

### 4.2.3.5 Heavy Engineering Industries & Automobiles

#### 1.0 Subject Matter

(Present a brief historical background on the growth of industry – a bird's eye view picture and analysis of the Heavy Engineering Industry using the information/ tables) provided in the annexure.

GIS based map depicting location of all the Heavy Engineering industries (*Automobile, Power Plant Equipment, Locomotives, Machine Tools, Vessels, etc./ others*) District level

Production from Heavy Engineering industries in the State. (*Refer Annexure Table-1*).

Time trend of the number (growth) of Heavy Engineering industries. (*Refer Annexure Table-2*).

#### 2.0 Details of Water Availability, Supply, Demand, Withdrawal & Consumption for the Heavy Engineering industries

##### Water Supply & Demand for Heavy Engineering industries in the State

Time trend of total water demand and actual current water supplied to the Heavy Engineering industries along with growth of Heavy Engineering industries in the state. (*Refer Annexure Tables-2, 3*)

##### Total Freshwater Withdrawal and Actual Water Consumption by Heavy Engineering industries in the State

##### Comparative trend of Total Freshwater Withdrawal Vs Actual Water Consumption by Heavy Engineering industries in a State

##### Comparative status of total water consumption by each Heavy Engineering industries

**State Water Budgeting:** (*Refer Annexure Table-3(d)*).

SECTOR	Previous Year / Average Annual Demand (MCM)	Previous Year/ Average Annual Supply & Consumptive Use (MCM)		Demand for the present Water Year (MCM)
		Supply	Consumptive Use	
All Heavy Engineering industries				
<b>GRAND TOTAL</b>	xxx	xxx	xxx	xxx

#### 3.0 Issues and Challenges

Illustrative issues and challenges may include

- Waste water disposal and associated surface and ground water contamination
- Water demand and supply issues in the Heavy Engineering sector in the state, provide details
- Capital investment related issues w.r.to wastewater treatment/ recycle/reuse, water conservation interventions etc.
- Issues related to water pricing in Heavy Engineering industries
- Technology availability, affordability and efficiency related issues
- Issues & challenges relevant to the water supply & consumption
- Issues related to monitoring and reporting of data

(*Supporting data & analysis for above points may also be furnished*)

#### 4.0 Problem Tree / Root cause Analysis: Cause, Effect and Interventions

#### 5.0 Governance / Management:

Statute / Law / Policy/ Regulations if any

- State level laws, policy and governance for the Heavy Engineering sector in the state on water access, consumption and wastewater discharge.
- Any specific fresh and waste water regulation/ guidelines in state, provide details.
- Has the state notified any regulations including for zero liquid discharge for the Heavy Engineering industries in state? Provide details.

**Institutions governing / managing / monitoring the resources and Institutional structure.**

- Institutions governing / managing / monitoring the industrial water consumption and supply.

Governing body for Heavy Engineering industries	Water allocation & Monitoring authority	Waste water discharge monitoring
<i>E.g. Department/ Associations of Heavy Engineering industries</i>	<i>E.g. CGWA/ Water resource department/ Urban or Rural body</i>	<i>e.g. State pollution Control Board</i>

**Areas of Peoples/Private Participation if any**

- Water Projects set up by Heavy Engineering industries for the benefit of neighborhood/ local community/ Environment.

Heavy Engineering industries	Any OE <sup>14</sup> or critical block within the watershed	Water Conservation / Waste Water Treatment initiatives if any	Partnership			Sustainability of initiative
			Community Participation	PPP	Others	

Heavy Engineering industries	Any OE or critical block within the watershed	Water Reuse/ Recycle initiatives under PPP	PPP Yes/No	Sustainability of initiative

**Schemes, Economics& Financing-**

Existing schemes and programs along with financial allocations, expenditure etc.

