Pre- Feasiblity Report

Contents

Chapter 1
Executive summary

1.1 Executive Summary

M/s Nandi Sahakari Sakkare Karkhane Niyamit, (NSSKH) is a cooperative society registered on 5th May 1982; under Karnataka Co-operative societies act 1959. The company stated its crushing operation for commercial production of sugar on 9th December 1992.

The main conception behind setting up the project to form a society for socio economic development of the area. The management of the plant is planning to develop its plant as integrated Sugar complex by value addition to its byproducts by installing Co-generation and distillation Plant.

The initial crushing capacity of the plant was 2500 TCD with 2.5 MW Co-gen facilities. The plant was further expanded to crushing capacity to 3500 TCD along with Co-Gen capacity of 18.14 MW. The plant was further expanded its crushing capacity of 5000 TCD. The company in the year 2nd September 2008 again increased its capacity from 5000 TCD to 6500TCD Sugarcane crushing and installation of 50 KLPD Distillery. To improve the economic viability of the existing sugar factory, the company is now proposes to expand its Sugar Unit capacity from 6500 TCD to 14000 TCD and Cogeneration Power Unit from 18.14 MW to 62.14 MW in the same factory premises with no change in distillery unit. The detail status of the project is given under Table 1.2. The surplus power produced will be exported to the public power grid. The salient features of the proposed project are given in Table 1.1

Table-1.1 Salient Features of the Project- Expansion

Sl. no	Particular's	
1	Name of the Company	M/s Nandi Sahakari Sakkare Karkhane Niyamit
2	Name Address for correspondence	Shri. R.T. Dasai, M/s Nandi Sahakari Sakkare Karkhane Niyamit , Krishnanagar, Survey No 90 & 92, Hosur Village.Taluk and District, Vijayapur , Karnataka State -587117.
3	Location of the proposed Unit	M/s Nandi Sahakari Sakkare Karkhane Niyamit , Krishnanagar, Survey No 90 & 92, Hosur Village.Taluk and District, Vijayapur , Karnataka State -587117.
4	Constitution of the Organization	Limited Company

5	Capacity of the Project	Proposed Expansion of i Sugar plant : 6500 TCD to 14000 TCD ii. Cogeneration power 18.14 MW to 62.14 MW in the existing Sugar plant and Boiler. iii. Distillery 50 KLPD (No change)			
6	No. of Working Days	Sugar : 180 Days Cogen Power Plant : 180 Days			
7	Man power	Existing : Sugar Co-Gen : 627 no's Distillery: 70 no's Total : 697 no's Proposed : Sugar & Co-Gen : 150 no's			
8	Total Land, Acres	Sugar Plant	16.8Acres		
		Co-gen Plant	3.59 Acres		
		Distillery Plant Area	3.21 Acres		
		Green Belt Area	84 Acres		
		Open Vacant land for future use	116 Acre		
		Land Available for the Sugar Complex	240 Acres		
9	Raw material requirement	**Particular's**	**Existing**	**Addition**	**Total**
		Sugar Unit	Sugarcane : 6500 TCD	Sugarcane : 7500 TCD	Sugarcane : 14000 TCD
		Co-Generation (Boiler)	Bagasse: 1950 T/d	Bagasse: 2250 T/d	Bagasse: 4200 T/d
10	Product s	**Particular's**	**Existing**	**Addition**	**Total**
		White sugar	748 T/d	863 T/d	1611 T/d
		Co-Generation Power	18.14 MW	44.0 MW	62.14MW
		Molasses	292.5 T/d	337.5 T/d	630.0 T/d
11	Fresh water Source	Permission has taken from Executive Engineer, Karnataka Nigam Ltd – Biligi for lifting water from Krishna river.			
	Fresh water requirement	484 m3/d			
12	Co-Gen Power plant Capacity		Existing	Addition	Total
		Power	18.14 MW	44.0 MW	62.14MW
		Boiler	105 TPH	240 TPH	345 TPH
13	Boiler Fuel for Co-Gen plant	During Season	Boiler along with Bagasse (up to 15%)		
		During Off-Season	Boiler along with Available Bagasse (up to 15%)		

14	Effluent treatment facility	ETP consisting of bar screen, oil separator, neutralizer, ASP with aeration & clarifier. Effluent is treated to irrigation standards.
15	APC facility to boiler	**Co-gen sugar Boilers of 105 T/h capacity & 240 T/h** Stack of adequate height and ESP/Bag filter. **Diesel gen set of 1250 KVA** Stack of adequate height, anti-vibration pads & acoustic enclosures will be provided.
16	Solid waste source and disposal	1. Bagasse: Used as fuel in boiler 2. Press mud: to farmers for as manure/soil nutrient 3. Molasses: used raw material in the captive distillery
17	Investment for pollution control facilities	Rs 600 Lakhs

1.2 Status of the Proposed Industry

Table-1.2 Status of the Proposed Industry

Sl. No.	Item	Detail
1	Company registration	M/s Nandi Sahakari Sakkare Karkhane Niyamit is incorporated in the year 9th December 1992
2	(IEM) with Govt of India	Industrial entrepreneur memoranda (IEM) are filed. i. NO. 1868/SIA/IMO/2009 ii. NO. 1903/SIA/IMO/2011
3	Land purchase permission	From District Commissioner of Bagalkot for purchase of land under section 109 of KLR Act.
4	Combined Consent order for 6500 TCD and 18.14 MW Boiler and 50 KLPD Distillery	PCB/SEO/17/CAT/127/HPI/2015-16 DATED – 20.01. 2016

Chapter-2
Introduction of the Project / Background Information

2.1 Identification Of Project

M/s Nandi Sahakari Sakkare Karkhane Niyamit, (NSSKN) is a cooperative society registered on 5th May 1982; under Karnataka Co-operative societies act 1959. The company stated its crushing operation for commercial production of sugar on 9th December 1992. The company has been successfully running Sugar industrial complexes in the State of Karnataka since 1992. The group is having its registered office at Krishnanagar, Hosur post, Vijayapur, Karnataka.

To improve the economic viability of the existing sugar industry the company is now proposing to expand its Sugar Unit capacity from 6500 TCD to 14000 TCD and Cogeneration Power Unit capacity from 18.14 MW to 62.14 MW. The surplus power produced will be exported to the public power grid.

Brief Particulars about Directors.

Nandi SSK Niyamat is managed by an elected body having 5 years term. The Name of the Directors of the Board is as follows;

Sl. No	Name	Designation
1.	Shri. K. C. Desai	Chairman
2.	Shri. D. C. Desai	Director
3.	Shri. S. B. Patil	Director
4.	Shri. U. A. Mallannavar	Director
5.	Shri. A. P Lenkennavar	Director
6.	Shri. H. S. Koraddi	Director
7.	Shri. G. K. Patil	Director
8.	Shri. G. K. Konappanavar	Director
9.	Shri. B. D. Patil	Director
10.	Shri. S. D. Sahukar	Director
11.	Shri. T. K. Patil	Director
12.	Shri. D. H. Devanal	Director
13.	Shri. P. R. Gadadan	Director
14.	Shri.B.H.Halagali	Director
15.	Shri.S.S.Biradar	Director
16.	Shri.P.B.Sarnaik	Director
17.	Shri.R.H.Bidanur	Director
18.	Shri.I.S.Koppad	Director
19.	Shri.R.H.Desai	Director

20.	Shri.R.T.Desai	Managing Director

Names, Designation of the senior officers of the factory.

