>
<td>Varyav</td>
<td>22.596</td>
<td>8495</td>
<td>4</td>
<td>14003</td>
<td>6</td>
<td>25167</td>
<td>12</td>
</tr>
<tr>
<td>70</td>
<td>Chhapara Bhatha</td>
<td>2.962</td>
<td>4478</td>
<td>15</td>
<td>23415</td>
<td>79</td>
<td>51478</td>
<td>174</td>
</tr>
<tr>
<td>71</td>
<td>Kosad</td>
<td>9.532</td>
<td>8004</td>
<td>8</td>
<td>28663</td>
<td>30</td>
<td>76256</td>
<td>80</td>
</tr>
<tr>
<td>72</td>
<td>Amroli</td>
<td>0.413</td>
<td>13078</td>
<td>317</td>
<td>17138</td>
<td>415</td>
<td>26845</td>
<td>650</td>
</tr>
<tr>
<td>73</td>
<td>Utran</td>
<td>2.916</td>
<td>8673</td>
<td>30</td>
<td>12894</td>
<td>44</td>
<td>28627</td>
<td>99</td>
</tr>
<tr>
<td>74</td>
<td>Motavarachha</td>
<td>9.042</td>
<td>7055</td>
<td>8</td>
<td>7704</td>
<td>9</td>
<td>35360</td>
<td>40</td>
</tr>
<tr>
<td>75</td>
<td>Sarthana</td>
<td>3.309</td>
<td>172</td>
<td>1</td>
<td>237</td>
<td>1</td>
<td>27154</td>
<td>83</td>
</tr>
<tr>
<td>76</td>
<td>Simada</td>
<td>2.602</td>
<td>1101</td>
<td>4</td>
<td>3345</td>
<td>13</td>
<td>23897</td>
<td>92</td>
</tr>
<tr>
<td>77</td>
<td>Puna</td>
<td>7.331</td>
<td>8557</td>
<td>12</td>
<td>119092</td>
<td>162</td>
<td>181852</td>
<td>249</td>
</tr>
<tr>
<td>78</td>
<td>Magob</td>
<td>1.496</td>
<td>1568</td>
<td>10</td>
<td>5755</td>
<td>38</td>
<td>22440</td>
<td>150</td>
</tr>
<tr>
<td>79</td>
<td>Parvat</td>
<td>2.121</td>
<td>6206</td>
<td>29</td>
<td>20693</td>
<td>98</td>
<td>54282</td>
<td>256</td>
</tr>
<tr>
<td>80</td>
<td>Godadara</td>
<td>2.968</td>
<td>3028</td>
<td>10</td>
<td>23234</td>
<td>78</td>
<td>108650</td>
<td>367</td>
</tr>
<tr>
<td>81</td>
<td>Dindoli</td>
<td>5.197</td>
<td>3496</td>
<td>7</td>
<td>13014</td>
<td>25</td>
<td>77955</td>
<td>150</td>
</tr>
<tr>
<td>82</td>
<td>Unn</td>
<td>3.516</td>
<td>4545</td>
<td>13</td>
<td>28820</td>
<td>82</td>
<td>52740</td>
<td>150</td>
</tr>
<tr>
<td>83</td>
<td>Sonari</td>
<td>1.294</td>
<td>186</td>
<td>1</td>
<td>498</td>
<td>4</td>
<td>5705</td>
<td>45</td>
</tr>
<tr>
<td>84</td>
<td>Gabheni</td>
<td>12.46</td>
<td>3433</td>
<td>3</td>
<td>6321</td>
<td>5</td>
<td>19150</td>
<td>16</td>
</tr>
<tr>
<td>85</td>
<td>Budiya</td>
<td>3.638</td>
<td>2047</td>
<td>6</td>
<td>2349</td>
<td>6</td>
<td>2733</td>
<td>8</td>
</tr>
<tr>
<td>86</td>
<td>Jiyav</td>
<td>5.734</td>
<td>1143</td>
<td>2</td>
<td>1550</td>
<td>3</td>
<td>8953</td>
<td>16</td>
</tr>
<tr>
<td>87</td>
<td>Vadod</td>
<td>3.77</td>
<td>2246</td>
<td>6</td>
<td>13763</td>
<td>37</td>
<td>43127</td>
<td>115</td>
</tr>
<tr>
<td>88</td>
<td>Bamroli (Part)</td>
<td>5.333</td>
<td>8576</td>
<td>16</td>
<td>34592</td>
<td>65</td>
<td>74256</td>
<td>140</td>
</tr>
<tr>
<td>89</td>
<td>Bhimrad</td>
<td>2.402</td>
<td>1115</td>
<td>5</td>
<td>1257</td>
<td>5</td>
<td>4637</td>
<td>20</td>
</tr>
<tr>
<td>90</td>
<td>Bharthana – Vesu</td>
<td>2.194</td>
<td>1219</td>
<td>6</td>
<td>1920</td>
<td>9</td>
<td>5890</td>
<td>27</td>
</tr>
<tr>
<td>91</td>
<td>Sarsana</td>
<td>2.014</td>
<td>745</td>
<td>4</td>
<td>849</td>
<td>4</td>
<td>4090</td>
<td>21</td>
</tr>
<tr>
<td>92</td>
<td>Khajod</td>
<td>16.392</td>
<td>1214</td>
<td>1</td>
<td>1434</td>
<td>1</td>
<td>5627</td>
<td>4</td>
</tr>
<tr>
<td>93</td>
<td>Abhava</td>
<td>21.96</td>
<td>2505</td>
<td>1</td>
<td>2881</td>
<td>1</td>
<td>10283</td>
<td>5</td>
</tr>
<tr>
<td>94</td>
<td>Vesu</td>
<td>8.99</td>
<td>3298</td>
<td>4</td>
<td>6251</td>
<td>7</td>
<td>31567</td>
<td>36</td>
</tr>
<tr>
<td>95</td>
<td>Rundh</td>
<td>3.652</td>
<td>1639</td>
<td>4</td>
<td>2155</td>
<td>6</td>
<td>4781</td>
<td>14</td>
</tr>
<tr>
<td>96</td>
<td>Magdalla</td>
<td>2.299</td>
<td>2021</td>
<td>9</td>
<td>5257</td>
<td>23</td>
<td>6952</td>
<td>31</td>
</tr>
<tr>
<td>97</td>
<td>Gaviyar</td>
<td>4.061</td>
<td>1413</td>
<td>3</td>
<td>2449</td>
<td>6</td>
<td>5918</td>
<td>15</td>
</tr>
<tr>
<td>98</td>
<td>Vanta</td>
<td>1.531</td>
<td>472</td>
<td>3</td>
<td>661</td>
<td>4</td>
<td>4250</td>
<td>28</td>
</tr>
<tr>
<td>99</td>
<td>Dumas</td>
<td>20.577</td>
<td>7266</td>
<td>4</td>
<td>6868</td>
<td>3</td>
<td>28631</td>
<td>14</td>
</tr>
<tr>
<td>100</td>
<td>Sultanabad</td>
<td>4.491</td>
<td>2641</td>
<td>6</td>
<td>3263</td>
<td>7</td>
<td>15851</td>
<td>36</td>
</tr>
<tr>
<td>101</td>
<td>Bhimpor</td>
<td>6.389</td>
<td>7239</td>
<td>11</td>
<td>7553</td>
<td>12</td>
<td>15485</td>
<td>25</td>
</tr>
</tbody>
</table>

| Total: | 326.51 | 1634695 | 2876374 | 4454353 |

The census 2011 population of entire Surat city, for the total area of 326.51 sq.km., is
more than 44 lacs.

2.2 Revision under Population Projection

Based on the above figures, the population forecast of the total area of SMC has been estimated by SMC for the Water Supply Master Plan. The proposed area under this report, being the fringe areas of SMC limits, the same have been developed in unplanned manner so far. As a part of SMC limits, town planning schemes are being prepared and under implementation.

However, till date, these areas were not so developed and the population was restricted to certain limits only, in absence of basic infrastructure facilities in the area. As the development as well as population in these areas of SMC was limited to certain extent only, in comparison of other part of Surat city. Since, now the infrastructure facilities provided in the last 5 years, the tremendous development has taken place and huge growth rate is being observed in terms of migration of citizens of the city from other area as well as construction of high rise building duly availing the benefits of paid F.S.I.

Based on the past population figures of census, the projected populations of these areas worked by standard methods of CPHEEO manual will be very restricted. Moreover, as the town planning schemes for these areas have been prepared and under implementation, the area is developing at very fast rate with the provision of basic infrastructure facilities. Further, as described above, the project area is developed in unplanned manner, the projected population by the mathematical formulae will now not be appropriate for the future planning for the development of the area and as such, the population density method for the estimation of future population, as per CPHEEO manual recommendations, has been adopted. The population projection is done by reviewing the population density in the nearby area of the project area as well as applying F.S.I. of 2.25 over normal F.S.I. of 1.8 in the TP Scheme area. However, SMC shall have to also revise their Water Supply Master Plan for the project area, as required. The revised population projection of Dindoli Drainage Zone is prepared and detailed in Table 2-2.
Table 2-2 : Projected Population of Dindoli Drainage Zones (Non-agricultural area only) of SMC for the year 2048

| Sr. No. | Name of village | Habitable Area In Ha. | Year 2016 | | Year 2033 | | Year 2048 |
|---------|-----------------|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1       | TP-22 - Sarthana| 102.58                | 300       | 30774     | 600       | 61548     | 900       | 92322     |
| 2       | Gamtal - Sarthana| 2.02                 | 1000      | 2020      | 1000      | 2020      | 1000      | 2020     |
| 3       | TP-21 -(P) Sarthana| 86.21               | 300       | 25863     | 600       | 51726     | 900       | 77589 |
|         | **Sub Total**   | **190.81**           | **58657** | **115294**| **171931**|           |           |           |

Sewage Pumping Station at Sarthana

| Sr. No. | Name of village | Habitable Area In Ha. | Year 2016 | | Year 2033 | | Year 2048 |
|---------|-----------------|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1       | TP-21 -(P) Sarthana| 60.29                | 300       | 18087     | 600       | 36174     | 900       | 54261     |
| 2       | TP-68 -Puna Simada| 227.51               | 500       | 113755    | 900       | 204759    | 900       | 204759    |
| 3       | TP-60(P) -Puna  | 132.35               | 500       | 66175     | 900       | 119115    | 900       | 119115    |
| 4       | TP-17 -Puna     | 69.08                | 500       | 34540     | 900       | 62172     | 900       | 62172     |
| 5       | TP-64 -Magob    | 30.52                | 500       | 15260     | 900       | 27468     | 900       | 27468     |
| 6       | TP-20 -Puna     | 17.59                | 500       | 8795      | 900       | 15831     | 900       | 15831     |
|         | **Sub Total**   | **537.34**           | **256612**| **465519**| **483606**|           |           |           |

Sewage Pumping Station at Puna

| Sr. No. | Name of village | Habitable Area In Ha. | Year 2016 | | Year 2033 | | Year 2048 |
|---------|-----------------|-----------------------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1       | TP-60(P) -Puna  | 0.00                  | 500       | 0         | 900       | 0         | 900       | 0         |
| 2       | TP-20 -Puna     | 87.26                 | 500       | 43630     | 900       | 78534     | 900       | 78534     |
| 3       | TP-11 -Puna     | 77.74                 | 500       | 38870     | 900       | 69966     | 900       | 69966     |
| 4       | TP-12 -Puna     | 75.41                 | 500       | 37705     | 900       | 67869     | 900       | 67869     |
| 5       | TP-17 -Puna     | 24.61                 | 500       | 12305     | 900       | 22149     | 900       | 22149     |
| 6       | Gamtal -Puna    | 8.68                  | 1000      | 8680      | 1000      | 8680      | 1000      | 8680      |
| 7       | TP-53 -Magob    | 0.00                  | 300       | 0         | 600       | 0         | 900       | 0         |
| 8       | TP-64 -Magob    | 31.93                 | 300       | 9579      | 600       | 19158     | 900       | 28737     |
| 9       | TP-19 -Parvat-Magob| 0.00                | 500       | 0         | 900       | 0         | 900       | 0         |
|         | **Sub Total**   | **305.63**           | **150769**| **266356**| **275935**|           |           |           |
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of village</th>
<th>Habitable Area In Ha.</th>
<th>Year 2016</th>
<th></th>
<th>Year 2033</th>
<th></th>
<th>Year 2048</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Population</td>
<td></td>
<td>Population</td>
<td></td>
<td>Population</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>SMC T.P.No. 61 (P)</td>
<td>65.59</td>
<td>250</td>
<td>16398</td>
<td>400</td>
<td>26236</td>
<td>600</td>
<td>39354</td>
</tr>
<tr>
<td>2</td>
<td>Gamtal - Parvat</td>
<td>4.41</td>
<td>1000</td>
<td>4410</td>
<td>1000</td>
<td>4410</td>
<td>1000</td>
<td>4410</td>
</tr>
<tr>
<td>3</td>
<td>TP-19 -Parvat-Magob</td>
<td>115.77</td>
<td>500</td>
<td>57883</td>
<td>900</td>
<td>104190</td>
<td>900</td>
<td>104190</td>
</tr>
<tr>
<td></td>
<td><strong>Sub Total (4)</strong></td>
<td><strong>185.77</strong></td>
<td><strong>78691</strong></td>
<td><strong>134836</strong></td>
<td><strong>147954</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>SMC T.P.No. 61 (P)</td>
<td>225.41</td>
<td>250</td>
<td>56353</td>
<td>400</td>
<td>90164</td>
<td>600</td>
<td>135246</td>
</tr>
<tr>
<td>2</td>
<td>SMC T.P.No. 69 (P)</td>
<td>89.20</td>
<td>250</td>
<td>22300</td>
<td>400</td>
<td>35680</td>
<td>600</td>
<td>53520</td>
</tr>
<tr>
<td>3</td>
<td>Gamtal – Godadara</td>
<td>3.86</td>
<td>1000</td>
<td>3860</td>
<td>1000</td>
<td>3860</td>
<td>1000</td>
<td>3860</td>
</tr>
<tr>
<td></td>
<td><strong>Sub Total (27)</strong></td>
<td><strong>318.47</strong></td>
<td><strong>82513</strong></td>
<td><strong>129704</strong></td>
<td><strong>192626</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>SMC T.P.No. 62</td>
<td>312.00</td>
<td>250</td>
<td>78000</td>
<td>400</td>
<td>124800</td>
<td>600</td>
<td>187200</td>
</tr>
<tr>
<td>2</td>
<td>SMC T.P.No. 69 (P)</td>
<td>210.80</td>
<td>250</td>
<td>52700</td>
<td>400</td>
<td>84320</td>
<td>600</td>
<td>126480</td>
</tr>
<tr>
<td>3</td>
<td>Gamtal - Dindoli</td>
<td>7.23</td>
<td>1000</td>
<td>7230</td>
<td>1000</td>
<td>7230</td>
<td>1000</td>
<td>7230</td>
</tr>
<tr>
<td></td>
<td><strong>Sub Total (20)</strong></td>
<td><strong>530.03</strong></td>
<td><strong>137930</strong></td>
<td><strong>216350</strong></td>
<td><strong>320910</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Grand Total</strong></td>
<td><strong>2068.05</strong></td>
<td><strong>765171</strong></td>
<td><strong>1328059</strong></td>
<td><strong>1592962</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION 3 : SECTOR BACKGROUND : SEWERAGE

3.1 History of Sewerage Facilities

The old Surat town had a piped sewerage since 1953. The first sewage treatment plant was commissioned in 1958. In fact, collection of sewage by pumping in different localities of the city was in practice even much prior to 1953.