- Water Tariff and procurement cost (*Refer Annexure 6(a) & 6(b)*)
- Expenditure on Water management (*Refer Annexure 6(c) & 6(d)*)

**6.0 Measurement, Monitoring and Data Constraints/ Management**

**Water & Wastewater Measurement:**

Shall specify measurement methods and technologies at Raw water source, industrial process and Waste Water (generation, recycle/reuse & discharge) and Water Quality as per CPCB / SPCB

- **Monitoring** at State Government: Institution/ Agency/ Official responsible for Sustainable Water Management comprehensively for this Sector.
- **Data Management:** Should specify - Frequency of measurement, Frequency of Reporting to centralized agency, Water Quality Parameters monitored, how data is being used to improve Water Use Efficiency and ensure water quality parameters within the prescribed norms etc.
- **Constraints** with respect to the measurement & monitoring.

<sup>14</sup>Overexploited block of groundwater

**7.0 Performance Indicators:**a. **Benchmarks on water use** (Refer table-13)b. **Status of various Performance Indicators– for comparison across Districts/ Plants/ Units/ Products etc.**

Category	Indicator		Bench Mark/ Unit (as applicable)	Heavy Engineering industry 1	Heavy Engineering industry 2	Heavy Engineering industry 3
Measurement	<b>Water Quantity</b>					
	Measurement at Raw water source	Manual	Yes/No			
		Real Time/ Automatic	Yes/No			
	Measurement at major water usage areas	Manual	Yes/No			
		Real Time/ Automatic	Yes/No			
	Waste Water (generation, recycle/reuse & discharge)	Manual	Yes/No			
		Real Time/ Automatic	Yes/No			
	Undertaken internal Water Audit in the last Year?		Yes/No			
Undertaken Third party Water Audit in the last Year?		Yes/No				
Submitting monthly water balance to state pollution control board (SPCB)?		Yes/No				
Management Plans	Having Water Management Plans?		Yes/No			
	Whether Water Managements are operational		Yes/No			
Water Conservation	Have taken up RWH/ GW Recharge?		Yes/No			
	% of total Water requirement being met from Treated Waste Water					
	Have taken up Restoration measures?		Yes/No			
	% of reduction of water demand compared to the previous year.					
	Introduction of water efficient technologies in process to reduce water consumption.		Yes/No			
Water Use Efficiency (Annexure- Table 7)	<b>Specific Water Consumption (SWC); (m<sup>3</sup>/tonne)</b> (refer Annexure-Table 7(a), (b) & (c))					
	Have specific water consumption benchmarks/ standards established		Yes/No			
	Have specific water consumption within the norms/bench marks/standards		Yes/No			
Water Productivity (Annexure- Table 8)	<b>Water Productivity (INR/m<sup>3</sup>)</b> Quantity of water necessary to produce these goods					

	<i>(refer Annexure- Table 8(a)&amp;(b))</i>					
<b>Water Intensity</b> <i>(Annexure- Table 9)</i>	<b>Water Intensity;</b> (m <sup>3</sup> /1000 Rs or m <sup>3</sup> /US\$) Volume of water used per unit of gross value added (GVA) <i>(refer Annexure- Table 9(a)&amp;(b))</i>					
<b>Water Foot print</b> <i>(Annexure- Table 10)</i>	Total volume of freshwater used directly and/or indirectly for the industrial operation/product <i>(refer Annexure- Table 10(a))</i>					
<b>Waste Water</b> <i>(Annexure- Table 11)</i>	Total Waste Water Generated					
	% Waste Water Treated					
	% Treated waste water recycled					
	Implementation/ achieved zero liquid discharge (ZLD).		Yes/No			
<b>Water Quality</b> <i>(Annexure-Table 12)</i>	Installation of online water quality monitoring systems.		Yes/No			
	Compliance with the wastewater quality discharged norms.		Yes/No			
	Discharging wastewater into open area/ earthen nallah /open drain/ municipal sewer?					
	Notified for violating effluent discharge norms for discharge in natural resources (surface/ground).		Yes/No			
	No. of areas near Heavy Engineering industry where Water Quality has adversely affected					
<b>Economics</b>	Whether economic incentives are in place to encourage water efficiency & conservation?		Yes/No			
	Whether economic disincentive mechanisms like penalties etc. are in place to discourage water wastage & inefficient use?		Yes/No			
	Whether water use charges & tariff are revised regularly and are reflective of rational pricing mechanisms?		Yes/No			
<b>Public Interface</b>	Operationalization of online water quality portal for information dissemination and feedback		Yes/No			