S.No	Name	Designation
1.	Shri. R. T. Desai	Managing Director
2.	Shri. C. S. Hubli	General Manager
3.	Shri Sanjit Kumar	General Manager(operation)
4.	Shri. M. Dattatreya	Dy. General Manager (Dist)
5.	Shri. M. L. Pachchannavar	Dy. General Manager (Cane)
6.	Shri. L. A. Patil	Office superintendent & I/c.Secretary

2.3 Brief Description of Nature of the Project

Nandi Sahakari Sakkare Karkhane Niyamit at Krishnanagar, Hosur post, Vijayapur, Karnataka started its operations with 2500 TCD sugars with 2.5 MW on 9th December 1992 and after few years it has increased its capacity to 3500 TCD along with Co-gen capacity of 18.14 MW. The plant was further expanded to a crushing capacity of 5000 TCD.The company after few years again increased its capacity to 6500 Sugar Unit with installation of 50 KLD distillery in the year 2nd September 2008. To improve the economic viability of the existing sugar factory, the company is now proposing to expand its Sugar Unit capacity from 6500 TCD to 14000 TCD and Cogeneration Power Unit from 18.14 MW to 62.14 MW. Bagasse generated in the sugar plant is used as a captive fuel for the generation of power in co-gen plant, the surplus power produced will be exported to the public power grid, and molasses generated as a byproduct is used as a raw material in distillery unit.

2.4 Need for the project and Its Importance to the Country and Region

Belgaum, Bagalkot and Vijayapur districts of North Karnataka have excelled in sugar cane agriculture due to added irrigation facility, favorable atmospheric conditions and most suitable soil present in the area. Farmers in all Taluks of Vijayapur District have taken to sugar cane agriculture largely due to water sources availability, higher yield of sugar cane and good price for the sugar cane from sugar factories. The sugar cane in the area has also reached best levels in the country peaking to more than 13.0 % in winter and averaging to 11.5 to 12 %. The farmers in the area are also well informed and adopt modern technology and grow better varieties of sugar cane.

The proposed factory is situated near sugar cane agricultural area surrounded by sugar cane rich areas. The site is well situated east of Krishna River. The entire large area of land between the rivers is growing sugar cane as main crop, due to the assured returns from the crop.

There are 5 sugar factories nearby, namely

1. Bilagi Sugar Mill Ltd., Badagandi.
2. Prabhulingeshwar Sugar & Chemicals Ltd. Siddapur.
3. Nirani Sugars Ltd, Mudhol (Kulali Cross)
4. Jamakhandi Sugars Ltd, Hirepadasalagi.
5. Basaveshwar Sugars Ltd., Karajol.

The total agriculture of sugar cane in the district at present is about 55,000 Ha cane growing area is 37,000 Ha, the total sugar available for crushing is 29.23 Lakh Tones. There is very good potential for increasing per hectare yield and also to bring additional land into sugar cane agriculture.

The promoter felt the need for the establishment of a sugar factory in the sugar cane belt of adjacent Taluk, and is now expanding this project. They also visualized the need to provide employment to the local population and improve the overall economy of the society in the area. After studying the necessity for such a factory and the profitability of the project especially with co-generation and sale power they decided to establish a sugar factory with cogeneration in Krishnanagar, Hosur post, Vijayapur, Karnataka, the proposed site.

2.4.1 Justification for Establishment of the Industry

There is large potential to grow sugar cane in the Taluk. Sugar cane grown in the District is transported to other regions as there is much excess of sugar cane is available, than what the factories can crush and as such the farmers are put to loss. The sugar industry being agro based, serves as powerful medium for upliftment of the socio economic conditions of the farmers in the area of operation.

Agro climatic conditions like soil, water, solar radiation, rainfall, relative humidity and temperature within the state of Karnataka Particularly Vijayapur Taluk and district for under taking sugarcane cultivation are most suited. The experience of the already existing sugar factory is economically viable mainly because the sugar recovery is high in the zone.

2.5 Demand Supply Gap, Imports V/S Indigenous Production

The main raw material required for manufacture of sugar is sugar cane, which is obtained from agricultural produce existing in the region of the factory. Chemicals such as lime, phosphorous acid etc., are used in the process of purification of sugar cane juice. Sodium chloride, hydrochloric acid and caustic soda are used in water treatment. Chemicals and consumables will be obtained from Bangalore or Chennai.

Sugar is the main product in the industry. However, bagasse, molasses and press mud are produced as by-products in the process. Bagasse is used as fuel in the generation of captive

electric power. The bagasse produces in the industry is consumed as fuel lint the boiler. Other products like press mud and molasses, are advantageously utilized for profitable applications. Press mud is used as manure in agriculture. Molasses is used as raw material for manufacture of ethanol.

Table-2.1 Sugar Estimates for India

Particular	Quantity of sugar in lakh tons		
	2012-13	2013-14 (average of last 3 yrs)	August,2014 (Oct.2013 toAug.2014)
Opening Sugar stock	66.01	93.07	-
Production	251.83	252.55	241.31*
Imports	17.18	7.83	10.27*
Availability	335.02	353.45	-
Total Export	11.95	25.83	25.68*
Total Available for domestic consumption	323.07	327.62	-
Consumption	230.00	235.00	-
Ending Stock	93.07	92.62	-

(Source: Department of Food &Public Distribution, Dept. of Commerce)

Table-2.2 Trade Data of India for Last 5 Years

Year	Export, LT	Import, LT
2009-10	0.42	25.51
2010-11	17.11	11.98
2011-12	27.38	0.99
2012-13	27.91	11.21
2013-14	24.60	8.81

(Source: Department of commerce)

2.6 Employment Generation

The existing manpower in the industry is 697 no's (Sugar Co-Gen and Distillery), 627 no's all alone for Sugar Co-Gen. The additional direct man power to the industry after expansion programme will be 150 no's. The employees will be recruited from the local source and they will be residing in the local villages. Apart from this more than 500 manpower will get indirect employment opportunities in terms of transportation, vehicle maintenance and agriculture sugar cane cultivation.

Chapter-3
Project Description

3.1 Type of Project

Nandi Sahakari Sakkare Karkhane Niyamit is an integrated sugar industrial complex consisting of sugar 6500 TCD and 18.14 MW co-generation unit with 50 KLPD Distillery Unit. It is located in Krishnanagar, Hosur post, Vijayapur, Karnataka. Now project proponents have proposed to expand its Sugar Unit capacity from 6500 TCD to 14000 TCD and Cogeneration Power Unit from 18.14 MW to 62.14 MW. The surplus power produced will be exported to the public power grid.