3.2 Baseline Information

As the City grew the City managers tried to provide infrastructures matching the growth. The city is divided into six drainage zones with a total length of 1776 km of sewerage network, 57 nos. of sewage pumping stations and 11 nos. of sewage treatment plants; the total sewerage generated is about 880 MLD. At present, only 187.50 sq. km (92% of habitable area) is covered by the sewerage system out of present total area of 327 sq.kms (204 sq.kms habitable area) of Surat. This serves around 97% of the total population.

<table>
<thead>
<tr>
<th>Description</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of SMC (Sq.Km.)</td>
<td>326.515</td>
</tr>
<tr>
<td>Underground drainage (% population served)</td>
<td>97</td>
</tr>
<tr>
<td>Drainage network area (Sq.Km.)</td>
<td>187.50 / 204</td>
</tr>
<tr>
<td>% of habitable area covered</td>
<td>92 %</td>
</tr>
<tr>
<td>Total length of drainage network (Km.) (On TP roads)</td>
<td>1776</td>
</tr>
<tr>
<td>Sewerage pumping stations installed</td>
<td>57</td>
</tr>
<tr>
<td>Sewage Treatment Plant installed</td>
<td>11</td>
</tr>
<tr>
<td>Sewage Treatment Plant – Capacity MLD installed</td>
<td>982.50</td>
</tr>
</tbody>
</table>

3.3 Sewerage – Drainage Zones

The sewerage network in Surat is presently served by six drainage schemes inclusive of the sewerage network in walled city area, namely, South-East Zone, West zone, South-West zone, East Zone, North Zone and the South Zone drainage schemes. The schemes serve a total population of 45 lakhs (As per Census 2011) through 57 sewage pumping stations and 11 Sewage Treatment Plants as shown in Table 3-1. The details on sewage treatment plant with its treatment processes, year of commissioning, utilization etc. is shown in Table 3-2.
### Table 3-1: Details of Drainage Zones with Sewage Treatment Plants and Sewage Pumping Stations

<table>
<thead>
<tr>
<th>Sewage Treatment Plant (Capacity – MLD)</th>
<th>Main pumping Stations (Capacity – MLD)</th>
<th>Auxiliary stations (Capacity – MLD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anjana (82.50)</td>
<td>Limbayat (41) New Anjana (12) Umarwada (14.50)</td>
<td></td>
</tr>
<tr>
<td>Dindoli (66)</td>
<td>Godadar (27) Dindoli (30) Sarthana (9) Magab (56) Puna (33)</td>
<td>Parvat (4.50)</td>
</tr>
<tr>
<td>Bhesan (100)</td>
<td>Rander (30) Adajan (15) Pal (15) Bhesan (33) Pisad (26)</td>
<td>-</td>
</tr>
<tr>
<td>Asarma (15)</td>
<td>Pal-Palanpore (31)</td>
<td>Pal TP – 74 (4)</td>
</tr>
<tr>
<td>Bhatar (120)</td>
<td>Nampura (98) Athwa (21) Umra (N) (18.5) Umra (s) (19.5) Althan (19) Piplod (9) Khatodara (50) Khatodara (GIDC) (18)</td>
<td>-</td>
</tr>
<tr>
<td>Khajod (25)</td>
<td>Vesu Terminal (51) Pocket G (Khajod) (4) Pocket H (Bhimrad) (9)</td>
<td>Vesu Intermediate (21)</td>
</tr>
<tr>
<td>Karanj (100)</td>
<td>Karanj (93) Navagam (55)</td>
<td>Modi Mohollo (3) Patel Nagar (2)</td>
</tr>
<tr>
<td>Singanpore (100)</td>
<td>Paras (52) Singanpore (62) Kantareshwar (69)</td>
<td>Old GIDC katargam (2) Shantinikheta (1)</td>
</tr>
<tr>
<td>Variav-Kosad (84)</td>
<td>Mota Varachha (11) Mota Varachha GEB (28) Utran (37) Kosad Railway (57) Kosad (83) Chhpabhatsha (25) Variav (37) Variav (49)</td>
<td></td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>Sewage Treatment Plant (Capacity – MLD)</th>
<th>Main pumping Stations (Capacity – MLD)</th>
<th>Auxiliary stations (Capacity – MLD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gavier (53)</td>
<td>Pocket A (Dumas – Gavier) (14) Pocket B (Dumas – Vanta) (40) Pocket C (Dumas) (21) Pocket D (Dumas – Sultanabad) (21) Pocket E (Bhipore) (24)</td>
<td></td>
</tr>
</tbody>
</table>

Table 3-2 : Details of Drainage Zones with Sewage Treatment Plants and Sewage Pumping Stations

<table>
<thead>
<tr>
<th>S.No</th>
<th>Location</th>
<th>Year of commissioning</th>
<th>Capacity (MLD)</th>
<th>Design</th>
<th>Utilizing</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anjana</td>
<td>1995 / 2007</td>
<td>82.5</td>
<td>85</td>
<td></td>
<td>Conventional Activated Sludge</td>
</tr>
<tr>
<td>2</td>
<td>Bhesan</td>
<td>1995 / 2009</td>
<td>100</td>
<td>95</td>
<td></td>
<td>Conventional Activated Sludge</td>
</tr>
<tr>
<td>3</td>
<td>Bhatar</td>
<td>1999 / 2014</td>
<td>162</td>
<td>140</td>
<td></td>
<td>Conventional Activated Sludge / SBR</td>
</tr>
<tr>
<td>4</td>
<td>Karanj</td>
<td>1999 / 2015</td>
<td>140</td>
<td>130</td>
<td></td>
<td>Conventional Activated Sludge / IFAS</td>
</tr>
<tr>
<td>5</td>
<td>Singanpore</td>
<td>2003 / 2014</td>
<td>155</td>
<td>150</td>
<td></td>
<td>Conventional Activated Sludge / SBR</td>
</tr>
<tr>
<td>6</td>
<td>Bamroli</td>
<td>2008</td>
<td>100</td>
<td>95</td>
<td></td>
<td>UASB+ Extended Aeration</td>
</tr>
<tr>
<td>7</td>
<td>Asarma</td>
<td>2011</td>
<td>15</td>
<td>10</td>
<td></td>
<td>Moving Bed Bio Reactor</td>
</tr>
<tr>
<td>8</td>
<td>Khajod</td>
<td>2011</td>
<td>25</td>
<td>20</td>
<td></td>
<td>Moving Bed Bio Reactor</td>
</tr>
<tr>
<td>9</td>
<td>Variav-Kosad</td>
<td>2012</td>
<td>84</td>
<td>110</td>
<td></td>
<td>UASB+ Moving Bed Bio Reactor</td>
</tr>
<tr>
<td>10</td>
<td>Dindoli</td>
<td>2012</td>
<td>66</td>
<td>40</td>
<td></td>
<td>Conventional Activated Sludge</td>
</tr>
<tr>
<td>11</td>
<td>Gavier</td>
<td>2016</td>
<td>53</td>
<td>5</td>
<td></td>
<td>SBR</td>
</tr>
<tr>
<td></td>
<td>Grand Total</td>
<td></td>
<td>982.5</td>
<td>880</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SECTION 4: SALIENT FEATURES OF DINDOLI DRAINAGE ZONE

4.1 Coverage

The area of Dindoli Drainage Zone for old city limit is about 1354 hectares and is covered by following drainage boundaries:

- North: Karanj (East) Drainage Zone
- East: SMC boundary
- South: South Drainage Zone
- West: South drainage zone & Railway line

The area covered under Dindoli Drainage Zone is presented in Figure 2 with this report.

Figure 2: Dindoli Drainage Zone (Dindoli Drainage Zone)
4.2 Land Use and Development

SMC is the planning authority for the development of the area. The development plan has been prepared by SMC delineates the land use pattern for various town planning (TP) schemes and the municipal and the other governing agencies in this area are required to implement the development policies as per the guidelines given in the plan.

The present land use primarily comprises of residential area with commercial, institutional, agricultural areas and open spaces in between. The development, in general, is faster in the Dindoli Drainage Zone. In this zone, the following 10 Town Planning (T.P.) Schemes have been prepared either by Surat Municipal Corporation (SMC) or Surat Urban Development Authority (SUDA).

Table 4-1: Details of T.P. Schemes for the Dindoli Drainage Zones

<table>
<thead>
<tr>
<th>Sr. no.</th>
<th>T.P. Scheme No.</th>
<th>Name of T.P. scheme</th>
<th>Area of T.P. Scheme in Hectares</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>T.P.No. 21</td>
<td>Sarthana</td>
<td>146.50</td>
</tr>
<tr>
<td>2</td>
<td>T.P.No. 22</td>
<td>Sarthana</td>
<td>102.58</td>
</tr>
<tr>
<td>3</td>
<td>T.P.No. 17</td>
<td>Puna</td>
<td>93.69</td>
</tr>
<tr>
<td>4</td>
<td>T.P.No. 60</td>
<td>Puna</td>
<td>132.35</td>
</tr>
<tr>
<td>5</td>
<td>T.P.No. 64</td>
<td>Magob</td>
<td>62.45</td>
</tr>
<tr>
<td>7</td>
<td>T.P.No. 20</td>
<td>Puna</td>
<td>104.85</td>
</tr>
<tr>
<td>8</td>
<td>T.P.No. 68</td>
<td>Puna – Simada</td>
<td>227.51</td>
</tr>
<tr>
<td>9</td>
<td>T.P.No. 11</td>
<td>Puna</td>
<td>77.74</td>
</tr>
<tr>
<td>10</td>
<td>T.P.No. 12</td>
<td>Puna</td>
<td>75.41</td>
</tr>
</tbody>
</table>

4.3 Population Projection

The Dindoli Drainage Zone lies in East and South-East zone of Surat city. Total 10 Town Planning Schemes are covered fully/partly under this drainage zone. The ward
worse population record for these 8 census wards for the year 2001 and 2011 are given in Table 4-2. The census figures of 2001 indicate that the population density is not uniform in various wards and the same is relatively higher in some of the wards. The areas like Limbayat, Dindoli, Umarwada, Anjana are considered as developed areas whereas area like Magob, Dumbhal is considered as developing area.

Table 4-2 : Census Population Records for Dindoli Drainage Zone

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>48</td>
<td>Magob</td>
<td>53</td>
<td>7,560</td>
<td>143</td>
<td>58,275</td>
<td>425</td>
<td>770</td>
</tr>
<tr>
<td>2</td>
<td>75</td>
<td>Sarthana</td>
<td>330</td>
<td>237</td>
<td>1</td>
<td>25706</td>
<td>78</td>
<td>10846</td>
</tr>
<tr>
<td>3</td>
<td>76</td>
<td>Simada</td>
<td>260</td>
<td>3345</td>
<td>13</td>
<td>23527</td>
<td>91</td>
<td>703</td>
</tr>
<tr>
<td>4</td>
<td>77</td>
<td>Puna</td>
<td>733</td>
<td>119092</td>
<td>163</td>
<td>346598</td>
<td>473</td>
<td>291</td>
</tr>
<tr>
<td>5</td>
<td>78</td>
<td>Magob</td>
<td>150</td>
<td>5755</td>
<td>39</td>
<td>20816</td>
<td>140</td>
<td>361</td>
</tr>
<tr>
<td>6</td>
<td>79</td>
<td>Parvat</td>
<td>212</td>
<td>20693</td>
<td>98</td>
<td>55216</td>
<td>261</td>
<td>267</td>
</tr>
<tr>
<td>7</td>
<td>80</td>
<td>Godadara</td>
<td>297</td>
<td>23234</td>
<td>79</td>
<td>111628</td>
<td>377</td>
<td>480</td>
</tr>
<tr>
<td>8</td>
<td>81</td>
<td>Dindoli</td>
<td>520</td>
<td>13014</td>
<td>26</td>
<td>75092</td>
<td>145</td>
<td>577</td>
</tr>
</tbody>
</table>

4.4 Housing

The Dindoli Drainage Zone mainly comprises of residential localities. The housing stock in the study area can be broadly categorized in following six types.

I : Slums
II : Low Rise Flats
III : High Rise Flats
IV : Traditional Raw Houses
V : Modern Raw Houses
VI : Bungalows

An estimate of distribution of population in various housing types as mentioned above was carried out by SMC for all the census wards. It is expected that proportion of
various categories within a ward would generally remain constant over a period of design year. The water allocation for various housing categories has been finalised by SMC in water supply master plan. The wastewater likely to be generated is estimated based on the water allocation for respective housing categories.