Category	Indicator	Bench Mark/ Unit (as applicable)	District 1	District 2	District 3
Water Quantity Measurement	% of Heavy Engineering industries with water flow meters				
	% of water sources of Heavy Engineering industries geotagged				
	% of Heavy Engineering industries undertaking internal water audits in last year				
	% of Heavy Engineering industries undertaking external water audits in last year				
	% of Heavy Engineering industries submitting water balance to SPCB (state pollution control board)				

**8.0 Reforms undertaken/ being undertaken/ proposed if any**

**9.0 Road map of activities / tasks proposed for**

- Better governance
- Better source / supply management
- Better demand management / improved Water Use Efficiency
- Water Quality
- Water Economics and Financing
- Sustainable Water budgeting with timelines and agencies responsible for each task/activity.

**ANNEXURE**

**1 Total number, types & capacity of Heavy Engineering industries in the State**

Total Production from Heavy Engineering industries in the State						
Type	No. of Heavy Engineering industries	Total Installed Capacity of all the Heavy Engineering industries (tonne)	Total Production Capacity of all the Heavy Engineering industries (tonne)	Daily Average Production of all the Heavy Engineering industries (tonne)		
Automobile						
Power Plant Equipment						
Locomotives						
Vessels						
Machine Tools						
Others						
<b>Total</b>						

**2 Growth Trend of Heavy Engineering industries over a period and Water Demand and Supply position**

Heavy Engineering industries	Years					
	1990	1995	2000	2005	2010	2017
Automobile						
Power Plant Equipment						
Locomotives						
Vessels						
Machine Tools						
Others						
<b>Total</b>						

<i>Water Demand and Supply</i>						
Total Water Demand (MCM)						
Total Water Supply (MCM)	GW					
	SW					
	Total					
Demand-Supply Gap						

### 3 Water Budgeting

#### 3(a) Demand, Supply (Withdrawals) & Consumptive Use:

Heavy Engineering Industries: (MCM) Present Water Year: 1 <sup>st</sup> June to 31 <sup>st</sup> May next year									
INDUSTRY (within the Basin/ Sub-basin A)	Previous Year/ Average Annual Demand	Demand for Present Water Year	Previous Year/ Average Annual Supply				Previous Year/ Average Annual Waste Water Generated	Previous Year/ Average Annual Consumptive Use	Remarks
			Rain Water	Surface Water	Ground Water*	TOTAL SUPPLY			
Unit 1									
Unit 2									
<b>GRAND TOTAL</b>									

\*GW Draft can be calculated from the number of GW abstraction structures & corresponding draft for each Industrial Use/ Process.

#### 3(b) Source Wise: Previous Year/ Average Annual Water Supply

Heavy Engineering Industries: (MCM)										
Source	Sub Source	Unit 1	Unit 2	Unit 3	Unit 4					TOTAL
Rain Water	Directly Harvested Rain Water									
<b>Total</b>										
Surface Water	Springs, Nallahs									
	Major Projects									
	Medium Projects									
	Minor Projects									
	Ponds, Tanks									
	Wetlands									
	Sea Water /Desalinated Water									
Inter Basin Transfer										
<b>Total</b>										
Ground Water* (Dynamic / Static)	Dug wells (Total No. x Draft)									
	Dug cum Bore well (Total No. x Draft)									
	Bore/Tube wells (Total No. x Draft)									

	Others etc										
<b>Total</b>											
<b>Treated Waste Water</b>											
<b>GRAND TOTAL</b>											

\*GW Draft can be calculated from the number of GW abstraction structures & corresponding draft for each Industrial Use/ Process.