Interlinked/Independent Project

Sugar cane crushing with sugar manufacture and co-gen power generation in the integrated co-gen sugar industrial complex are interdependent operations. Bagasse generated in sugar unit is utilized as fuel in the co-gen power unit. Similarly, the power generated in co-gen unit is utilized in the sugar unit.The molasses generated in the sugarcane is utilized in the Distillery Industry.

3.2 Location of the Proposed Project

3.2.1 General Location

Nandi SSK Niyamat, is located at a distance of about 5 Kms from Galagali Village, and Bagalkot is at 47 Kms (S), Jamakandi is at a distance of 20 Kms (W), Biligi at a distance of 20 Kms (SE) and Mudhol at a distance of 23 Kms (SW), SH- 55 is at west of the industry. The district headquarters is Vijayapur which is about a distance of 48 KM (N). The location of site in the district map of Vijayapur is shown in Figure-3.1. The location details of the site are given in Table-3.1.

The factory is geographically located at 75^{O} 28’ 46.05” East longitude and 16^{O} 27’ 00”North latitude and an elevation of 537 meters above MSL. The factory is surrounded by agricultural lands with sugar cane as main crop. The total command area for the factory is 240 Acres and presently factory crushing only 6500 tones per day in past 5 years.

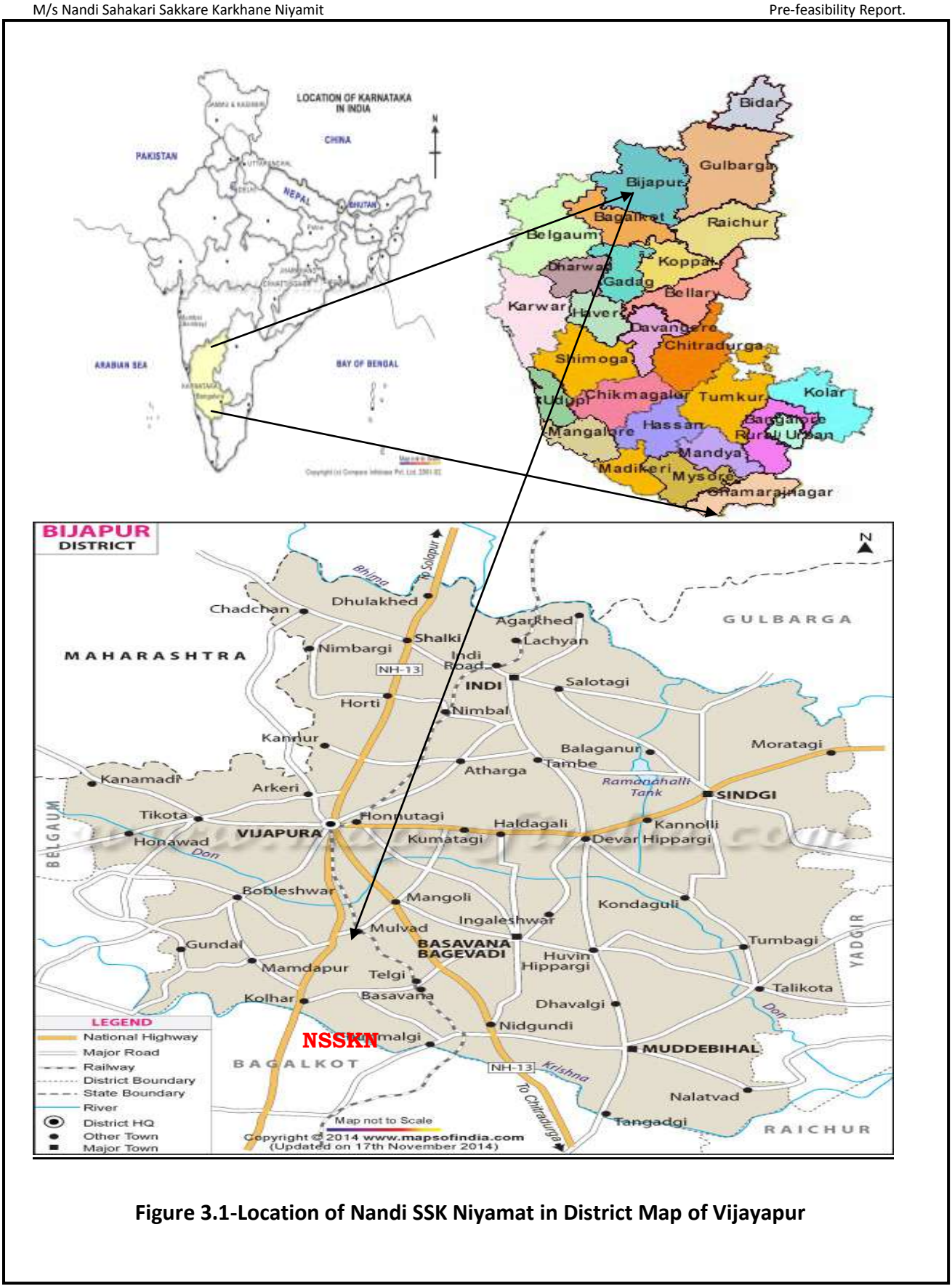

Figure 3.1-Location of Nandi SSK Niyamat in District Map of Vijayapur

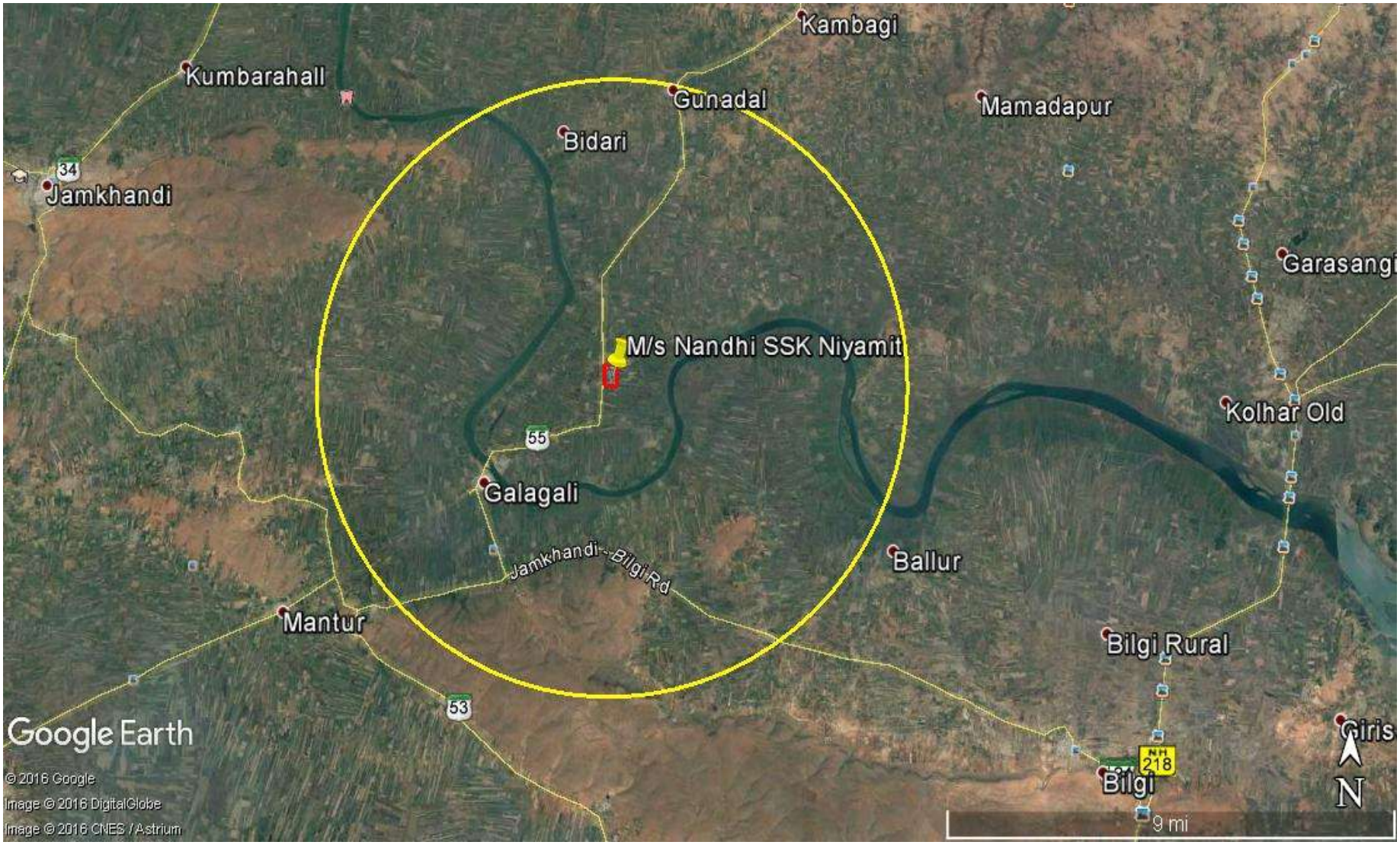

Figure-3.2 (a) Satellite View of the Study Area with Site Location

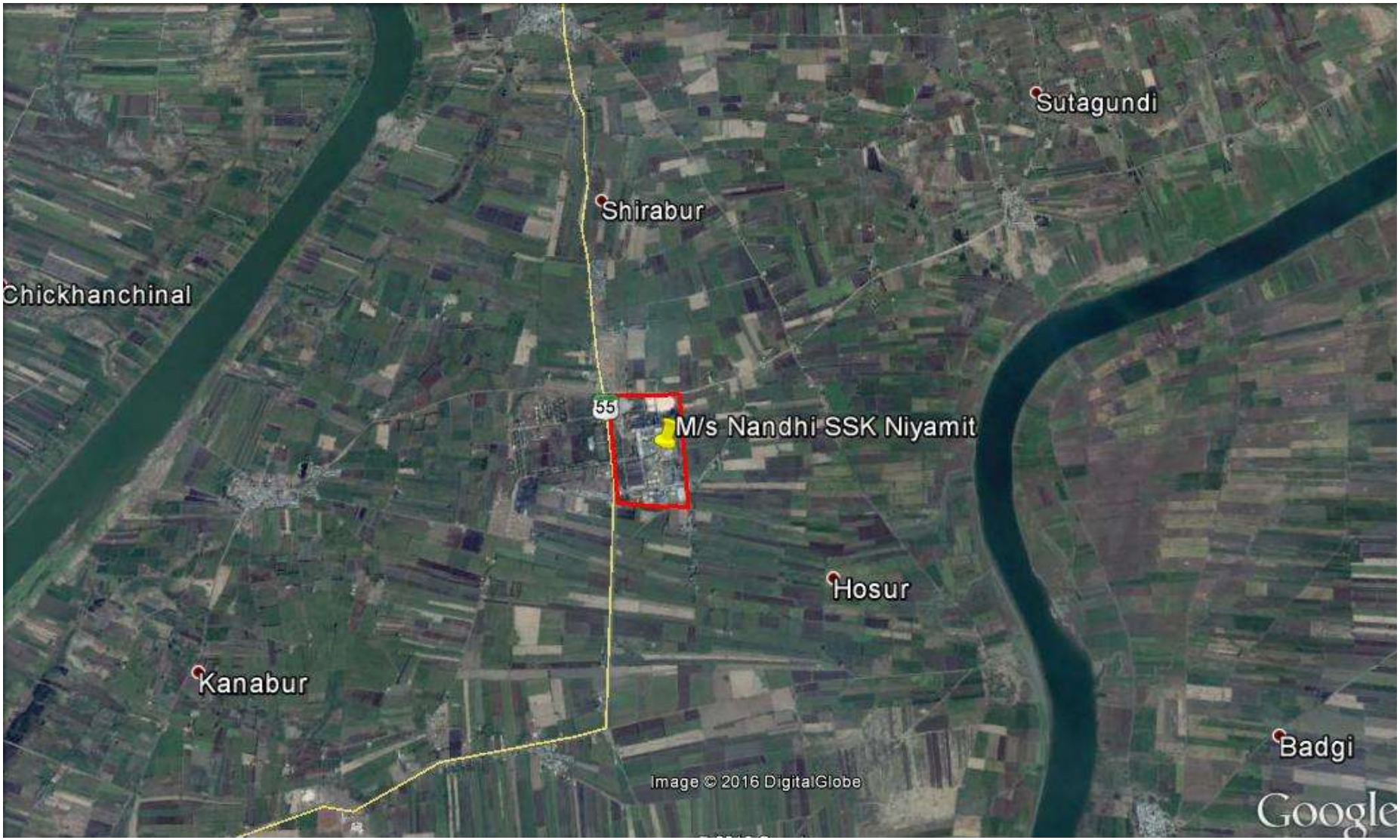

Figure-3.2 (b) Satellite View of the Project Site

Table-3.1 Location Features of the Site