4.5 **Existing Sewerage and Sanitation Facilities**

Out of total 1354 hectares of Dindoli Drainage Zone, more than 95% area is having comprehensive sewerage system. The Dindoli Drainage Zone mainly consists of six sewerage schemes; Sarthana, Magob, Puna, Parvat, Godadara and Dindoli. These sewerage scheme were commissioned during the year 2010-11.

There are three six sewage pumping station (SPS) installed at Sarthana, Magob, Puna, Parvat, Godadara and Dindoli in the Dindoli Drainage Zone.

At present, there is one sewage treatment plant of 66 MLD capacity at Dindoli is in operation since 2011. The treated wastewater from Dindoli Sewage Treatment Plant is disposed off in nearby Bhedwad Khadi as per the earlier prescribed norms of GPCB.

4.6 **Population Projection**

The population forecast data is taken from SMC’s water supply Master Plan studies as the planning for sewerage system will be essentially based on water supply. These projections are based on a more practical approach wherein the rates of growth in the adjoining areas of the city are compared with those in the city limit and the areas where heavy migration is expected are identified and factors like existing population density, land use pattern, development plans, industrial growth etc. are given due consideration.

The ward wise population forecast for the Dindoli drainage zone, for the years 2016, 2033 and 2048 is presented in Table 6-1.
SECTION 5 : FIELD SURVEY

5.1 Strategy For Field Survey

The following strategy was adopted for designing the system.

SMC has an extensive sewage testing laboratory at all its STPs and having the comprehensive data on the inlet raw sewage characteristics. SMC daily analysis the raw as well as treated sewage characteristics at all its sewage treatment plants. Hence, the same inlet raw sewage data has been used while preparing detail project report.
SECTION 6 : DESIGN CRITERIA

6.1 Population Projection

The population forecast data is taken from SMC’s water supply Master Plan studies as the planning for sewerage system will be essentially based on water supply. These projections are based on a more practical approach wherein the rates of growth in the adjoining areas of the city are compared with those in the city limit and the areas where heavy migration is expected are identified and factors like existing population density, land use pattern, development plans, industrial growth etc. are given due consideration.

The population forecast under Dindoli Drainage Zone, for the years 2016, 2033 and 2048 is presented in Table 6-1 as per the master plan of water supply.

Table 6-1: Population Projections for Dindoli Drainage Zone

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of village</th>
<th>Habitable Area In Ha.</th>
<th>Year 2016</th>
<th>Year 2033</th>
<th>Year 2048</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TP-22 - Sarthana</td>
<td>102.58</td>
<td>300</td>
<td>30774</td>
<td>600</td>
</tr>
<tr>
<td>2</td>
<td>Gamtal - Sarthana</td>
<td>2.02</td>
<td>1000</td>
<td>2020</td>
<td>1000</td>
</tr>
<tr>
<td>3</td>
<td>TP-21 -(P) Sarthana</td>
<td>86.21</td>
<td>300</td>
<td>25863</td>
<td>600</td>
</tr>
<tr>
<td></td>
<td>Sub Total</td>
<td>190.81</td>
<td>58657</td>
<td>115294</td>
<td>171931</td>
</tr>
</tbody>
</table>

Sewage Pumping Station at Puna

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of village</th>
<th>Habitable Area In Ha.</th>
<th>Year 2016</th>
<th>Year 2033</th>
<th>Year 2048</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TP-21 -(P) Sarthana</td>
<td>60.29</td>
<td>300</td>
<td>18087</td>
<td>600</td>
</tr>
<tr>
<td>2</td>
<td>TP-68 -Puna Simada</td>
<td>227.51</td>
<td>500</td>
<td>113755</td>
<td>900</td>
</tr>
<tr>
<td>3</td>
<td>TP-60(P) -Puna</td>
<td>132.35</td>
<td>500</td>
<td>66175</td>
<td>900</td>
</tr>
<tr>
<td>4</td>
<td>TP-17 -Puna</td>
<td>69.08</td>
<td>500</td>
<td>34540</td>
<td>900</td>
</tr>
<tr>
<td>5</td>
<td>TP-64 -Magob</td>
<td>30.52</td>
<td>500</td>
<td>15260</td>
<td>900</td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater

Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Year 2016</td>
<td>2033</td>
<td>2048</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pop.</td>
<td>Populat</td>
<td>Pop.</td>
<td>Populat</td>
<td>Pop.</td>
<td>Populat</td>
</tr>
<tr>
<td>6</td>
<td>TP-20 -Puna</td>
<td>17.59</td>
<td>500</td>
<td>8795</td>
<td>900</td>
<td>15831</td>
<td>900</td>
<td>15831</td>
</tr>
<tr>
<td></td>
<td><strong>Sub Total</strong></td>
<td><strong>537.34</strong></td>
<td><strong>256612</strong></td>
<td><strong>465519</strong></td>
<td><strong>483606</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sewage Pumping Station at Magob

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TP-60(P) -Puna</td>
<td>0.00</td>
<td>500</td>
<td>0</td>
<td>900</td>
<td>0</td>
<td>900</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>TP-20 -Puna</td>
<td>87.26</td>
<td>500</td>
<td>43630</td>
<td>900</td>
<td>78534</td>
<td>900</td>
<td>78534</td>
</tr>
<tr>
<td>3</td>
<td>TP-11 -Puna</td>
<td>77.74</td>
<td>500</td>
<td>38870</td>
<td>900</td>
<td>69966</td>
<td>900</td>
<td>69966</td>
</tr>
<tr>
<td>4</td>
<td>TP-12 -Puna</td>
<td>75.41</td>
<td>500</td>
<td>37705</td>
<td>900</td>
<td>67869</td>
<td>900</td>
<td>67869</td>
</tr>
<tr>
<td>5</td>
<td>TP-17 -Puna</td>
<td>24.61</td>
<td>500</td>
<td>12305</td>
<td>900</td>
<td>22149</td>
<td>900</td>
<td>22149</td>
</tr>
<tr>
<td>6</td>
<td>Gamtal -Puna</td>
<td>8.68</td>
<td>1000</td>
<td>8680</td>
<td>1000</td>
<td>8680</td>
<td>1000</td>
<td>8680</td>
</tr>
<tr>
<td>7</td>
<td>TP-53 -Magob</td>
<td>0.00</td>
<td>300</td>
<td>0</td>
<td>600</td>
<td>0</td>
<td>900</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>TP-64 -Magob</td>
<td>31.93</td>
<td>300</td>
<td>9579</td>
<td>600</td>
<td>19158</td>
<td>900</td>
<td>28737</td>
</tr>
<tr>
<td>9</td>
<td>TP-19 -Parvat-Magob</td>
<td>0.00</td>
<td>500</td>
<td>0</td>
<td>900</td>
<td>0</td>
<td>900</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td><strong>Sub Total</strong></td>
<td><strong>305.63</strong></td>
<td><strong>150769</strong></td>
<td><strong>266356</strong></td>
<td><strong>275935</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sewage Pumping Station at Parvat

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SMC T.P.No. 61 (P)</td>
<td>65.59</td>
<td>250</td>
<td>16398</td>
<td>400</td>
<td>26236</td>
<td>600</td>
<td>39354</td>
</tr>
<tr>
<td>2</td>
<td>Gamtal - Parvat</td>
<td>4.41</td>
<td>1000</td>
<td>4410</td>
<td>1000</td>
<td>4410</td>
<td>1000</td>
<td>4410</td>
</tr>
<tr>
<td>3</td>
<td>TP-19 -Parvat-Magob</td>
<td>115.77</td>
<td>500</td>
<td>57883</td>
<td>900</td>
<td>104190</td>
<td>900</td>
<td>104190</td>
</tr>
<tr>
<td></td>
<td><strong>Sub Total (4)</strong></td>
<td><strong>185.77</strong></td>
<td><strong>78691</strong></td>
<td><strong>134836</strong></td>
<td><strong>147954</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sewage Pumping Station at Godadara

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SMC T.P.No. 61 (P)</td>
<td>225.41</td>
<td>250</td>
<td>56353</td>
<td>400</td>
<td>90164</td>
<td>600</td>
<td>135246</td>
</tr>
<tr>
<td>2</td>
<td>SMC T.P.No. 69 (P)</td>
<td>89.20</td>
<td>250</td>
<td>22300</td>
<td>400</td>
<td>35680</td>
<td>600</td>
<td>53520</td>
</tr>
<tr>
<td>3</td>
<td>Gamtal – Godadara</td>
<td>3.86</td>
<td>1000</td>
<td>3860</td>
<td>1000</td>
<td>3860</td>
<td>1000</td>
<td>3860</td>
</tr>
<tr>
<td></td>
<td><strong>Sub Total (27)</strong></td>
<td><strong>318.47</strong></td>
<td><strong>82513</strong></td>
<td><strong>129704</strong></td>
<td><strong>192626</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sewage Pumping Station at Dindoli

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SMC T.P.No. 62</td>
<td>312.00</td>
<td>250</td>
<td>78000</td>
<td>400</td>
<td>124800</td>
<td>600</td>
<td>187200</td>
</tr>
<tr>
<td>2</td>
<td>SMC T.P.No. 69 (P)</td>
<td>210.80</td>
<td>250</td>
<td>52700</td>
<td>400</td>
<td>84320</td>
<td>600</td>
<td>126480</td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of village</th>
<th>Habitable Area In Ha.</th>
<th>Year 2016</th>
<th>Year 2033</th>
<th>Year 2048</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Gamtal - Dindoli</td>
<td>7.23</td>
<td>1000</td>
<td>7230</td>
<td>1000</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sub Total (20)</td>
<td>530.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>137930</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grand Total</td>
<td>2068.05</td>
<td></td>
<td>765171</td>
<td></td>
</tr>
</tbody>
</table>

### 6.2 Water Supply

As per the directives of SMC vide its water supply master plan, the design year to be considered for the design of wastewater system is up to year 2048 and consequently the system is proposed to be designed considering water allocation to the study area. The average domestic water supply rate is considered as 180 lpcd as per water supply master plan.

### 6.3 Wastewater Generation

Normally, 80 % of the water reaching the consumers is considered as wastewater in the sewers. However, the per capita wastewater flows, for the design of sewerage system are considered to be equivalent to the per capita water supply reaching to the consumer. This assumption takes into account the water being used from private wells, hand pumps and infiltration allowance.

### 6.4 Design of Tertiary Sewage Treatment Plants

#### 6.4.1 Characteristics of Sewage

The design of the sewage treatment plant is mainly based on BOD₅, Suspended Solids (SS), Total Kjeldahl Nitrogen, Ammonical Nitrogen and Total Phosphate concentrations. Since, SMC has an extensive laboratory at the sewage treatment plant itself. The results of daily analysis are taken from SMCs daily records of last 12
months. Since, this report deals with the tertiary sewage treatment plant, the parameters from secondary treatment shall be inlet parameters for tertiary sewage treatment plant. Hence, In this report, treated sewage parameters considered for the novation / augmentation of existing sewage treatment plant are considered to define the characteristics of sewage for the designs. Further, in addition, the parameters related to tertiary treatment plant such as TDS, Total Hardness, Manganese, Fe, etc. were analysed at government approved private labs also.

6.4.2 Treatment Standards

The tertiary sewage treatment plant is designed to deliver the treated wastewaters conforming to the Industrial Grade Water (IGW) as specified by the Industries. However, since the reject water shall have to be discharged in nearby Creek, the disposal parameters are considered with the nutrient and phosphate removal. The raw sewage and treated sewage characteristics considered for the design is summarized in the Error! Reference source not found. in next chapter.

6.4.3 Process Design Criteria

The design of tertiary sewage treatment plant is carried out as per the guidelines given in Manual on Sewerage and Sewage Treatment - 2012 published by CPHEEO and generally adopted for design of UF and RO level treatment.
SECTION 7: PROPOSED TERTIARY SEWAGE TREATMENT PLANT AT DINDOLI

7.1 Location of Tertiary Sewage Treatment Plant

The topography of the Dindoli Drainage Zone is partly divided into two parts by the Western Railway. It is further controlled by Koyali Khadi and Mithi Khadi. The average ground level in the area varies from 14.00 m to 5.50 m.

The topography and availability of land for construction of tertiary sewage treatment plant are two major factors in selection of site. Since, this is part of existing sewage treatment plant and sewage from the entire zone is pumped to existing STP facility, the site near to existing sewage treatment plant is considered. The wastewater after treatment shall be pumped to Pandesara WDS for its further use and reject water after necessary treatment shall be disposed in to the Bhedwad creek. The site for proposed TSTP at Dindoli is shown in Figure 3.

7.2 Project Scope and Component

7.2.1 Project objective

Surat Municipal Corporation intends to execute TSTP for supplying bulk industrial grade water by tertiary treatment of sewage from the Dindoli STP to Pandesara Industrial area. Briefly, the scope of the project involves setting up a Tertiary Treatment Plant to further treat secondary-treated sewage water from the Dindoli STP to produce and supply Industrial Grade water to the Pandesara industrial estate. This would enable SMC to reduce pressure on ground water resources in the city and free up potable water supplied to Pandesara Industrial area at present.
7.2.2 Dindoli Sewage Treatment Plant

7.2.2.1 Location and service coverage

The layout of Dindoli STP is given in Annexure 3. Dindoli Sewage Treatment Plant is one of the eleven STP’s functioning in Surat and has been selected due to its proximity to the Pandesara Industrial estate. It is located in the south-eastern part of the city at a distance of approximately 4 to 5 kms from Pandesara Industrial Estate. The Dindoli STP serves the south-eastern part of Surat city. Raw sewage from entire East and South-East Zone flow into the Dindoli STP.

7.2.2.2 Capacity

The STP is designed for an ultimate treatment capacity of 167 MLD. At present, the STP is getting utilized to treat only 40 MLD of sewage water where the sewage after secondary treatment is getting disposed in the creek. However, considering the pumping station and rising main augmentation work going on at present, it is forecasted that more than 150 MLD sewage will reach the STP.

7.2.2.3 Technology

The existing STP has been designed on Conventional Activated Sludge Process for an ultimate capacity of 66 MLD. The existing STP is proposed to augment to 167 MLD with IFAS and SBR technology. The existing STP is equipped with 2 nos. – 400 KW biogas based power plant.