**3(c) Previous Year/ Average Annual Demand, Supply (Source wise) and Consumption for Basin/ Sub-basin A:**

Source of Water	Demand of all Units in Basin/ Sub-basin A	Supply/ Withdrawal for all Units	Consumptive Use of all Units	Gap/Remarks
Rain Water (Directly Harvested)				
Springs, Nallahs				
Major Projects				
Medium Projects				
Minor Projects				
Ponds, Tanks				
Wetlands				
Desalinated Water/ Sea water				
Inter-Basin Transfer				
Ground Water (Dynamic)				
Treated Waste Water				
<b>TOTAL (MCM)</b>				

**3(d) Previous Year/ Average Annual Demand, Supply (Source wise) and Consumption for Whole State:**

Source of Water	Demand of all Units in the State	Supply/ Withdrawal for all Units	Consumptive Use of all Units	Gap/Remarks
Rain Water (Directly Harvested)				
Springs, Nallahs				
Major Projects				
Medium Projects				
Minor Projects				
Ponds, Tanks				
Wetlands				
Desalinated Water/ Sea water				
Inter-Basin Transfer				
Ground Water (Dynamic)				
Treated Waste Water				
<b>TOTAL (MCM)</b>				

## 3(e) Summary State Water Budget for Heavy Engineering Industries

SECTOR	Previous Year / Average Annual Demand (MCM)	Previous Year/ Average Annual Supply & Consumptive Use (MCM)		Demand for the present Water Year (MCM)
		Supply	Consumptive Use	
<b>All Heavy Engineering Industries</b>	xxx	xxx	xxx	xxx

## 4 Proportion of Water withdrawal and consumption by Heavy Engineering industries against total industries in the State

Heavy Engineering industries	Total Water Withdrawal by all Heavy Engineering industries (%) (Refer Annexure-4(a))	Total water withdrawal by all the Industries in state	Total Water Consumption by all Heavy Engineering industries (%) (Refer Annexure-4(b))	Total water Consumption by all the Industries in state
Automobile				
Power Plant Equipment				
Locomotives				
Vessels				
Machine Tools				
Others				
<b>Total</b>				

4(a) Total Water Withdrawal/Abstraction by Heavy Engineering industries (HEI) in the State as percentage of Total water withdrawal by all the industries in the State

$$\text{Total water withdrawal by HEI Sector (\%)} = \frac{(\text{Total water withdrawal by all the HEI in the State}) \times 100}{(\text{Total water withdrawal by all the industries in the state})}$$

4(b) Total Actual Water Consumption by Heavy Engineering industries in the state as percentage of Total water withdrawal by all the industries in the State

$$\text{Total water consumption by HEI Sector (\%)} = \frac{(\text{Total actual water consumption by all HEI in State}) \times 100}{(\text{Total water withdrawal by all the industries in the state})}$$

## 4(c) Total Freshwater Withdrawal by all Heavy Engineering industries and Total Actual Water Consumption by all Heavy Engineering industries in the State

	CY -11	CY -10	CY -9	CY -8	CY -7	CY -6	CY -5	CY -4	CY -3	CY -2	CY -1	CY / 2017
Total Fresh Water Withdrawal by all Heavy Engineering industries (MCM)												
Total Actual Water Consumption by all Heavy Engineering industries (MCM)												



**5 Total Water Withdrawal (Abstraction) and Actual Water Consumption as percentage of total renewable freshwater resources**

	CY-5	CY-4	CY-3	CY-2	CY-1	CY/ 2017
Total Fresh Water Withdrawal by all Heavy Engineering industries (%) (Refer Annexure-5(a))						
Total Actual Water Consumption by all Heavy Engineering industries (%) (Refer Annexure-5(b))						

**5(a) Total Water Withdrawal/Abstraction by Heavy Engineering industries (HEI) in the State as percentage of Total available freshwater resources of the State**

$$\text{Total water withdrawal by HEI Sector (\%)} = \frac{(\text{Total water withdrawal by all the HEI in the State}) \times 100}{(\text{Total available freshwater resources of the state})}$$