Sl. No.	Feature	Particulars
1.	Name of the Industry	M/s Nandi Sahakari Sakkare Karkhane Niyamit
2.	Location of the Industry	Survey Nos. 90,92, Krishnanagar ,Hosur Post, VijayapurTaluk and District, Karnataka State
3.	Latitude / Longitude Altitude	75^{O} 28' 46.05" East and 16^{O} 27' 00" North 537 m above MSL
4.	Toposheet	47 P/6, 47 P/7, 47 P/10, 47 P/11.
5.	Present use of land	The Factory Site (Existing) is an industrial land surrounded by rain fed dry agriculture lands.
6.	Daily average temp. in ^{0}C	Min: 9.7 ^{o} C- 16.1^{o} C during January. Max. 31.8 ^{0} C- 39.9^{0} C during May
7.	Relative humidity	72.8 %
8.	Annual rain fall in mm	400 to 700 (Average 620.44mm)
9.	Predominant wind & direction	5.8 to 7.6 km/h, predominantly from W and WSW
10.	Soil type	Majority of the soil are Black Cotton which are suitable for the cultivation of sugarcane crop.
11.	Topography	Moderately undulated topography with small hillocks.
12.	Nearest highway	SH 55 (W)
13.	Nearest railway station	Telgi Railway station, Bagavadi Road - 55 KM (E)
14.	Nearest airport	Belgaum - 120 KM (SW) & Hubli - 130 Kms (SW)
15.	Nearest village	Jambagi - 2 KM (S)
16.	Nearest City	Bagalkot - 36 Km (S) Vijayapura (Bijapur) - 48 KM (N)
17.	Nearest industry	Pabhulingeshwara Sugars and Chemicals Ltd, siddapur – 27 Kms
18.	Nearest water body	Alamatti Reservoir – 1.5 Km (E) Krishna River Bank -1.5 Km (E)
19.	Environmentally sensitive locations such as Archaeological structures, Historical places, Protected forests, Sanctuaries, and Sensitive bio-spheres	None within 10 Kms
20.	Seismic characteristics	Seismic Zone-II as per Indian Seismological Institute (relatively safe region)