7.2.2.4 Output Parameters

The disposal standards of existing STP is for removal of organic matter and suspended solids only, i.e. for only BOD and SS removal. Hence, the disposal standards shall have to be upgraded as per the latest revised manual of CPHEEO on sewage treatment. The revised disposal criteria as specified by the CPHEEO manual, published in the year 2012, also requires the treatment level of Nutrient removal also. The revised GWSSB SOR also focusses on the need of removal of nutrient and phosphate removal. The
GPCB has also revised the disposal norms during last year 2015. The revised standards as per the revised manual of CPHEEO, GPCB guidelines and as proposed under this project is shown in the Table 7-1 below.

Table 7-1 : Treated Sewage Characteristics as per CPHEEO Manual - 2012

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameters</th>
<th>Unit</th>
<th>Treated Effluent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BOD₅</td>
<td>mg/l</td>
<td>≤ 10</td>
</tr>
<tr>
<td>2</td>
<td>Suspended Solids</td>
<td>mg/l</td>
<td>≤ 10</td>
</tr>
<tr>
<td>3</td>
<td>TN</td>
<td>mg/l</td>
<td>≤ 10</td>
</tr>
<tr>
<td>4</td>
<td>Dissolved P</td>
<td>mg/l</td>
<td>≤ 2</td>
</tr>
<tr>
<td>5</td>
<td>Fecal Coliform Count</td>
<td>MPN/100 ml</td>
<td>≤ 100</td>
</tr>
</tbody>
</table>

7.2.3 Pandesara Industrial Estate

7.2.3.1 Area and administrative status

The layout of the Pandesara Industrial Estate is enclosed in Annexure 3. Pandesara is a notified industrial estate which was established by GIDC and falls within SMC limits at is spread over an area of about 3 sq.km. The Industrial estate is represented by its association, the Pandesara Industrial Estate Association. There are about 400 industrial units operating in Pandesara estate, of which 119 units are water based industries comprising largely textile processing units and chemical industries.

7.2.3.2 Water demand and supply at Pandesara

The Table 7-2 summarizes the key aspects of water demand and supply at Pandesara Industrial Estate, which is described below. Current water demand at Pandesara is estimated at approximately 100 MLD, comprising about 80-85 MLD of process water requirement and 15-20 MLD of potable water demand. Of the total demand, nearly 40 MLD is met through existing TSTP at Bamroli and the rest is met through either SMC potable water supply or through private sources including borewells and water tankers.
Table 7-2: Water Demand and Supply at Pandesara – Current Status

<table>
<thead>
<tr>
<th>Name of the Estate</th>
<th>Pandesara</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Units</td>
<td></td>
</tr>
<tr>
<td>Water Based</td>
<td>119</td>
</tr>
<tr>
<td>Non Water Based</td>
<td>310</td>
</tr>
<tr>
<td><strong>Total Units</strong></td>
<td><strong>429</strong></td>
</tr>
<tr>
<td>Water Demand (MLD)</td>
<td>95 – 100 MLD</td>
</tr>
<tr>
<td>Source of Water</td>
<td>River Tapi / Private Bore wells</td>
</tr>
<tr>
<td>Supply by SMC – Potable Water</td>
<td>40 MLD</td>
</tr>
<tr>
<td>Supply by SMC – Industrial Grade Water</td>
<td>40 MLD</td>
</tr>
<tr>
<td>Supply from Bore wells</td>
<td>10 - 15 MLD</td>
</tr>
</tbody>
</table>

7.3 Tertiary Sewage Treatment Plant at Dindoli

7.3.1 Objective of TSTP

The main objective of tertiary sewage treatment is to generate, recycle and reuse as industrial grade water which can be used for industrial purpose without causing health hazards or nuisance. The reject water treatment is designed to deliver the wastewaters conforming to the standards specified by the CPHEEO manual / Ministry of Environment / Gujarat Pollution Control Board for discharge in the water bodies. The treated sewage will be disposed off into Bhedwad Khadi.

7.3.2 Treated Sewage Flow and Characteristics

As per the requirements of Pandesara Industries for the Industrial Grade Water requirements, their total water requirements is about 80 MLD. At present, about 40 MLD tertiary treated water is being supplied from Bamroli TTP. Hence, additional 40 MLD TTP shall have to be executed to satisfy the balance water requirements. The tertiary treated sewage / Industrial Grade Water characteristics are produced Table 7-3 as per the requirements of Pandesara Industries.
Table 7-3 : Tertiary Treated Water - Industrial Grade Water Characteristics

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameter</th>
<th>Unit</th>
<th>Raw Sewage (90%tile)</th>
<th>Secondary treated sewage</th>
<th>Tertiary Treated – Industrial Grade Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>True Colour (Hazen Units) max.</td>
<td>Hazen Units</td>
<td>90</td>
<td>50</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>2</td>
<td>Turbidity</td>
<td>NTU</td>
<td>*</td>
<td>*</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>3</td>
<td>pH</td>
<td>-</td>
<td>6.5 – 7.5</td>
<td>7 – 8.5</td>
<td>6.0 – 7.5</td>
</tr>
<tr>
<td>4</td>
<td>Total Hardness as CaCO3</td>
<td>mg/l</td>
<td>900</td>
<td>*</td>
<td>&lt; 300</td>
</tr>
<tr>
<td>5</td>
<td>Iron as Fe</td>
<td>mg/l</td>
<td>0.72</td>
<td>*</td>
<td>&lt; 0.25</td>
</tr>
<tr>
<td>6</td>
<td>Manganese as Mn.</td>
<td>mg/l</td>
<td>0.4</td>
<td>*</td>
<td>&lt; 0.10</td>
</tr>
<tr>
<td>7</td>
<td>TDS</td>
<td>mg/l</td>
<td>1400</td>
<td>1400</td>
<td>&lt; 500</td>
</tr>
<tr>
<td>8</td>
<td>BOD5</td>
<td>mg/l</td>
<td>250</td>
<td>≤ 10</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>9</td>
<td>COD</td>
<td>mg/l</td>
<td>600</td>
<td>≤ 50</td>
<td>&lt; 50</td>
</tr>
<tr>
<td>10</td>
<td>Total Suspended Solids</td>
<td>mg/l</td>
<td>300</td>
<td>≤ 10</td>
<td>&lt; 2</td>
</tr>
<tr>
<td>11</td>
<td>Total Nitrogen as N</td>
<td>mg/l</td>
<td>42</td>
<td>≤ 10</td>
<td>&lt; 10</td>
</tr>
<tr>
<td>12</td>
<td>Total phosphorus</td>
<td>mg/l</td>
<td>7</td>
<td>≤ 2 (as dissolved -P)</td>
<td>&lt; 7</td>
</tr>
</tbody>
</table>

7.3.3 Tertiary Sewage Treatment Process

Tertiary Sewage treatment is normally categorized in three stages.

- Disk / Cloth Media type Fine Filtration
- Ultra Filtration
- Reverse Osmosis

7.3.3.1 INLET ARRANGEMENT:

Inlet Chamber of Disk/cloth media type fine filtration system shall receive flow of secondary treated sewage of 60 MLD from proposed SBR system at Dindoli site.

7.3.3.2 COMPONENTS OF PROPOSED 40 MLD TTP

The various components of the Tertiary Treatment Plant to be constructed are as under:
7.3.3.2.1 Civil Components

- Filtration shed
- Shed for entire UF / RO system with Laboratory room
- RCC UF / RO feed water tank with epoxy lining
- Backwash / Reject Collection Tank
- MCC room and transformer yard
- Flash Mixer, Clariflocculator for UF/RO Reject treatment with chemical dosing system
- Foundations for all equipment / Tanks / Pump Houses / Degasser System

7.3.3.2.2 Mechanical Components

- Disk /cloth media type fine filtration
- Manual Strainer (200micron)
- Ultrafiltration(UF) system comprising of membrane modules, backwashing system, Cleaning in Place system (CIP) system, etc.
- Chemical dosing system (Coagulant, pH correction, etc) for UF operation, if required.
- Strainers/ Filters in UF backwash line
- UF backwash-cum- Reverse Osmosis(RO) feed tank
- RO Feed pumps
- Dechlorination facility to RO Feed Water
- Cartridge Filter for RO System
- RO System with membranes modules, cleaning and flushing system
- Chemical dosing system for RO operation and cleaning.
- Sludge Dewatering unit for reject water.
- Degasser Units
- ACF Unit

7.3.3.2.3 Interconnecting piping work

- All piping, valves, flanges, fittings and hardwares including pipe support structures between various treatment units as per requirement.
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

7.3.3.2.4 Electrical works

- HT panel
- Transformers
- MCC panels
- APFC panel
- PMC
- Change over system to proposed TTP
- MCC, HT and LT cables
- Earthing systems,
- Push buttons
- Plant and room lighting
- Cable trays and tray supports, related civil work including cable trench etc.

7.3.3.2.5 Instrumentation Works

- As per process requirement for proposed TTP including PLC control system and related civil work.

The layout plan and process flow sheet diagram showing the above mentioned process units for the proposed tertiary sewage treatment plants is shown in Figure 4 and Figure 5.

The design criteria as well as Process design calculations of proposed 40 MLD capacity tertiary sewage treatment plant are presented in Annexure 1.
SECTION 8 : PROJECT IMPLEMENTATION PLANNING

The total time considered for the execution of the project would be around 24 months. The detailed on the tender floatation to completion is presented in the Table 8-1 below.

Table 8-1 : Project Implementation Planning

<table>
<thead>
<tr>
<th>Step</th>
<th>Time Frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design and Detailed Eng.</td>
</tr>
<tr>
<td>2</td>
<td>Process Eng. and drawings</td>
</tr>
<tr>
<td>3</td>
<td>Civil Eng. and drawings</td>
</tr>
<tr>
<td>4</td>
<td>Civil Works and Electrical Drawings</td>
</tr>
<tr>
<td>5</td>
<td>Civil Work</td>
</tr>
<tr>
<td>6</td>
<td>Psickit and Finalising</td>
</tr>
<tr>
<td>7</td>
<td>Mechanical Work</td>
</tr>
<tr>
<td>8</td>
<td>Finalising</td>
</tr>
<tr>
<td>9</td>
<td>Electrical Work</td>
</tr>
<tr>
<td>10</td>
<td>Finalising</td>
</tr>
<tr>
<td>11</td>
<td>Civil engineering</td>
</tr>
<tr>
<td>12</td>
<td>Survey and finalising</td>
</tr>
<tr>
<td>13</td>
<td>Mechanical Work</td>
</tr>
<tr>
<td>14</td>
<td>Finalising</td>
</tr>
<tr>
<td>15</td>
<td>Finalising</td>
</tr>
<tr>
<td>16</td>
<td>Mechanical Work</td>
</tr>
<tr>
<td>17</td>
<td>Finalising</td>
</tr>
<tr>
<td>18</td>
<td>Mechanical Work</td>
</tr>
<tr>
<td>19</td>
<td>Finalising</td>
</tr>
<tr>
<td>20</td>
<td>Mechanical Work</td>
</tr>
<tr>
<td>21</td>
<td>Finalising</td>
</tr>
</tbody>
</table>

Land Availability

The land at existing STP campus is only to be used for TSTP.
SECTION 9 : PROJECT COST

The Bill of Quantity for Tertiary Sewage Treatment Plant is based on the GWSSB SOR 2014 – 15 for Public Health Engineering items and for Building works items, SOR for Roads and Buildings. The rates for some of the items specifically mechanical and instrumentation works are based on market rates. The project cost along with the contingency and admin cost is detailed in the Table 9-1 below.

Table 9-1 : Cost Estimates

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UF-RO Shed</td>
<td>1,93,81,682.40</td>
</tr>
<tr>
<td>2</td>
<td>Product Water Tank</td>
<td>86,99,213.05</td>
</tr>
<tr>
<td>3</td>
<td>Backwash Waste Water Sump</td>
<td>71,88,835.81</td>
</tr>
<tr>
<td>4</td>
<td>Flash Mixer And Flocculator</td>
<td>40,06,920.01</td>
</tr>
<tr>
<td>5</td>
<td>HT Room / LT Room / Transformer Yard</td>
<td>45,29,382.03</td>
</tr>
<tr>
<td>6</td>
<td>UF Backwash Tank/ RO Feed Sump/ Pump House/MCC Room</td>
<td>1,48,35,090.95</td>
</tr>
<tr>
<td>7</td>
<td>Filter House</td>
<td>1,34,42,280.95</td>
</tr>
<tr>
<td>8</td>
<td>Chemical Dosing Shed</td>
<td>1,60,33,843.16</td>
</tr>
<tr>
<td>9</td>
<td>RO Flushing Tank and Degasser Unit</td>
<td>42,15,360.47</td>
</tr>
<tr>
<td>10</td>
<td>Administrative Building</td>
<td>53,31,522.93</td>
</tr>
<tr>
<td>11</td>
<td>ACF/Blower Foundations &amp; Misc. Work</td>
<td>38,13,745.12</td>
</tr>
<tr>
<td>12</td>
<td>RO Feed Tank</td>
<td>2,63,47,907.90</td>
</tr>
<tr>
<td>13</td>
<td>Piping Works</td>
<td>7,49,54,274.61</td>
</tr>
<tr>
<td>14</td>
<td>Mechanical Works including UF and RO</td>
<td>68,55,26,393.49</td>
</tr>
<tr>
<td>15</td>
<td>Electrical Works</td>
<td>6,32,57,204.00</td>
</tr>
<tr>
<td>16</td>
<td>Instrumentation Works</td>
<td>9,75,02,100.00</td>
</tr>
<tr>
<td>UGSR/GSR and Pumping Main</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>5 ML UGSR cost</td>
<td>2,57,93,411.67</td>
</tr>
<tr>
<td>18</td>
<td>800 mm Pumping Main Works</td>
<td>7,88,82,130.00</td>
</tr>
<tr>
<td>19</td>
<td>Mechanical works for Water Distribution Station</td>
<td>66,31,660.39</td>
</tr>
<tr>
<td>20</td>
<td>Electrical works for Water Distribution Station</td>
<td>42,60,756.00</td>
</tr>
<tr>
<td>Total Cost for 40 MLD TTP</td>
<td>1,16,46,33,714.95</td>
<td></td>
</tr>
<tr>
<td>Total Cost for 40 MLD TTP(Say)</td>
<td>1,16,46,34,000.00</td>
<td></td>
</tr>
<tr>
<td>1 % Labour Cess</td>
<td>1,16,46,340.00</td>
<td></td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli
to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th></th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1,17,62,80,340.00</td>
</tr>
<tr>
<td>2% Administrative Charges</td>
<td>2,35,25,606.80</td>
</tr>
<tr>
<td>5% Contingency Charges</td>
<td>5,88,14,017.00</td>
</tr>
<tr>
<td>Grand Total</td>
<td>1,25,86,19,963.80</td>
</tr>
<tr>
<td>Say Grand Total</td>
<td>1,25,86,20,000.00</td>
</tr>
</tbody>
</table>
SECTION 10 : FINANCIAL STRUCTURING

The sources and composition of the funds required for the execution of the Sewerage Projects is presented herewith in the Table 10-1.