**5(b) Total Actual Water Consumption by Heavy Engineering industries in the state as percentage of Total available freshwater resources of the State**

$$\text{Total water consumption by HEI Sector (\%)} = \frac{(\text{Total actual water consumption by all HEI in State}) \times 100}{(\text{Total available freshwater resources of the state})}$$

**6 Water Economics & Financing:**

**6(a) Water Tariff (Rs./m<sup>3</sup>)**

Source	CY-5	CY-4	CY-3	CY-2	CY-1	CY/ 2017
GW						
Urban body						
Treated Waste Water for reuse						
Others						

**6(b) Procurement Cost of Water (in Rs)**

Year wise cost of procurement of Water				
CY-5	CY-4	CY-3	CY-2	CY-1

**6(c) Expenditure on Water including Treatment and Management-Time trend at State level**

	CY-5	CY-4	CY-3	CY-2	CY-1	CY/ 2017
Total Capex by Heavy Engineering industries on water treatment and management (Lakhs)						
Total O&M Expenditure by Heavy Engineering industries on water treatment and management (Lakhs)						
Total O&M Expense (%)						

**6(d) Expenditure at Heavy Engineering industry level for the Current Year- CY**

Heavy Engineering industries	Capital Expenditure (Lakhs)	O&M Expenditure (Lakhs)	Total	O&M Expense (%)

Heavy Engineering industry 1				
Heavy Engineering industry 2				
Heavy Engineering industry 3				
Heavy Engineering industry 4				
<b>Total</b>				

**7 Water Use Efficiency:**

Water use efficiency in terms of Specific Water Consumption (SWC) viz. amount of water used/consumed per unit of product produced. In case of Heavy Engineering industries, it can be represented as the total volume of water used/consumed (m<sup>3</sup>) per unit tonnes of product produced.

**Specific Water Consumption (SWC) of Heavy Engineering industries:**

$$\text{Specific Water Consumption (SWC); (m}^3\text{/tonne)} = \frac{\text{Volume of water consumed by the HEI, (m}^3\text{)}}{\text{(Total Production by the HEI), (tonnes)}}$$

**7(a) Specific Water Consumption (SWC) for Current Year**

	Vol. of Water Consumed (m <sup>3</sup> )	Total Product Produced (tonnes)	SWC (m <sup>3</sup> /tonne)
Heavy Engineering industry 1			
Heavy Engineering industry 2			
Heavy Engineering industry 3			

**7(b) Average SWC of Heavy Engineering industries for the State – time trend (also represent through Graph)**

	CY-5	CY-4	CY-3	CY-2	CY-1	CY/ 2017
Average SWC of Heavy Engineering industries in State						

**7(c) Specific Water Consumption (SWC)****Comparative Specific Water Consumption (SWC) of Heavy Engineering industries****Trend of average Specific Water Consumption (SWC) of Heavy Engineering industries**

Percentage of industries having specific water consumption within the norms/bench marks/standards (if applicable)

**8 Water productivity:**

For e.g. (illustrative purpose only)

- **Water Productivity** as the total economic value created of the output/product by the Industry in the State per unit volume of water withdrawal or consumption

$$\text{Water Productivity (INR/m}^3\text{)} = \frac{\text{(Total economic value created of the output/product by the Industry), INR}}{\text{(Total Volume of freshwater withdrawn/consumed), m}^3}$$

**OR**

Water Productivity in terms of **GVA (Gross Value Added)**; (INR/m<sup>3</sup>)

$$= \frac{(\text{Total Value of Product} - \text{Value of inputs other than water}), \text{ INR}}{(\text{Total Volume of freshwater consumed}), \text{ m}^3}$$

**8(a) Water Productivity in terms of GVA for Current Year**

	Value of Product	Value of inputs other than water	Total Volume of freshwater consumed	(Gross Value Added); (INR/m <sup>3</sup> )
Heavy Engineering industry 1				
Heavy Engineering industry 2				
Heavy Engineering industry 3				
<b>Total</b>				