3.2.2 Specific Location

The proposed industry at survey no 90, 92 Krishnanagar, Hosur Post, Vijayapur Taluk &district, Karnataka State. The location is adjacent to State Highway 55, the area is a rain fed dry agricultural land converted to industrial use. Google map showing the project boundary & site location is given in Figure 3.2

3.2.3 Basis for Selection of Project Site

The proposed project is expansion of the existing industry and in the same premises and therefore no alternate sites are considered. The existing land area is adequate. There will be no changes in land cover or topography due to the project. The choice of the project site for the existing and proposed industry confers several advantages, as listed below;

1. The site is in the vicinity of sugar cultivation area. The lands are irrigated through river and dam canals. The site is well connected to sugar cane cultivation lands through tar and metal roads.
2. Climatic condition is good for sugar cane cultivation and human settlement.
3. The site is well connected to the hinder land through district, state high ways. Jamakandi, Belgi, Mudhol and Bagalkotare at a distance of 20 km, 20 km, 23 km and 36 km respectively. They are connected to the site through well developed tar roads.
4. Water requirement to the industry is met from Krishna River. Water drawl permission for is available from Executive Engineer, Karnataka Nigam Ltd – Biligi for lifting water from Krishna River. Permitted water limit is adequate even after the expansion.
5. No incidence of cyclone, earth quake, and earth quake and land slide has been reported.
6. Social infrastructure facility such as education institutes, hospital, banks, housing, recreational, marketing are available at Kollegal, Mandya, Mysore and other near by towns.
7. There are no eco-sensitive locations such as national park, wild life sanctuary, bio-sphere reserve with in 10 km from the site. However, the perennial river Krishna is around 2 km from the site.

3.3 Size and Magnitude of Operation

3.3.1 Land Utilization

Existing land area for the Sugar Complex is 240 acres. The area occupied by the existing Sugar plant is 17.8 acres and Cogeneration plant is 4.5 acres, Distillery plant is 4.2 Acres and general Buildings are 13.5 acres, Green belt area is 84 acres. The remaining land area utilized for irrigation of treated effluent water to the Sugarcane. The utilization of land is given below. Expansion is planned only with the existing plant & machineries and infrastructure location by

improving the process and operation. Hence, even after expansion the land utilization will remain the same.

Land Utilization for the industry

Sl. No.	Application of land	Land Utilization, Acres	
		Present	**After expansion**
1	Built up area	40	80
2	Greenery and green belt	84	84
3	Vacant land for future development	116	66
	Total land area	**240Acre**	**240Acre**

3.3.2 Man Power

Operation Period

The existing manpower in the industry is 697 no's (Sugar Co-Gen and Distillery), 627 no's all alone for Sugar Co-Gen. The additional direct man power to the industry after expansion programme will be 150 no's.

Construction Period

Total manpower requirement during construction will be 100. Most of the labour force is available locally and they reside in villages.

Skilled and unskilled labourers and experienced in co-gen sugar industry and distillery are locally available around the project location. More than 85 % of the manpower requirement will be met from the local source.

3.3.3 Housing Facilities

The company will provide residential facilities to the essential workers and staff. Most of the workers come from nearby villages. A total of 140 quarters are already provided and proposed additional 50 no's quarters. These will accommodate construction workers during construction phase and regular employees during operation phase. These quarters will be provided will all civic amenities.

No of residential quarters : 140 no's (Existing)
: 50 no's (Proposed)
Persons residing in quarters : 760 no's (expected)

3.3.4 Resources Consumed

1. Sugar cane : 25.2 Lakh T/yr
2. Water drawn from Krishna river : Average 500 m3 /d
3. Molasses (from captive source) : 1,13,400 T/yr
4. Power 16 MW (captive source)
5. Fuel- Bagasse (Captive source) : 7,56,000 T/yr

3.3.5 Sugar Cane Cultivation Area

Sugar cane cultivation area is about 37,000 hectares spread in about 30 km distance from the site.

3.4.6 Transportation

1. Personnel

During construction a maximum of about 100 persons will be attending industry including, construction works, suppliers of material and related activities during the construction period. They use company vehicle facilities, public transportation and own vehicles. A total of about 8 buses/ cars and about 20 two wheelers will visit the industry for transportation of personnel.

During operation a maximum of about 847 persons are attending the industry (Sugar-Cogen and Distillery and Also Proposed expansion) including employees, and about 100 persons involving farmers and other visitors. A total of about 40 buses/ cars and about 80 two wheelers will visit the industry for transportation of personnel.

2. Material

A maximum of construction material transported per day will be about 20 loads gravel, 40 loads sand, 40 loads boulders/jelly/bricks and 2 load steels in addition to about 5 loads of plant machinery.

During operation, a maximum of about 44 loads/hr (533 loads/d) of lorry/tractor/carts are moving to the industry to carry raw material sugar cane, products, sugar, bio-manure, alcohol and other material. In addition about 10 lorry/tractors are working in the industry for internal movement of material.

3.3.7 Bulk Storage Facilities

1. Storage yards for :
   Storage of Bagasse – 6000 Sq. m (100m x 60 m)
   Press mud – 600 T and
   Boiler ash- 80 T

2. Sugars go down for storage :
   04 No's 7744 Sq. m (88 m x 22 m).
   03 No's 5280 Sq. m (88m x 20 m).
   01 Nos 3872 Sq. m (88 x 44m)

3. Molasses storage tanks 05 No's, (3 no's with Dia 20 and Area 628 Sq.m & 02 No's with Dia 24 and Area 754 Sq.m).

4. Water reservoir - 3600 m3

3.3.8 Waste Generation from the Project

Liquid gaseous and solid wastes generated from co-gen sugar unit are listed below. Management of these wastes is discussed as follows.

1. Waste Water

Co-Gen Sugar Unit

- Domestic waste water
- Industrial waste water
- Excess condensate water

2. Gaseous Missions

Co-Gen Sugar Unit

- Boiler flue gases
- Smoke from diesel generator
- Fugitive emissions

3. Solid Wastes

Co-Gen Sugar Unit

- Bagasse
- Press mud
- Molasses
- Boiler ash
- Lime sludge
- ETP sludge

3.3.9 Project Investment

Total capital investment on project will be **Rs.35,600** Lakhs and the investment on Environmental management plan will be Rs 600 Lakhs, Recurring cost on EMP will be about 75 Lakhs per year.