Table 10-1 : Details of the Sources of the Fund

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Project Contribution Source</th>
<th>% Share by Govt. entity</th>
<th>Amount (Rs. Lacs)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Government of India</td>
<td>33</td>
<td>415344600</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Government of Gujarat</td>
<td>37</td>
<td>465689400</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Surat Municipal Corporation</td>
<td>30</td>
<td>377586000</td>
<td></td>
</tr>
<tr>
<td><strong>Total Amount</strong></td>
<td><strong>100</strong></td>
<td></td>
<td><strong>1258620000</strong></td>
<td></td>
</tr>
</tbody>
</table>
SECTION 11: PROJECT INSTITUTION FRAMEWORK

The Surat Municipal Corporation shall execute the Sewerage projects in a best professional manner. On approval of DPR by the Central Government, The Corporation and their Consultants Green Design and Engineering Services Private Limited shall prepare Tender Document for the execution of the work. All the work shall be executed through public Tendering. The tenders shall specify qualification requirement for the Bidders such as minimum turnover, Financial Strengths, Experience in executing similar works and of type and magnitude, etc. Only those bidders satisfying the qualifying criteria shall be considered.

The executive Engineer for the Sewerage Service along with the Project Monitoring Consultants shall be looking after the supervision of the work including the quality assurance. He will be also responsible for the periodical “Project reporting” to the funding agency such as Government of Gujarat and Government of India, as applicable.

The institute framework is presented as shown below.
SECTION 12: OPERATION AND MAINTENANCE COST

As per the present practice of the Surat Municipal Corporation, the Operation and Maintenance of the Sewage Treatment Plants is being given to the contractors, who have built the plant, for 10 (Ten) Years.

The Operation and Maintenance Cost of the Tertiary Sewage Treatment Plants is presented in Table 12-1.

Table 12-1: Operation and Maintenance Cost

<table>
<thead>
<tr>
<th>STAFF</th>
<th>Nos.</th>
<th>Salary/month</th>
<th>Total Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant in charge</td>
<td>1</td>
<td>30000</td>
<td>30000.00</td>
</tr>
<tr>
<td>Instrument Engr.</td>
<td>4</td>
<td>30000</td>
<td>120000.00</td>
</tr>
<tr>
<td>supervisor</td>
<td>3</td>
<td>20000</td>
<td>60000.00</td>
</tr>
<tr>
<td>chemist</td>
<td>3</td>
<td>15000</td>
<td>45000.00</td>
</tr>
<tr>
<td>fitter/plant operator</td>
<td>7</td>
<td>9500</td>
<td>66500.00</td>
</tr>
<tr>
<td>Elect. Technician</td>
<td>7</td>
<td>9500</td>
<td>66500.00</td>
</tr>
<tr>
<td>Operators/Beldar</td>
<td>14</td>
<td>6500</td>
<td>91000.00</td>
</tr>
<tr>
<td>Security</td>
<td>9</td>
<td>7000</td>
<td>63000.00</td>
</tr>
<tr>
<td>Supervisor - Security</td>
<td>1</td>
<td>15000</td>
<td>15000.00</td>
</tr>
<tr>
<td>Gardener</td>
<td>1</td>
<td>6500</td>
<td>6500.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>563500.00</td>
</tr>
<tr>
<td>PF</td>
<td></td>
<td>13.61%</td>
<td>76692.35</td>
</tr>
<tr>
<td>Service Tax</td>
<td></td>
<td>15.00%</td>
<td>105901.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5%</td>
</tr>
<tr>
<td>ESI</td>
<td></td>
<td>6%</td>
<td>33810.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>706011.97</td>
</tr>
<tr>
<td>Total Salary Expense per Month</td>
<td>811913.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Salary Expense per Year</td>
<td>9742965.15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

40 MLD

<table>
<thead>
<tr>
<th>Amount per year</th>
<th>Service Tax</th>
<th>Total Cost per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Membrane Replacement 130000</td>
<td>52000000.00</td>
<td>52000000.00</td>
</tr>
<tr>
<td>Spares Replacement (0.5% of Capex)</td>
<td>5881401.70</td>
<td>882210.26</td>
</tr>
<tr>
<td>Variable Cost 1850</td>
<td>26640000.00</td>
<td>3996000.00</td>
</tr>
<tr>
<td>Electricity Cost (Rs. 6/- per KWH) 4050</td>
<td>58320000.00</td>
<td>58320000.00</td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th></th>
<th>mg/l to be removed</th>
<th>rate per mg/l removal</th>
<th>Amount per month</th>
<th>Service Tax</th>
<th>Total per month</th>
<th>Total per year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alkalinity</strong></td>
<td>215.00</td>
<td>8.5</td>
<td>2193000.00</td>
<td>328950.00</td>
<td>2521950.00</td>
<td>30263400.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>mg/l to be removed</th>
<th>rate per mg/l removal</th>
<th>Amount per month</th>
<th>Service Tax</th>
<th>Total per month</th>
<th>Total per year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TDS</strong></td>
<td>900.00</td>
<td>5.5</td>
<td>5940000.00</td>
<td>891000.00</td>
<td>6831000.00</td>
<td>81972000.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Color to be removed</th>
<th>rate per color removal</th>
<th>Amount per month</th>
<th>Service Tax</th>
<th>Total per month</th>
<th>Total per year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Apparent Color</strong></td>
<td>40.00</td>
<td>11</td>
<td>528000.00</td>
<td>79200.00</td>
<td>607200.00</td>
<td>7286400.00</td>
</tr>
</tbody>
</table>

**Total Cost per year** 276984377.11
**Total Cost per ML** 18971.53
**Total Cost per KL** 18.97

**Revenue Generation:**

The total operation and maintenance cost of Rs. 27.70 Crores per annum shall have to recover through revenue generation in form of user charges from industries.
Annexure 1 : Design for Tertiary Sewage Treatment Plant at Dindoli
PROCESS DESIGN

RAW SEWAGE, SECONDARY TREATED SEWAGE / TTP FEED WATER CHARACTERISTICS AND TTP TREATED – INDUSTRIAL GRADE WATER CHARACTERISTICS

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameter</th>
<th>Unit</th>
<th>Raw Sewage (90%tile)</th>
<th>Secondary treated sewage</th>
<th>Tertiary Treated – Industrial Grade Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>True Colour (Hazen Units) max.</td>
<td>Hazen Units</td>
<td>90</td>
<td>50</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>2</td>
<td>Turbidity</td>
<td>NTU</td>
<td>*</td>
<td>*</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>3</td>
<td>pH</td>
<td>-</td>
<td>6.5 – 7.5</td>
<td>7 – 8.5</td>
<td>6.0 – 7.5</td>
</tr>
<tr>
<td>4</td>
<td>Total Hardness as CaCO3</td>
<td>mg/l</td>
<td>900</td>
<td>*</td>
<td>&lt; 300</td>
</tr>
<tr>
<td>5</td>
<td>Iron as Fe</td>
<td>mg/l</td>
<td>0.72</td>
<td>*</td>
<td>&lt; 0.25</td>
</tr>
<tr>
<td>6</td>
<td>Manganese as Mn.</td>
<td>mg/l</td>
<td>0.4</td>
<td>*</td>
<td>&lt; 0.10</td>
</tr>
<tr>
<td>7</td>
<td>TDS</td>
<td>mg/l</td>
<td>1400</td>
<td>1400</td>
<td>&lt; 500</td>
</tr>
<tr>
<td>8</td>
<td>BOD5</td>
<td>mg/l</td>
<td>250</td>
<td>≤ 10</td>
<td>&lt; 5</td>
</tr>
<tr>
<td>9</td>
<td>COD</td>
<td>mg/l</td>
<td>600</td>
<td>≤ 50</td>
<td>&lt; 50</td>
</tr>
<tr>
<td>10</td>
<td>Total Suspended Solids</td>
<td>mg/l</td>
<td>300</td>
<td>≤ 10</td>
<td>&lt; 2</td>
</tr>
<tr>
<td>11</td>
<td>Total Nitrogen as N</td>
<td>mg/l</td>
<td>42</td>
<td>≤ 10</td>
<td>&lt; 10</td>
</tr>
<tr>
<td>12</td>
<td>Total phosphorus</td>
<td>mg/l</td>
<td>7</td>
<td>≤ 2 (as dissolved -P)</td>
<td>&lt; 7</td>
</tr>
</tbody>
</table>

MAJOR COMPONENTS TO BE COVERED UNDER THIS PROJECT

1.0 INLET ARRANGEMENT:

Inlet Chamber of Disk/cloth media type fine filtration system shall receive flow of secondary treated sewage of 60 MLD from proposed SBR system at Dindoli site.

2.0 COMPONENTS OF PROPOSED 40 MLD TTP

The various components of the Tertiary Treatment Plant to be constructed are as under:

Civil Components
- Filtration shed
- Shed for entire UF / RO system with Laboratory room
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli
to generate industrial grade water under SMART CITY, Surat

- RCC UF / RO feed water tank with epoxy lining
- Backwash / Reject Collection Tank
- MCC room and transformer yard
- Flash Mixer, Clarifloculator for UF/RO Reject treatment with chemical dosing system
- Foundations for all equipment / Tanks / Pump Houses / Degasser System

**Mechanical Components**
- Disk /cloth media type fine filtration
- Manual Strainer (200micron)
- Ultrafiltration(UF) system comprising of membrane modules, backwashing system, Cleaning in Place system (CIP) system, etc.
- Chemical dosing system (Coagulant, pH correction, etc) for UF operation, if required.
- Strainers/ Filters in UF backwash line
- UF backwash-cum- Reverse Osmosis(RO) feed tank
- RO Feed pumps
- Dechlorination facility to RO Feed Water
- Cartridge Filter for RO System
- RO System with membranes modules, cleaning and flushing system
- Chemical dosing system for RO operation and cleaning.
- Sludge Dewatering unit for reject water.
- Degasser Units
- ACF Unit
- Water Distribution Station

**Interconnecting piping work**
- All piping, valves, flanges, fittings and hardwares including pipe support structures between various treatment units as per requirement.

**Electrical works**
- HT panel
- Transformers
- MCC panels
- APFC panel
- PMC
- Change over system to proposed TTP
- MCC, HT and LT cables
- Earthing systems,
- Push buttons
- Plant and room lighting
- Cable trays and tray supports, related civil work including cable trench etc.

**Instrumentation Works**
- As per process requirement for proposed TTP including PLC control system and related civil work.
PROCESS DESIGN CRITERIA

The Process design criteria for 40 MLD net output TSTP is provided hereunder. The specified sizing and quantities mentioned are minimum for satisfactory fulfillment of the specified final treated sewage quality.

BRIEF PROCESS DESCRIPTION OF UNITS FOR PROPOSED 40 MLD TTP

The treatment plant is designed based on the following basis:

- Final treated water quantity (nett output): 40 MLD
- UF Recovery attained / designed: ≥ 88%
- UF Flux LMH: ≤35 (Max)
- UF Membranes: Modified /Reinforced PES having good antifouling properties
- RO Recovery attained / designed: ≥ 75%
- RO Flux LMH: ≤17 (Max)

TTP PROCESS DESIGN

PRE-TREATMENT STAGE:

The pre-treatment stage is to condition the treated sewage as to minimize wear & tear to mechanical equipment in the downstream and reduces the fouling on the reverse osmosis plant, hence will operate with as little downtime for membrane cleaning in place (CIP) process as possible. Pretreatment stage is aimed to removal of suspended solids, colloidal matters, Silica and making treated sewage suitable for feeding into membrane systems for their longer life and expected performance. In practice, this is measured using SDI 15 mins fouling index measurement technique. The feed water to the RO will be designed to achieve an SDI value lower than 3 after the pretreatment processes.

Chlorination Prior to UF:

Continuous chlorination of UF feed water may be applied, if required. However, a
suitable de-chlorination provision (SMBS injection) shall be provided at the RO inlet to prevent the RO membranes from exposure to any traces of chlorine.

Provision for shock chlorination (high dose of chlorine for short period of time) shall be provided prior to the UF Units. Shock chlorination of upto 10 ppm for 30minutes to 1 hour (Max) three times in a week shall be considered.

ULTRAFILTRATION

The ultra-filtration stage is to condition the combined treated waste water so that the reverse osmosis plant will operate with as little downtime for CIP as possible. Expected water quality from the STP is to be of low turbidity, however the fouling nature of this on reverse osmosis membranes is still high and so the ultra-filtration is required to lower the colloidal fouling potential to acceptable levels. In practice this is measured using SDI15 fouling index measurement technique. The feed water to the RO will be designed to have an SDI lower than 3 following the ultra-filtration.

The fifteen minute Silt Density Index (SDI15) of the filtrate shall not exceed 3.0 during 95 percent of the time and shall never exceed 4.0

To achieve the above objectives the pretreatment plant scope of works includes:

- Chlorination, if required.
- Manual strainer
- Ultra-filtration
- Filtered water storage
- UF backwash pumps
- UF CIP system

Manual Strainer:

The Filtering process raw water enters the filter inlet through the coarse screen which protects the cleaning mechanism from large debris. The water passes through the fine screen, trapping dirt particles which accumulate inside the filter. Clean water flows
through the filter outlet.