**8(b) Average Water Productivity in terms of GVA for the State – time trend (also represent through Graph)**

	CY-5	CY-4	CY-3	CY-2	CY-1	CY/ 2017
<b>Average Water Productivity (GVA); (INR/m<sup>3</sup>)</b>						

**9 Water Intensity:**

$$\text{Water Intensity; (m}^3\text{/1000 Rs or m}^3\text{/US\$)} = \frac{\text{Volume of water consumed by the Industry, (m}^3\text{)}}{(\text{Unit value added by Product), (1000 Rs or US\$)}}$$

**9(a) Water Intensity for Current Year**

	Volume of water consumed	Unit value added by Product	Water Intensity; (m <sup>3</sup> /1000 Rs or m <sup>3</sup> /Rs)
Heavy Engineering industry 1			
Heavy Engineering industry 2			
Heavy Engineering industry 3			
<b>Total</b>			

**9(b) Average Water Intensity in terms for the State – time trend (also represent through Graph)**

	CY-5	CY-4	CY-3	CY-2	CY-1	CY/ 2017
<b>Average Water Intensity (m<sup>3</sup>/1000 Rs or m<sup>3</sup>/Rs)</b>						

**10 Water Footprint:**

The total volume of freshwater used directly and/or indirectly for the industrial operation/product. It includes the water used in industries own operation/process and its supply chain. Total Water footprints are composed of estimates for blue water (used from freshwater sources), green water (rain or soil water taken up by plants), and grey water (water required to dilute wastewater to be fit for discharge).

**Water Footprint for Heavy Engineering Product**

Water Footprint (WF) of product = Sum of WF of Operations of the plant and WF of Supply Chain

i.e. **Water Footprint (WF) = WF<sub>Supply Chain</sub> + WF<sub>Operations</sub>**

**10(a) Water Foot print for Current Year**

	WF Supply Chain	WF Operations	Total
Heavy Engineering industry 1			
Heavy Engineering industry 2			
Heavy Engineering industry 3			
<b>Total</b>			

**11Waste Water**

	Bench Mark/ Units (as applicable)	Heavy Engineering Industry 1	Heavy Engineering Industry 2	Heavy Engineering Industry 3
Total Waste Water Generated				
% Waste Water Treated				
% Waste Water Recycled				
<ul style="list-style-type: none"> <li>• % Treated waste water used in Industrial activity</li> <li>• % Treated waste water used in Green belt</li> <li>• % Treated waste water used in others</li> </ul>				
% Total quantum of wastewater discharged.				
Implementation/ achieved zero liquid discharge (ZLD).				

**11(a) Use of Treated Waste Water**

	Source of Waste Water	Source of Treated Waste Water for reuse	Qty. of Treated WW consumed	Total Water Consumption	% use of Treated WW out of total Water Consumption
Heavy Engineering industry 1					
Heavy Engineering industry 2					
Heavy Engineering industry 3					

**12 Water Quality**

		<b>Bench Mark (as applicable)</b>	<b>Heavy Engineering industry 1</b>	<b>Heavy Engineering industry 2</b>	
Water Quality	Installation of online water quality monitoring systems.				
	Compliance with the wastewater regulatory quality discharge norms.				
	Discharging wastewater into open area/ earthen nallah /open drain/ municipal sewer?				
	Notified for violating effluent discharge norms for discharge in natural resources (surface/ground).				

Water Quality Time trend- Graphs: Compliance to Waste water discharge Quality norms (E.g. BOD / PH /COD / TSS etc.)

**13 Bench Marks/ Norms/ Standards and deviation from the norms/bench marks/standards currently for Heavy Engineering industry sector in state.**

**13(a) Benchmark for Water Consumption, Waste Water Generation etc.**

	<b>Parameters</b>	<b>Unit</b>	<b>Indian Bench Mark</b>	<b>International Bench Mark</b>
1	Specific Water Consumption	m <sup>3</sup> /tonne		
2	Waste Water generation	m <sup>3</sup> /tonne		
3	Waste Water discharged	m <sup>3</sup> /tonne		