3.4.0 Technology and Process Description

The integrated sugar industrial complex after its expansion will consist of following associated manufacturing units.

Sl. No.	Units	Existing Capacity	Addition Capacity	After expansion Capacity
1	Sugar unit	6500 TCD	7500	14000 TCD
2	Cogen power generation	18.14 MW	44 MW	62.14 MW

3.4.1 Manufacturing Process for Sugar Unit

Sugarcane is the raw material for manufacture of sugar. Juice is extracted from sugarcane, which is then processed to recover sugar. Bagasse, which is the left out fiber material after extraction of juice from sugarcane, is used as fuel in boiler to produce steam. Steam is used in sugar plant for evaporation of juice to recover sugar and in power plant for generation of captive electric power. A flow diagram for production of sugar and a process flow chart with material balance are given in Figure 3.4 and Figure 3.5, respectively. Plant details of the co-gen sugar unit are given in Table 3.3. A brief description of the process is given below:

i. Crushing Of Sugarcane

Sugarcane is harvested in the fields, dressed and bundled in small bundles, stacked in Lorries, and tractor trailers supplied to factory is weighed and crushed in a set of mills. Crushing takes place mainly in two stages: first the preparation and then milling. Sugarcane is prepared by passing through leveller, cutter and fibrizer. The prepared cane is then crushed by passing through 4 sets of mills. Hot water is added in the course of crushing as imbibition water for better extraction of juice from sugarcane. After crushing, the bagasse is sent to boiler as fuel and juice is sent for clarification and recovery of sugar.

ii. Juice Clarification And Concentration

The weighed quantity of juice is primarily heated to 70-75 ^{0}C in juice heaters. It undergoes a process of lime treatment and sulphitation with the addition of lime and sulphur dioxide, respectively. The juice is heated again to 105 ^{0}C in another set of juice heaters. The hot juice with 15% solids is decanted out from the clarifier and sent for evaporation in a set of multiple effect evaporator bodies. In the evaporators the juice is concentrated into syrup of 60% solids. Sludge from juice clarifier is filtered to separate solid impurities as press mud.

iii. Crystallization

The syrup from evaporators is taken to pans for boiling where the syrup concentrates and attains super saturation stage. In such a condition sugar grains are formed in the syrup. The syrup mass with sugar particles is called massecuite. The massecuite is dropped in crystallisers and cooled to complete the crystallization.

iv. Centrifuge

Massecuite is taken into the high speed centrifuge. Sugar crystals are separated form mother liquor in the centrifuge. Non crystallisable matter from the syrup, called molasses, is drained out from the centrifuge. The molasses is weighed and sent to storage tank. The wet sugar from centrifuge is sent to driers.

v. Drying, Grading and Bagging.

Sugar is dried in the vibrating tray drier and graded by passing though standard sieves. The graded sugar is bagged, weighed, stitched, numbered and stacked in sugar godown.

3.4.2 Co-Gen Power Unit

i. Steam Generation

The industry is already provided with high pressure boiler with a capacity 105 TPH at 67 kg/cm2 pressure and 510 ^{0}C temperature and now proposed an additional boiler of capacity 240 TPH at 87 kg/cm2 pressure and 510 ^{0}C. Steam is required for both power and sugar plants. The boiler is designed to operate on bagasse, agro waste based bio mass and coal. Bagasse is available from sugar plant as captive source. The flue gas from the boiler is passed through ESP to free it from suspended particles and then vented through a stack of adequate height. The boiler ash is quenched and is sent to bin through belt conveyor. Bagasse from mills or storage yard is sent to boiler through mechanical conveyor.

ii. Electro Static Precipitator

The boiler is equipped with high efficiency three fields Electro Static Precipitator, which removes the suspended particles and ash particles from the flue gas. The efficiency of the precipitator is around 99.0% and the dust concentration at the outlet of the ESP will be less than 50.0 mg/Nm^3.

iii. Chimney

A chimney of 65 m height is constructed to dissipate the flue gas and this height has been considered taking only bagasse into account. An Addition of Chimney with suitable height is proposed for the expansion.

iv. Electricity Generation

The high pressure steam from the boiler is passed through the double extraction cum condensing type of turbine to generate 62.14 MW. The turbine is run by the high pressure steam which in turn rotates alternator. The electric power produced is used to meet the captive power requirement of the sugar industry and co-gen plant. Surplus power from the industry is exported to power grid through distribution grid. The steam extracted at reduced pressure from turbine is used in sugar plant to meet its process requirement.

The boiler and the turbo generator scheme meets the entire Sugar process steam and the power requirement for the both Sugar & Cogen plants and results in surplus power for export to Power Grid.

Energy efficiency and the export of power to the grid are made possible by the employment of high pressure and high temperature steam cycles.