The gradual dirt buildup on the inner screen surface causes a filter cake to develop, with a corresponding increase in the pressure differential across the screen. A pressure differential switch senses the pressure differential and when it reaches a pre-set value, the cleaning process begins.

The Strainer shall be manual wedge wire type and shall have maximum rating of 200 microns.

**Ultra-Filtration:**

Ultra-filtration shall be provided to filter the screened clarified water. This will remove many of the colloidal particles remaining in solution and produce filtered water with low SDI and turbidity. The primary purpose of the UF system is to remove sub-micron particles including bacteria, large colloids and other suspended solids from the treated effluent to improve the performance of the downstream RO process by reducing fouling and minimising the chemical cleaning requirements. The secondary purpose of the UF System is to serve as one of the “multiple barriers” to the micro-organisms.

Total 8 Nos. of UF Trains (7W + 1S) shall be provided. Each Rack must be equipped with provision to mount additional 20% (minimum) membranes in future and the hardware (feed pump, backwash pump and piping, must all be sized based on this requirement). Space shall also be provided in the layout for installing one additional skid at a later date, if required.

**Guaranteed Performance Requirements:**

The filtrate turbidity for any 24-hour period shall not exceed 0.5 NTU.

The fifteen minute Silt Density Index (SDI15) of the filtrate shall not exceed 3.0 during
90 percent of the time and shall never exceed 4.0

**Flushing**

The UF system shall be configured such that individual trains can be flushed or backwashed with RO permeate water during periods of extended reduced flow or standby.

**Spare Capacity**

The additional “spare” space shall be provided in the UF skids, layout and footprint such that additional modules can be readily installed into each of the membrane skids to provide 20% (minimum) additional membrane area per train and operate at a reduced flux in the future, if considered necessary.

Space and pipe connections provided for this additional 20% membrane area shall be shown on the detailed design layout, to allow for future installation of additional membrane area, in case of deterioration of feed water quality.

The sufficient space shall also be provided for the possible future addition of one (1) complete UF skid.

**Membrane and Rack MOC Requirements:**

- Membrane Fibres: Modified / Reinforce PES
- Module Body: PVC-U/ SS 316
- Filtrate headers: PVC-U/ SS 316
- Filtrate Pipes: PVC-U/ SS 316
- Frames: 10037 (CS/MS) C4 coated

**UF Backwash Water Storage:**

Water from this UF permeate tank shall be used as Feed water to the RO trains. Some of the water is used to backwash the Ultra Filtration trains to maintain the operating
flow/flux of the membranes

**UF CIP system**

A CIP system is provided for the ultra filtration plant. This can be used to undertake maintenance or recovery cleans of the UF membranes to maintain plant performance.

In order to feed Reverse Osmosis system with desired and consistent quality of water Ultra-Filtration is selected as pre-treatment.

**UF SYSTEM OPERATION:**

The UF system consists of the following modes of operation:

- **Service Cycle:**

  The UF membrane system will operate on an out-to-in mode where the feed stream flows on the outside of the membrane with the filtrate flowing through the inside.

  To maintain a minimum cross-flow velocity, some of the reject stream shall be re-circulated to prevent the accumulation of solids on the surface of the membrane. The balance of the reject stream shall be bled-off to prevent the build-up of solids in the re-circulation loop. Such feed and bleed operation allows the UF to operate continuously before the need for backwash thereby improving recovery and availability of the system.

- **UF Backwash (BW) Cycle:**

  With the accumulation of solids during filtration, the resistance to flow will increase which can be overcome by subjecting the membrane to a reverse flow, with the product water Air-scouring is also introduced concurrently to improve the effectiveness of the Backwashing. This backwashing operation shall be carried out periodically which can be predetermined by either total flow or elapsed time. The overall system will be controlled such that only one train will undergo backwashing at any one time. The backwash stream is discharged to the waste sump.
• **Maintenance Cleaning (MC):**

To maintain optimum filtration efficiency, periodic chemical cleaning of the membranes is required. MC is an automated sequence meant for short-term regaining of permeability, which is a short duration cleaning with chlorine and citric acid as per pre-set schedule with minimum stoppage of the system. The frequency of maintenance cleaning is dependent on the raw water quality and its variation. The expected frequency of this short term cleaning is 48-72 hours.

• **Recovery cleaning (RC):**

An extensive cleaning procedure requires longer stoppage on a process train for permanent regaining of the membrane permeability and performance. The membranes are subjected to a regime of soak and flush cycle which will remove the foulants or contaminants that cannot be removed by backwashing alone. Similar to MC, frequency of RC is dependent on the feed water quality and its variation; the expected frequency of this long term cleaning is once in 15-25 days.

**UF CIP SYSTEM:**

A dedicated cleaning in place system will be provided for Ultra filtration system which consists of one number chemical preparation tank, Two (2) numbers of CIP pump & its necessary accessories.

**ACID, SMBS AND ANTISCALANT DOSING SYSTEM:**

The UF product water is then dosed with acid (if required) for bringing down the pH is aimed to reducing the LSI as per the membrane manufacturer’s recommendation, which will enhance the life of membranes and In case any chlorine passes though, the Oxidation Reduction Potential (ORP) meter senses the free chlorine and trips the RO High pressure Pump. This automation is to ensure that the chlorine water will not enter the RO Plant as the chlorine will hydrolyse the RO Membranes. Further to ensure that the RO membranes are protected from any accidental exposure to Chlorine(free), SMBS dosing shall be provided at the RO inlet. This SMBS dosing shall be
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

The RO feed water has high scaling potential especially due to Silica, CaCO3, CaSO4 and CaF2, which are harmful to membranes and hence an on-line antiscalant dosing is provided for controlling the scaling and fouling tendency of the feed water. The Sodium hypo chlorite reacts with the ammonia present the water produces the chloramines. Chloramine can further react with sodium hypochlorite and gives sodium hydroxide and dichloramine which minimise/prevent bio fouling in reverse osmosis system.

All dosing system shall be provided at the inlet of final Micron Cartridge filters (5 microns). The dosing points shall have enough residence/ reaction time in the piping and no two dosing points shall be provided near to each other (minimum distance shall be maintained as per manufacturer recommendation) to avoid any unnecessary reactions and by products.

Data Sheet of UF System:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Particulars</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UF Feed Flow Rate</td>
<td>57 MLD (Average), 60 MLD Maximum</td>
</tr>
<tr>
<td>2</td>
<td>Recovery from UF System</td>
<td>88-90%</td>
</tr>
<tr>
<td>3</td>
<td>UF Filtrate Flow</td>
<td>50 MLD</td>
</tr>
<tr>
<td>4</td>
<td>Nos. Of Skids</td>
<td>8 Nos. (7W+1S)</td>
</tr>
<tr>
<td>5</td>
<td>UF Feed Flow Rate / Skid</td>
<td>357.14 m³/hr</td>
</tr>
<tr>
<td>6</td>
<td>UF Filtrate Flow / Skid</td>
<td>297.61 m³/hr</td>
</tr>
<tr>
<td>7</td>
<td>Type of Membrane</td>
<td>Hollow Fibre</td>
</tr>
<tr>
<td>8</td>
<td>Type of Membrane Mounting</td>
<td>Vertical</td>
</tr>
<tr>
<td>9</td>
<td>Active Filtration Area / Membrane</td>
<td>55 – 60 m²</td>
</tr>
<tr>
<td>10</td>
<td>Mode of Operation</td>
<td>Crossflow/Dead End</td>
</tr>
<tr>
<td>11</td>
<td>Pore Size (nominal)</td>
<td>&lt; 0.012 microns</td>
</tr>
<tr>
<td>12</td>
<td>Feed Temperature</td>
<td>Max 40°C</td>
</tr>
</tbody>
</table>
**Recycling / Reuse of Wastewater**

**Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli**

to generate industrial grade water under SMART CITY, Surat

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>13</strong></td>
<td><strong>Design Flux Rate (When all trains are in operation)</strong></td>
<td><strong>35 lmh</strong></td>
</tr>
<tr>
<td><strong>14</strong></td>
<td><strong>Allowable TMP Filtration</strong></td>
<td><strong>1.5 bars</strong></td>
</tr>
<tr>
<td><strong>15</strong></td>
<td><strong>Chlorine Resistance (Normal)</strong></td>
<td><strong>Max 200 ppm</strong></td>
</tr>
<tr>
<td><strong>16</strong></td>
<td><strong>MOC of Membrane</strong></td>
<td><strong>PESM/Reinforced PES</strong></td>
</tr>
<tr>
<td><strong>17</strong></td>
<td><strong>MOC Membrane Housing</strong></td>
<td><strong>PVC-U / SS 316</strong></td>
</tr>
<tr>
<td><strong>18</strong></td>
<td><strong>MOC of Racks</strong></td>
<td><strong>PVC-U / CS (with powder coated paint)</strong></td>
</tr>
</tbody>
</table>

**REVERSE OSMOSIS UNITS:**

Reverse Osmosis process is a membrane process in which a synthetic semi-permeable membrane is used to separate water from dissolved impurities. When a semi-permeable membrane separates a dilute and concentrates solution of salts, due to osmosis, the water from the dilute solution side passes through the membrane to the concentrated side till osmotic equilibrium is attained. Now, if the pressure is applied and increased gradually on the concentrated side, the flow of water continues to reduce till the applied pressure reverses the direction of flow of water and water from the concentrated side enters the dilute side. This process is called the Reverse Osmosis. It is very essential to ensure that the water fed to reverse osmosis membranes is free from particulate matter to prevent membrane fouling. Also, the water should be free from organic matter, heavy metals and oxidizing agents like free chlorine. Thin Film Composite Semi Permeable Membranes under the influence of external pressure will undergo the process of Reverse Osmosis separating high TDS water into Very Low TDS Permeate (more than 99% salinity rejection) and Very Highly TDS Reject streams. The RO system consists of minimum 5trains. The RO membrane shall be selected as low pressure / high pressure type as design requirement.

The partially blending of the RO permeate (30 MLD) with UF filtered water (10 MLD) will make suitable treated water quality (TDS < 500 ppm) as required.

**LIMITING CONDITION OF FEED WATER TO RO UNIT**
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDI</td>
<td>&lt;3</td>
</tr>
<tr>
<td>Temperature</td>
<td>40 deg. C (max.)</td>
</tr>
<tr>
<td>Free chlorine</td>
<td>Nil or as per design</td>
</tr>
<tr>
<td>Oil and grease</td>
<td>Nil or as per design</td>
</tr>
</tbody>
</table>

SILT DENSITY INDEX

The SDI of feed water to RO shall be kept below 3 for a continuous operation of the RO plant.

The SDI is a measure of colloidal particles in the feed water and hence SDI value of 3 indicates that the feed water has very low content of colloidal particles. This ensures minimal colloidal fouling of RO membranes. This test shall be carried out once in a week and its value recorded.

BACTERIAL CONTAMINATION

The feed water to RO shall be free from bacterial contamination. The check for bacterial content (CFU per ml) shall be carried out once a day and action initiated to minimize membrane fouling.

ORGANIC CONTAMINATION

To minimize organic fouling of membranes, it is necessary to monitor this parameter once a day and cleaning of membranes as per recommended procedure should be followed. The frequency of cleaning will have to be determined by RO plant operating conditions.

OIL & GREASE

The Oil & Grease should be NIL or as per membrane design requirements. The presence of it in the feed water to RO, severely affects the membrane performance. The presence of Oil and Grease physically fouls the membrane and make it ineffective,
which is then very difficult to remove even by cleaning.

TEMPERATURE

The operating temperature of feed water shall not be exceeding 40 deg. Celsius or as per design requirements.

FREE RESIDUAL CHLORINE (FRC)

FRC at inlet to RO shall be monitored at least once a shift and recorded, as presence of FRC is detrimental to the performance of membrane.

RO CIP SYSTEM:

Reverse Osmosis membranes need periodic cleaning and servicing. For optimal performance specific chemicals are required, depending on the cause of the pollution.

Scaling

Scaling is concerned with the seclusion of suspended inorganic particles, such as calcium carbonate, barium sulfate and iron compounds.

Fouling

Fouling is concerned with the seclusion of organic, colloidal and suspended particles. Bacteria and other microorganisms that decompose these particles will create substrates. As a consequence they will grow and develop further.

It is very important to purify the membrane preventively. In many cases regular mild cleaning is better than cleaning periodically with an aggressive cleaning product. The membrane will than last longer.

<table>
<thead>
<tr>
<th>S.No</th>
<th>Type of scaling</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Calcium Carbonate Scaling</td>
<td>Mainly Occurs with the high presence of Calcium</td>
</tr>
</tbody>
</table>
2. Bio-film Formation  Growth of micro Organism on the membrane
3. Organic Deposits  Oil & Organic Substance formation

A dedicated cleaning in place system will be provided for reverse osmosis system which consists of one number chemical preparation tank with agitator, Two (1W + 1 S) numbers of CIP pump & one number of 10 micron cartridge filter.

**REJECT CUM WASTEWATER TREATMENT:**

The reject from UF / RO will be subject to chemical treatment for rejection of mainly Suspended Solids and Organic matter. For this, the chemical treatment system shall be provided which includes Flash Mixers, Clariflocculator, Chemical Dosing System and Sludge Dewatering System. The system will be designed considering reject flow and wastewater flow from TTP. The reject flow will be pumped to Flash Mixer units and subsequently taken to Clariflocculator unit. The overflow from the Clariflocculator shall be connected to existing nearest point of treated sewage disposal line of Dindoli STP. The required Alum / PAC dosing system with pumps will be provided for chemical treatment. The sludge shall be dewatered in the existing centrifuge unit. The required Polyelectrolyte Dosing system including dosing tanks and pumps shall also be provided for sludge dewatering system. The dewatered sludge shall be disposed off into existing landfill site from the treatment facility at Dindoli.