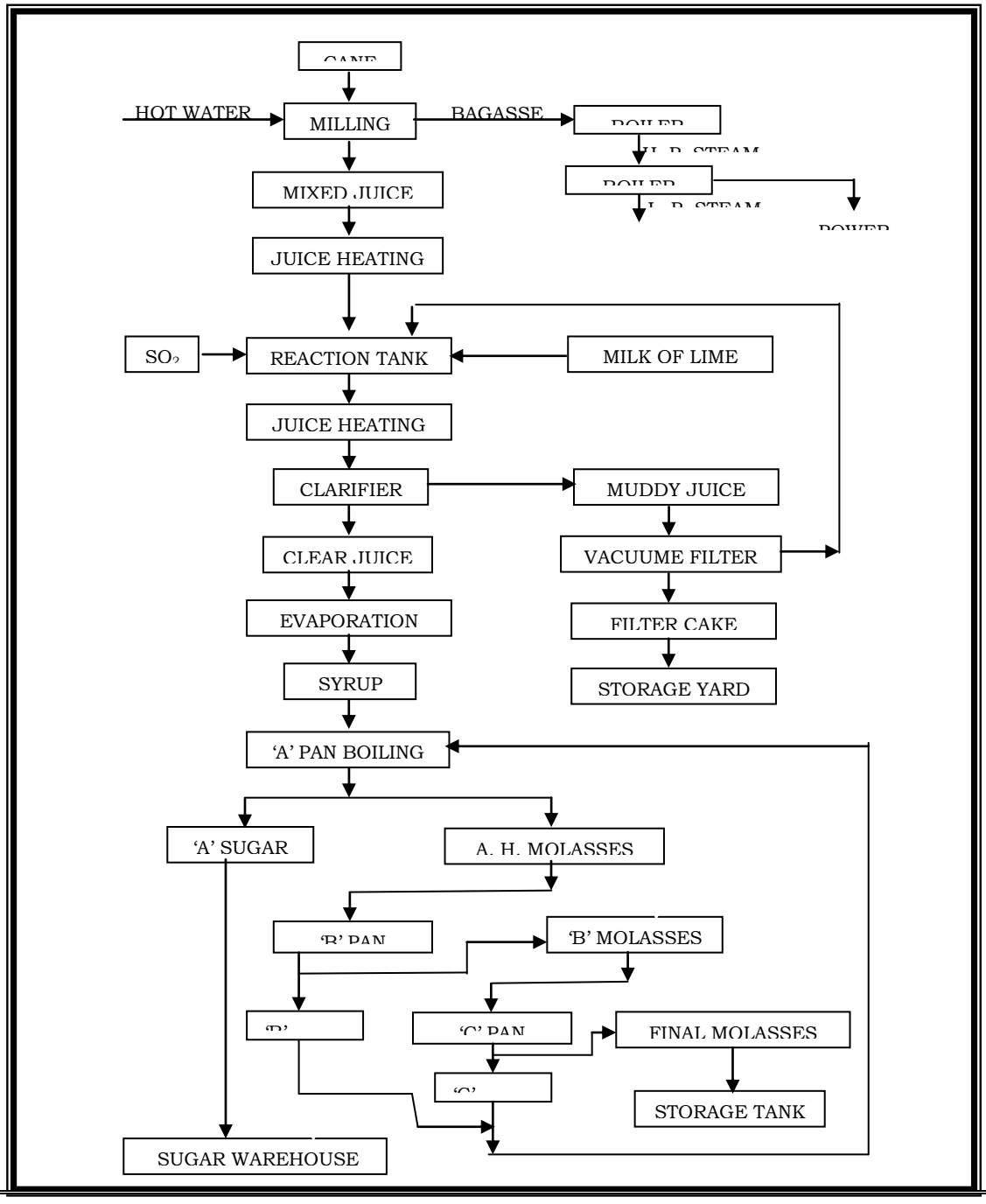

Figure-3.3 Flow Chart for Manufacture of Sugar

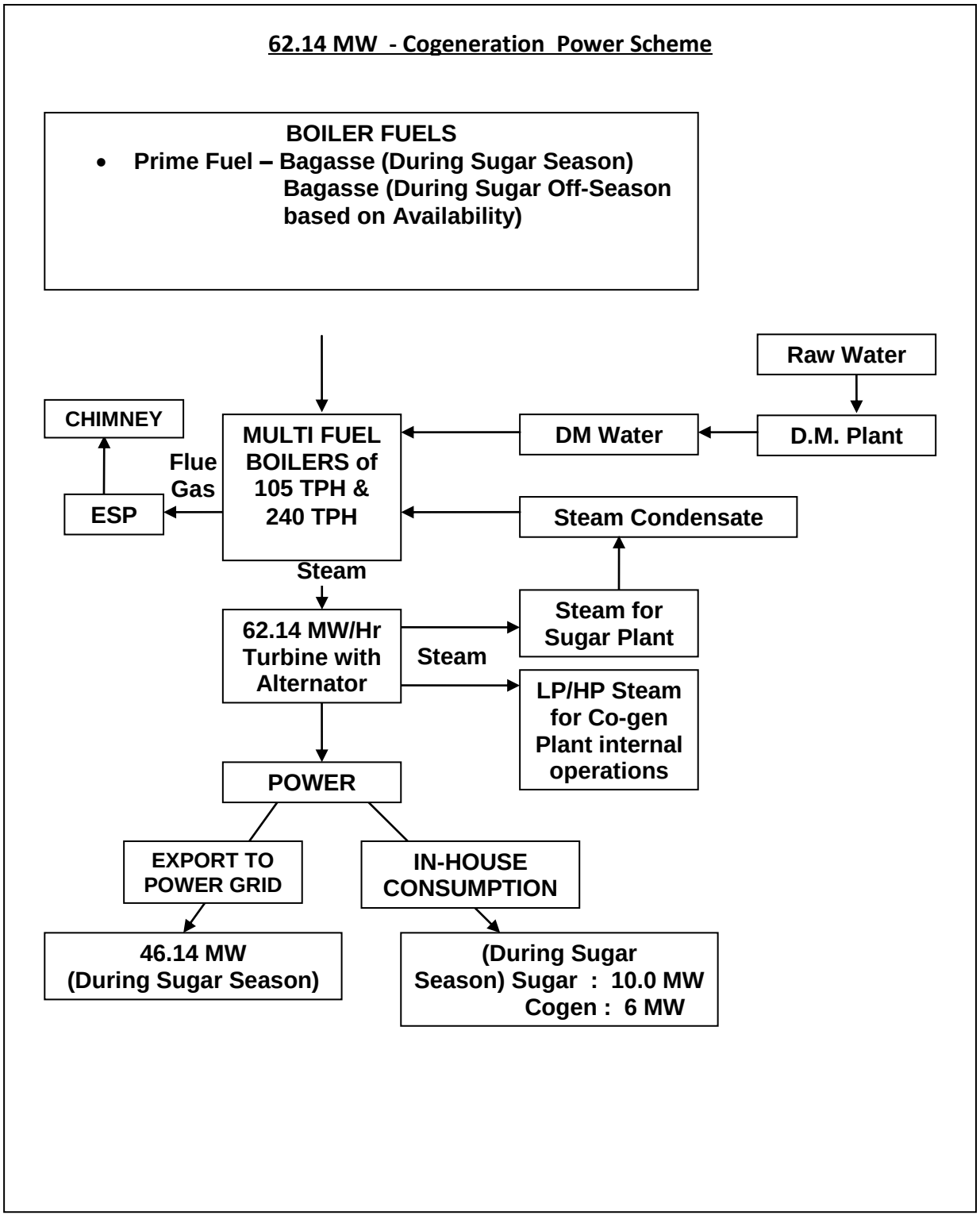

Figure-3.4 Process Flow Chart for Co Gen Power Plant

3.5 Raw Material and Products.

1. Co-gen sugar unit

The main raw material required for manufacture of sugar is sugarcane, which is obtained from agricultural source existing in the region of the factory. Chemicals such as lime, Sulphur, phosphoric acid etc. are used in the process for purification of sugarcane juice. Lubricating oil and grease are also used as consumables in the industry. Chemicals and consumables are locally available in the country. The details of raw materials and products are given in Table 3.2.

Sugar is the main product in the industry. However, bagasse, molasses and press mud are also produced as by-products in the process. Bagasse is used as fuel in the boiler for production of high-pressure steam, which in turn is used in generation of captive electric power. Major part of the bagasse produced in the industry is consumed as fuel in the boiler. Other products viz., press mud and molasses, which once thought to be waste products, are now advantageously utilized for profitable applications. Press mud is used as manure in agriculture. Molasses is used as raw material for manufacture of ethanol and other products.

Table-3.2 Raw Materials and Products for Co-gen Sugar Unit
(After proposed expansion)

Sl. No	Item	% of cane	Quantity, T/d	Storage facility	Transportation
1	**Raw Material**				
	Sugarcane	100	14,000	Cane yard	Lorry, tractors & bullock carts
2	**Consumable chemicals**				
	Lime	0.2	28	60 T, Go-down	Lorry
	Sulphur	0.05	7	250 T, Go-down	Lorry
	Phosphoric acid		0.25	15 T, 50 kg carboys	Lorry
5	**Product,** Sugar	12	1680	Go-down, 50/100 kg bags	Lorry
6	**By products**				
	Bagasse, 50% moisture	30	4200	Closed Yard	Belt conveyor
	Press mud, 75 % moisture	4	560	Yard	Tractors
	Molasses, 10 % moisture	4.5	630	M.S. tank	Lorry tanker

3.6 Source and Requirement of Fuel

The Boiler of 105 T/h and 240T/h are fired with bagasse, Cane Trash (Biomass if available) and with coal in case of necessity. Total requirement of exclusive fuel as bagasse for running of the boiler will be around 4200 T/d during season and off season. Bagasse is available from sugar plant as captive source. Cane trash also will be utilized as per its availability.