One no. of Clariflocculator unit of 26.10 m dia with 4.0 m SWD will be designed and constructed for reject / wastewater treatment of the TTP Plant.
### DATA SHEETS FOR 40 MLD (Nett Output) TERTIARY TREATMENT PLANT

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td><strong>UF FEED PUMP</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td>Verticle Turbine</td>
</tr>
<tr>
<td></td>
<td>Number of working Pumps</td>
<td>2 Nos.</td>
</tr>
<tr>
<td></td>
<td>Number of standby Pumps</td>
<td>2 Nos.</td>
</tr>
<tr>
<td></td>
<td>Design Flow (m³/hr) each</td>
<td>1250.0 m³/hr</td>
</tr>
<tr>
<td></td>
<td>Design Head (m)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>MOC:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Casing</td>
<td>1.5% NiCl</td>
</tr>
<tr>
<td></td>
<td>Impeller</td>
<td>CF8M</td>
</tr>
<tr>
<td></td>
<td>Shaft</td>
<td>SS 410</td>
</tr>
<tr>
<td></td>
<td>Sleeves</td>
<td>SS 410</td>
</tr>
<tr>
<td></td>
<td>Base Plate</td>
<td>Epoxy Coated MS</td>
</tr>
<tr>
<td></td>
<td>Suction Pipe</td>
<td>SS 316</td>
</tr>
<tr>
<td>2.</td>
<td><strong>STRAINERS</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Materials of construction:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Body</td>
<td>SS 304</td>
</tr>
<tr>
<td></td>
<td>Screen</td>
<td>SS 304</td>
</tr>
<tr>
<td></td>
<td>Backwash valve</td>
<td>SS 304</td>
</tr>
<tr>
<td></td>
<td>Backwash arm and internals</td>
<td>SS 304</td>
</tr>
<tr>
<td></td>
<td>Seals</td>
<td>Mechanical</td>
</tr>
<tr>
<td></td>
<td>Screen size (Micron)</td>
<td>200</td>
</tr>
<tr>
<td></td>
<td>Screen type</td>
<td>Manual</td>
</tr>
<tr>
<td></td>
<td>Number of units (Working)</td>
<td>4 Nos.</td>
</tr>
<tr>
<td></td>
<td>Number of units (standby)</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>Design Flow (m³/hr)</td>
<td>625.0</td>
</tr>
<tr>
<td>3</td>
<td><strong>ULTRAFILTRATION SYSTEM</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Membranes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nominal Molecular cut of weight</td>
<td>1,20,000 daltons</td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater  
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli  
to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Membrane material</td>
<td>Modified /Reinforced PES</td>
</tr>
<tr>
<td></td>
<td>Membrane configuration</td>
<td>Hollow Fibre, Vertical</td>
</tr>
<tr>
<td></td>
<td>Active Membrane area per module , m²</td>
<td>55 – 60 m²</td>
</tr>
<tr>
<td></td>
<td>Max. module operating temperature</td>
<td>8.2 bars @ 20°C &amp; 5 bars @ 40°C</td>
</tr>
<tr>
<td></td>
<td>Module operating pH range</td>
<td>pH 3 to pH 10</td>
</tr>
</tbody>
</table>

B. Loading
- Design flux (When all trains in Operation): 35 lmh (Max)
- Number of trains: 7 W + 1 S
- Trans membrane pressure (TMP): Max 1.5 bars

C. Backwash
- Interval: Min 20 mins – max 45 mins
- Backwash duration: 55 s to 60 s
- Recovery (Min): 88 – 90%

D. Cleaning
- Anticipated cleaning interval @ design flux: As per process requirement
  - Cleaning solution makeup water: RO Permeate / Process Water

4. UF BACKWASH PUMP
- Type: Horizontal Centrifugal
- MOC Casing/Impeller: CF8M
  - Design Capacity (m³/hr): As per Membrane Manufacturer design
  - Design head (m): As per design
  - Number of working units: 1 No.
  - Number of standby units: 1 No.

5. UF CEB – NaOCl DOSING PUMP (If required)
- Type: Simplex Diaphragm Type
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli
to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MOC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Liquid end</td>
<td>PP</td>
</tr>
<tr>
<td></td>
<td>Valve and Valve Seat</td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td>Plunger</td>
<td>CS</td>
</tr>
<tr>
<td></td>
<td>Diaphragm</td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td>Design Capacity (m³/hr)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>Design head (m)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>Number of working units</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>Number of standby units</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

6. UF CEB – NaOH DOSING PUMP (If required)

<table>
<thead>
<tr>
<th></th>
<th>Type</th>
<th>Simplex Diaphragm Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MOC</td>
<td>PP</td>
</tr>
<tr>
<td></td>
<td>Liquid end</td>
<td>PP</td>
</tr>
<tr>
<td></td>
<td>Valve and Valve Seat</td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td>Plunger</td>
<td>CS</td>
</tr>
<tr>
<td></td>
<td>Diaphragm</td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td>Design Capacity (m³/hr)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>Design head (m)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>Number of working units</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>Number of standby units</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

7. UF CEB – CITRIC ACID DOSING PUMP (If required)

<table>
<thead>
<tr>
<th></th>
<th>Type</th>
<th>Simplex Diaphragm Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MOC</td>
<td>PP</td>
</tr>
<tr>
<td></td>
<td>Liquid end</td>
<td>PP</td>
</tr>
<tr>
<td></td>
<td>Valve and Valve Seat</td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td>Plunger</td>
<td>CS</td>
</tr>
<tr>
<td></td>
<td>Diaphragm</td>
<td>PTFE</td>
</tr>
<tr>
<td></td>
<td>Design Capacity (m³/hr)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>Design head (m)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>Motor Rating (KW)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of working units</td>
<td>1 No.</td>
</tr>
</tbody>
</table>
### Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of standby units</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

#### 8. UF CIP TANK – NaOH + NaOCl and HCL
- Diameter (m): As per design
- Height (m): As per design
- Tank Operating (useable) volume (M³): As per design
- Material: FRP / GRP
- Number required: 1 No.

#### 9. UF CIP PUMP - NaOH + NaOCl
- Type: Horizontal Centrifugal end suction Pump
- MOC: Casing/Impeller CF8M
- Design Capacity (M³/hr): As per design
- Design head(m): As per design
- Number of working units: 1 No.
- Number of standby units: 1 No.

#### 10. UF CEB PUMP – HCL / Acid
- Type: Horizontal Centrifugal end suction Pump
- MOC: Casing/Impeller CF8M
- Design Capacity (M³/hr): As per design
- Design head(m): As per design
- Number of working units: 1 No.
- Number of standby units: 1 No.

#### 11. RO FEED PUMP
- Type: Horizontal Centrifugal end Suction
- Flow rate at duty point (m³/hr): 444.40 m³/hr each
- Design Head (m): 120 m
- Number of units: 6 Nos. (4W + 2S)
- MOC:
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Casing</td>
<td>CF8M</td>
</tr>
<tr>
<td></td>
<td>Impeller</td>
<td>CF8M</td>
</tr>
<tr>
<td></td>
<td>Shaft</td>
<td>SS 316</td>
</tr>
<tr>
<td></td>
<td>Sleeve</td>
<td>SS 316</td>
</tr>
<tr>
<td></td>
<td>Base Plate</td>
<td>Epoxy coated MS</td>
</tr>
</tbody>
</table>

12. REVERSE OSMOSIS (RO) SYSTEM

A. CARTRIDGE FILTERS

- Rated flow (m³/h) 444.40 per Cartridge Housing
- Total flow(m³/h) 1777.77 (4W Filter + 1 SB Filter)
- Micron rating (microns) 5 (Nominal)
- MATERIAL OF CONSTRUCTION
  - Cartridge filter membrane PP
  - Shell SS316L
  - Type of cartridge PP wound / as per requirement

B. RO Trains

- Number of RO Trains 4 Nos. Working
- Feed Flow rate (m³/hr) per train 444.40
- Permeate Flow rate (m³/hr) per train 312.4
- Total Recovery 75% (single pass)
- Number of stages per train 2 Stages
- Pressure Vessel in Stage _1 As per design
- Pressure Vessel in Stage _2 As per design

13. RO CIP TANK

- Diameter As per Design
- Height As per Design
- Tank Operating (useable) volume As per Design
- Material GRP / FRP / PP
- Heating Arrangement To be provided
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.</td>
<td>RO CIP PUMP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Manufacture</td>
<td>As per Vendor List</td>
</tr>
<tr>
<td></td>
<td>• Type</td>
<td>Horizontal Centrifugal end suction</td>
</tr>
<tr>
<td></td>
<td>• MOC: Casing/Impeller</td>
<td>CF8M</td>
</tr>
<tr>
<td></td>
<td>• Design Capacity (m³/hr)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Design Head (m)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Number of working units</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>• Number of stand by units</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>• Micron cartdrige filter required</td>
<td>To be provided</td>
</tr>
<tr>
<td>15.</td>
<td>RO FLUSH PUMP</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Type</td>
<td>Horizontal Centrifugal end suction</td>
</tr>
<tr>
<td></td>
<td>• MOC : Casing/Impleller</td>
<td>CF8M</td>
</tr>
<tr>
<td></td>
<td>• Design Capacity (m³/hr)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Design head (m)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Number of working units</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>• Number of stand by units</td>
<td>1 No.</td>
</tr>
<tr>
<td>16.</td>
<td>DOSING SYSTEM</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SODIUM HYPOCHLORITE STORAGE AND DOSING TANK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Volume</td>
<td>20 m³</td>
</tr>
<tr>
<td></td>
<td>• Dimension – diameter</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Dimension – Height</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Material Of Construction</td>
<td>GRP / PP</td>
</tr>
<tr>
<td></td>
<td>ANTISCALANT STORAGE AND DOSING TANK</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Volume</td>
<td>5 m³</td>
</tr>
<tr>
<td></td>
<td>• Dimension – diameter</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Dimension – Height</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Material Of Construction</td>
<td>GRP / PP</td>
</tr>
<tr>
<td>No.</td>
<td>ITEM/DESCRIPTION</td>
<td>PARTICULARS</td>
</tr>
<tr>
<td>-----</td>
<td>------------------------------------------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td><strong>HCL / H2SO4 STORAGE AND DOSING TANK</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Volume</td>
<td>20 m³</td>
</tr>
<tr>
<td></td>
<td>• Dimension – diameter</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Dimension – Height</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Material Of Construction</td>
<td>MS</td>
</tr>
<tr>
<td></td>
<td><strong>SODIUM HYDROXIDE STORAGE AND DOSING TANK</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Volume</td>
<td>10 m³</td>
</tr>
<tr>
<td></td>
<td>• Dimension – diameter</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Dimension – Height</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Material Of Construction</td>
<td>GRP / PP</td>
</tr>
<tr>
<td></td>
<td><strong>RO FEED ANTISCALANT DOSING PUMP</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Type</td>
<td>Simplex Diaphragm Type</td>
</tr>
<tr>
<td></td>
<td>• Flowrate (LPH)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Operating head (m)</td>
<td>30 m</td>
</tr>
<tr>
<td></td>
<td>• Number of units (Working)</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>• Number of units (stand by)</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td><strong>RO FEED SMBS DOSING PUMP</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Type</td>
<td>Simplex Diaphragm</td>
</tr>
<tr>
<td></td>
<td>• Flowrate (LPH)</td>
<td>As per design</td>
</tr>
<tr>
<td></td>
<td>• Operating head (m)</td>
<td>30 m</td>
</tr>
<tr>
<td></td>
<td>• Number of units (Working)</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>• Number of units (stand by)</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td><strong>RO FEED HCL / H2SO4 DOSING PUMP</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Type</td>
<td>Simplex Diaphragm</td>
</tr>
<tr>
<td></td>
<td>• Flowrate (LPH)</td>
<td>As per design</td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli
to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operating head (m)</td>
<td>30 m</td>
</tr>
<tr>
<td></td>
<td>Number of units (Working)</td>
<td>2 Nos.</td>
</tr>
<tr>
<td></td>
<td>Number of units (stand by)</td>
<td>1 No.</td>
</tr>
</tbody>
</table>

17A. UF FEED SUMP

<table>
<thead>
<tr>
<th></th>
<th>No. of unit</th>
<th>1 No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HRT</td>
<td>30 min</td>
</tr>
<tr>
<td></td>
<td>Design flow</td>
<td>41.66 m³/min</td>
</tr>
<tr>
<td></td>
<td>Volume</td>
<td>1250 m³ (minimum)</td>
</tr>
<tr>
<td></td>
<td>MOC</td>
<td>RCC M30</td>
</tr>
</tbody>
</table>

17B. RO FEED TANK

<table>
<thead>
<tr>
<th></th>
<th>No. of unit</th>
<th>1 No.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HRT</td>
<td>15 min</td>
</tr>
<tr>
<td></td>
<td>Design Flow</td>
<td>29.62 m³/min</td>
</tr>
<tr>
<td></td>
<td>Volume</td>
<td>444.4 m³ (min)</td>
</tr>
</tbody>
</table>

18. ACTIVATED CARBON FILTERS

<table>
<thead>
<tr>
<th></th>
<th>Total flow (m³/h)</th>
<th>208.33 (2W Filter + 1SB Filter)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operating Press (kg/sqcm)</td>
<td>* (0.5 to 2.5 / or as per manufacturer’s recommendation)</td>
</tr>
<tr>
<td></td>
<td>Pressure drop at design flow should not exceed (kg/sqcm)</td>
<td>* (0.08 / or as per manufacturer’s recommendation)</td>
</tr>
<tr>
<td></td>
<td>Backwash Pressure (kg/sqcm)</td>
<td>* (0.5 to 2.5 / or as per manufacturer’s recommendation)</td>
</tr>
<tr>
<td></td>
<td>Empty Bed Contact time (minutes)</td>
<td>* (not less than 5)</td>
</tr>
<tr>
<td></td>
<td>Carbon</td>
<td>Liquid Phase activated carbon</td>
</tr>
<tr>
<td></td>
<td>Construction</td>
<td>Carbon steel Epoxy coated tank of adequate shell</td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli
to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>thickness or Fibre Reinforced Plastic (FRP) / Equivalent</td>
<td></td>
</tr>
</tbody>
</table>

19.0 ANCILLARY ITEMS

19.1 COMPRESSED AIR SYSTEM – PROCESS

A. Air Compressors:
- Number (working) 2 Nos.
- Number (Standby) 1 No.
- Type Screw
- Capacity (m³/hr) As per design
- Design Pressure (m) As per design

B. Air Receiver:
- Number As per requirement
- Type (i.e vertical, cylindrical) Vertical
- Material of construction MS
- Volume 2.5 M³
- Design pressure (m) As per design

C. Process Air Regulator Assembly:
- Number As per requirement
- Type Spring loaded
- Minimum Design Inlet Pressure 8 bar
- Minimum Design Outlet pressure 1 bar

20. RO REJECT CHEMICAL TREATMENT UNITS

A. Flash Mixer
- No. of units One No.
- Design Flow – Each 18 MLD
- Retention period 60 Seconds
- Capacity As per design
- Size As per design
Recycling / Reuse of Wastewater  
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Material of Construction</td>
<td>RCC</td>
</tr>
<tr>
<td></td>
<td><strong>Mixer</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. of Mixers</td>
<td>One No.</td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td>Turbine</td>
</tr>
<tr>
<td></td>
<td>Material of Construction</td>
<td>SS 304</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th><strong>B. ALUM/PAC DOSING TANKS &amp; MIXER</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of units</td>
<td>2 Nos. (1W + 1S)</td>
</tr>
<tr>
<td>Capacity</td>
<td>As per design</td>
</tr>
<tr>
<td>Size</td>
<td>As per design</td>
</tr>
<tr>
<td>Material of Construction</td>
<td>RCC with inside Epoxy Painted</td>
</tr>
<tr>
<td><strong>Mixer</strong></td>
<td></td>
</tr>
<tr>
<td>No. of Mixers</td>
<td>Two Nos.</td>
</tr>
<tr>
<td>Type</td>
<td>Turbine Type</td>
</tr>
<tr>
<td>Material of Construction</td>
<td>SS 304</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th><strong>C. CLARIFLOCCULATOR</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of units &amp; capacity</td>
<td>1 No., 18 MLD</td>
</tr>
<tr>
<td>Surface Loading</td>
<td>40 m³/m²/day</td>
</tr>
<tr>
<td>Size of CLF</td>
<td>26.10 m dia</td>
</tr>
<tr>
<td>Side water depth of CLF</td>
<td>4.0 m</td>
</tr>
<tr>
<td>HRT of clarifier Zone</td>
<td>2.0 hr (min.)</td>
</tr>
<tr>
<td>Size of flocculator</td>
<td>10.3 m diameter</td>
</tr>
<tr>
<td>LD of flocculator</td>
<td>3.8 m</td>
</tr>
<tr>
<td>Free Board</td>
<td>500 mm</td>
</tr>
<tr>
<td>Material of Construction</td>
<td>RCC M:30</td>
</tr>
<tr>
<td>Desludging arrangement</td>
<td>sluice valve for sludge</td>
</tr>
<tr>
<td>Inlet Pipe</td>
<td>DI K-7</td>
</tr>
<tr>
<td>Inside finish</td>
<td>40 mm th.IPS on bottom raft and 20 mm th.smooth</td>
</tr>
</tbody>
</table>
### Recycling / Reuse of Wastewater

Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>double coat cement plaster on vertical walls with water proofing treatment.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Outside finish</td>
<td>20 mm th. sand face plaster</td>
</tr>
<tr>
<td></td>
<td>Platform</td>
<td>1.2 mt. Wide RCC M30 on every common &amp; outer wall of clarifier</td>
</tr>
<tr>
<td></td>
<td>Railing</td>
<td>G.I. (Class-B) pipe riling with epoxy paint</td>
</tr>
</tbody>
</table>

#### 21. DIRTY WATER SUMP

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of Unit</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>Volume of sump</td>
<td>600 m³</td>
</tr>
<tr>
<td></td>
<td>Pump:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. of Pump</td>
<td>2 Nos (1W + 1S)</td>
</tr>
<tr>
<td></td>
<td>Capacity</td>
<td>300 m³/hr</td>
</tr>
<tr>
<td></td>
<td>Head</td>
<td>18 M</td>
</tr>
<tr>
<td></td>
<td>Type</td>
<td>Submersible</td>
</tr>
<tr>
<td></td>
<td>Sp Gravity</td>
<td>1.02</td>
</tr>
</tbody>
</table>

#### 22. CENTRIFUGE FEED SUMP AND PUMP HOUSE

**Sump**

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of unit</td>
<td>1 No.</td>
</tr>
<tr>
<td></td>
<td>Capacity</td>
<td>15 m³ (min)</td>
</tr>
</tbody>
</table>

**Pump House**

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Size</td>
<td>5 m x 6 m</td>
</tr>
<tr>
<td></td>
<td>No. of pump</td>
<td>2 Nos. (1W + 1S)</td>
</tr>
<tr>
<td></td>
<td>Capacity of Pump</td>
<td>20 m³/hr</td>
</tr>
<tr>
<td></td>
<td>Head</td>
<td>18 m</td>
</tr>
<tr>
<td></td>
<td>Sp Gravity</td>
<td>1.03</td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli
to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.</td>
<td><strong>POLYELECTROLYTE DOSING TANKS &amp; MIXER (for Dewatering Unit)</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• No. of units</td>
<td>Two Nos. (1W+1S)</td>
</tr>
<tr>
<td></td>
<td>• Capacity</td>
<td>3.37 m³</td>
</tr>
<tr>
<td></td>
<td>• Size</td>
<td>1.5 mx 1.5 m x 1.5 m LD</td>
</tr>
<tr>
<td></td>
<td>• Material of Construction</td>
<td>RCC with inside Epoxy Painted</td>
</tr>
<tr>
<td></td>
<td><strong>Mixer</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• No. of Mixers</td>
<td>Two Nos.</td>
</tr>
<tr>
<td></td>
<td>• Type</td>
<td>Turbine Type</td>
</tr>
<tr>
<td></td>
<td>• Material of Construction</td>
<td>SS 304</td>
</tr>
<tr>
<td></td>
<td><strong>Dosing Pump</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• No. of Pump</td>
<td>2 Nos. (1W + 1S)</td>
</tr>
<tr>
<td></td>
<td>• Capacity</td>
<td>150 LPH each @2.0 kg/cm²</td>
</tr>
<tr>
<td>24.</td>
<td><strong>UGSR / GSR AND PUMPING MAIN FOR TSTP</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>UGSR / GSR</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• No. of Unit</td>
<td>One No.</td>
</tr>
<tr>
<td></td>
<td>• Flow</td>
<td>5 ML</td>
</tr>
<tr>
<td></td>
<td>• No. of Pumps</td>
<td>3 Nos. (2 W + 1 S)</td>
</tr>
<tr>
<td></td>
<td>• Type of Pumps</td>
<td>Vertical Turbine</td>
</tr>
<tr>
<td></td>
<td>• Capacity of Each Pump</td>
<td>270 LPS</td>
</tr>
<tr>
<td></td>
<td>• Total Head</td>
<td>15 M or As per Design</td>
</tr>
<tr>
<td></td>
<td>• Sp. Gravity</td>
<td>1.00</td>
</tr>
<tr>
<td></td>
<td><strong>New Rising Main</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Dia. Of rising main</td>
<td>800 mm</td>
</tr>
<tr>
<td></td>
<td>• Length</td>
<td>@ 4000 M</td>
</tr>
<tr>
<td></td>
<td>• MOC</td>
<td>DI K9 Pipe</td>
</tr>
</tbody>
</table>
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli
to generate industrial grade water under SMART CITY, Surat

<table>
<thead>
<tr>
<th>No.</th>
<th>ITEM/DESCRIPTION</th>
<th>PARTICULARS</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td><strong>PIPE WORK</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Material of Construction</td>
<td>MOC</td>
</tr>
<tr>
<td></td>
<td>UF feed after strainers</td>
<td>GRP/UPVC</td>
</tr>
<tr>
<td></td>
<td>Filtrate</td>
<td>GRP/UPVC</td>
</tr>
<tr>
<td></td>
<td>Compressed air</td>
<td>GI or equivalent</td>
</tr>
<tr>
<td></td>
<td>Filtrate exhaust</td>
<td>GRP/UPVC</td>
</tr>
<tr>
<td></td>
<td>Backwash waste</td>
<td>GRP/UPVC</td>
</tr>
<tr>
<td></td>
<td>HP RO feed</td>
<td>SS 304</td>
</tr>
<tr>
<td></td>
<td>Interstage RO permeate</td>
<td>UPVC</td>
</tr>
<tr>
<td></td>
<td>RO Permeate</td>
<td>UPVC</td>
</tr>
<tr>
<td></td>
<td>RO Concentrate</td>
<td>SS</td>
</tr>
<tr>
<td></td>
<td>UF CIP / CEB flow</td>
<td>UPVC</td>
</tr>
<tr>
<td></td>
<td>RO CIP flow</td>
<td>UPVC</td>
</tr>
<tr>
<td></td>
<td>RO flush</td>
<td>UPVC / SS</td>
</tr>
<tr>
<td></td>
<td>Anti-scalant</td>
<td>PE/CPVC</td>
</tr>
<tr>
<td></td>
<td>Sodium hydroxide and proprietary chemical</td>
<td>PE/CPVC</td>
</tr>
<tr>
<td></td>
<td>Sodium hypochlorite</td>
<td>PE/CPVC</td>
</tr>
<tr>
<td></td>
<td>HCL / H2SO4</td>
<td>PE/CPVC/MS PTFE</td>
</tr>
<tr>
<td></td>
<td>Potable water (safety shower)</td>
<td>UPVC</td>
</tr>
<tr>
<td></td>
<td>SMBS</td>
<td>UPVC</td>
</tr>
</tbody>
</table>
Annexure 2 : Cost Estimates for Tertiary Sewage Treatment Plant at Dindoli
COST SUMMARY

SURAT MUNICIPAL CORPORATION
COST ESTIMATE FOR 40 MLD NEW TTP AT DINDOLI, SURAT.

SUMMARY

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Description</th>
<th>Amount (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UF-RO Shed</td>
<td>1,93,81,682.40</td>
</tr>
<tr>
<td>2</td>
<td>Product Water Tank</td>
<td>86,99,213.05</td>
</tr>
<tr>
<td>3</td>
<td>Backwash Waste Water Sump</td>
<td>71,88,835.81</td>
</tr>
<tr>
<td>4</td>
<td>Flash Mixer And Flocculator</td>
<td>40,06,920.01</td>
</tr>
<tr>
<td>5</td>
<td>HT Room / LT Room / Transformer Yard</td>
<td>45,29,382.03</td>
</tr>
<tr>
<td>6</td>
<td>UF Backwash Tank/ RO Feed Sump/ Pump House/MCC Room</td>
<td>1,48,35,090.95</td>
</tr>
<tr>
<td>7</td>
<td>Filter House</td>
<td>1,34,42,280.95</td>
</tr>
<tr>
<td>8</td>
<td>Chemical Dosing Shed</td>
<td>1,60,33,843.16</td>
</tr>
<tr>
<td>9</td>
<td>RO Flushing Tank and Degasser Unit</td>
<td>42,15,360.47</td>
</tr>
<tr>
<td>10</td>
<td>Administrative Building</td>
<td>53,31,522.93</td>
</tr>
<tr>
<td>11</td>
<td>ACF/Blower Foundations &amp; Misc. Work</td>
<td>38,13,745.12</td>
</tr>
<tr>
<td>12</td>
<td>RO Feed Tank</td>
<td>2,63,47,907.90</td>
</tr>
<tr>
<td>13</td>
<td>Piping Works</td>
<td>7,49,54,274.61</td>
</tr>
<tr>
<td>14</td>
<td>Mechanical Works including UF and RO</td>
<td>68,55,26,393.49</td>
</tr>
<tr>
<td>15</td>
<td>Electrical Works</td>
<td>6,32,57,204.00</td>
</tr>
<tr>
<td>16</td>
<td>Instrumentation Works</td>
<td>9,75,02,100.00</td>
</tr>
<tr>
<td></td>
<td><strong>UGSR/GSR and Pumping Main</strong></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>5 ML UGSR cost</td>
<td>2,57,93,411.67</td>
</tr>
<tr>
<td>18</td>
<td>800 mm Pumping Main Works</td>
<td>7,88,82,130.00</td>
</tr>
<tr>
<td>19</td>
<td>Mechanical works for Water Distribution Station</td>
<td>66,31,660.39</td>
</tr>
<tr>
<td>20</td>
<td>Electrical works for Water Distribution Station</td>
<td>42,60,756.00</td>
</tr>
<tr>
<td></td>
<td><strong>Total Cost for 40 MLD TTP</strong></td>
<td>1,16,46,33,714.95</td>
</tr>
<tr>
<td></td>
<td><strong>Total Cost for 40 MLD TTP(Say)</strong></td>
<td>1,16,46,34,000.00</td>
</tr>
<tr>
<td></td>
<td>1 % Labour Cess</td>
<td>1,16,46,340.00</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td>1,17,62,80,340.00</td>
</tr>
<tr>
<td></td>
<td>2% Administrative Charges</td>
<td>2,35,25,606.80</td>
</tr>
<tr>
<td></td>
<td>5% Contingency Charges</td>
<td>5,88,14,017.00</td>
</tr>
<tr>
<td></td>
<td><strong>Grand Total</strong></td>
<td>1,25,86,19,963.80</td>
</tr>
<tr>
<td></td>
<td><strong>Say Grand Total</strong></td>
<td>1,25,86,20,000.00</td>
</tr>
</tbody>
</table>
Annexure 3 : Drawings for Tertiary Sewage Treatment Plant at Dindoli
Recycling / Reuse of Wastewater
Tertiary Sewage Treatment Plant of 40 MLD net output capacity at Dindoli to generate industrial grade water under SMART CITY, Surat

Figure 3 : Location Map of existing Sewage Treatment Plant at Dindoli

Figure 4 : Layout Plan showing various units for the tertiary sewage treatment plant at Dindoli

Figure 5 : Process Flow Diagram showing various units for the tertiary sewage treatment plant at Dindoli