Parameter	**Season and (Off-season based on Bagasse availability)**			
Boiler Capacity	**Parameter**	**105 T/h of steam**	**240 T/h of steam**	**Total**
Fuel Characteristics	Fuel	Bagasse		
	GCV Kcal/kg	2270		
	Ash contact	2.0 %		
	Steam / fuel ratio	2.4 T/T		
	Sulphur content	0.01 %		
Fuel utilization (Season and off- season)		1050 T/d	2400 T/d	3450 T/d
Ash from Boiler		21 T/d	48 T/d	69 T/d

Bagasse within the factory premise transferred to the Cogeneration Boiler through enclosed belt conveyors to avoid any fugitive emission. Adequate capacity of covered storage yard provided for bagasse storage. Production of ash from the boiler will be about 69 T/d during season and off-season, when the boiler is operated for power generation. The ash during sugar season and off-season mixed with Sugar plant press-mud and issued to farmers as manure.

3.7 Steam and Power

3.7.1 Co- Gen Sugar Unit

After the expansion of the existing 18.14 MW Cogeneration power plant to 62.14 MW,
The generation and utilization of power is given in Table-3.3

Table-3.3 Generation & utilization of power

Power Particulars		**Season and (Off-season based on Bagasse availability)**		
		Existing	**Addition**	**Total**
Stem generation at Boiler		105 TPH, 67 ATA , 510 ^{o}C	240 TPH,87 ATA , 510 ^{o}C	--
Power Generation		18.14 MW	44 MW	62.14 MW
In house power utilization	Sugar	4 MW	6 MW	10 MW
	Co-Gen	2 MW	4 MW	6 MW
Power Export		12.14 MW	34 MW	46.14 MW

3.7.2 Diesel Generator

A diesel generator of 1250 KVA is provided with 30 m height (AGL) Chimney. The D. G. set is operated only during the emergency of power failure to run the essential services.

3.8.4 HESCOM Power

The industry has permission to draw 6000 KVA from HESCOM source. During shortage or non-availability of power supply from captive power plant source, the power will be drawn from HESCOM Power source. The industry has provided power receiving station and transmitter to receive the power.

3.8 Source and Quantity of Water

Co-gen sugar unit are water intensive and utilize large quantity of water for use in process, cooling water purge, boiler feed water make up and domestic applications. The utilization of fresh water will be considerably reduced by incorporating various conservation measures.

Large quantity of recycle water is available as condensate water from juice evaporator in the case of sugar unit. This is will be treated and then reused as source of water in the industry. The source and quantity of fresh and recycled water at co-gen sugar and distillery units is given in Table- 3.4. Permission has taken from Executive Engineer, Karnataka Nigam Ltd – Biligi for lifting water from Krishna River.

Table- 3.4 Source Quantity of Fresh and Recycle Water

Source of Water	Co-gen Sugar Unit, Quantity, m^3/d		
	Existing Unit	Proposed Unit	Total
Permission obtained from Executive Engineer, Karnataka Nigam Ltd – Biligi for lifting water from Krishna river	212	273	485
Recycle water obtained as condensate from juice evaporator in case of sugar unit.	4615	5325	9940

3.8.1 Fresh Water From River Source

Fresh water is required in the co-gen plant for boiler feed and condenser cooling water make up and in the sugar plant for process application, domestic use, and gardening. The quantity of water required by the industry will be from Karnataka Nigam Ltd. The raw water will be is stored in the reservoir located at the highest level of the project site.

3.8.2 Fresh Water Treatment

The water has to be treated in a suitable water treatment plant. The extent of water treatment required for different applications is given below.

Boiler feed	: De-mineralized water
Cooling water	: Soft water
Domestic use	: Clarified, filtered and chlorinated
Gardening	: Raw water
Process in sugar plant & distillery	: Soft water

Raw water from Karnataka Nigam Ltd., is pumped to the main water reservoir of 3600 m3 capacity. The reservoir is a rectangular tank constructed of stone masonry/RCC. The tank is divided in to three compartments by internal partition walls. The bottom flooring of each compartment is V shaped with central discharge gutter running along the length of the compartment for easy drainage of accumulated sludge. During rainy days the tank also serves the purpose of settling and clarification of the turbid water.

The water from reservoirs is pumped to chemical mixer and then to mechanical clariflocculator. The clarified water is collected in a clarified water treatment plant for further treatment. The clarified water is then passed through pressure filter and then water softening plant. The soft water is collected in soft water storage tank for use in cooling water make up and sugars plant and distillery applications. Part of the filter plant outlet water is directly taken to demineralised plant for use in boiler feed water makeup.

Water requirement for domestic use is drawn from filter plant outlet and collected in an overhead water storage tank. Chemicals such as lime, sodium carbonate, caustic soda, bleaching powder, flocculants and hydrochloric acids are used in water treatment plant.

3.9 Water Utilization

Utilization of fresh and recycle water at co-gen sugar along with Water balance for co-gen sugar unit is given in Table-3.5.

Co-Gen Sugar Unit

Recycle Water

Sugar cane contains about 70 % of its weight as inherent water. Sugar cane is crushed in mills along with added 30 % added imbibition water. Juice collected from mills is clarified. 30 % of the water present in sugar cane (as % on sugar cane weight) will end up in bagasse (15 %), molasses, and press mud and lime sludge together (5 %) and as vapor loss in mills and centrifuge (5%). The remaining water (70 % on sugar cane weight) is recovered as condensate water by vaporization of juice in evaporators and pan boiling. Total condensate

water recovered from evaporation of juice in the sugar unit of 14000 TCD will be 2330 m3/d. The water, thus recovered is utilized in sugar industry as recycle water for use in imbibitions, cooling water make up, filter wash, lime flaking etc.

Fresh Water

The requirement of fresh water to the project is considerably reduced by adoption reduce, recycle and reuse measures. Fresh water is needed for use as boiler feed water make up, auxiliary cooling tower make up and domestic needs. Total fresh water requirement for the co-gen sugar unit will be 485 m3/d. Permission has taken from Executive Engineer, Karnataka Nigam Ltd – Biligi for lifting water from Krishna River.

Table-3.5 Water Balance for Co-Gen Sugar Unit, m^3/d

Sl. No	Particulars	6500 TCD & 18.14 MW Co-Gen	14000 TCD & 58.14 MW Co-Gen
1	**Water into system, m3/ d**		
1A	Source : Fresh water from river	212	485
	Usage : Domestic use in factory	50	137
	Laboratory	02	02
	Water Treatment plant	160	346
	Total	**212**	**485**
1B	Water from sugar cane at 70 % of cane	**4615**	**9800**
	Total 1A and 1B	**4827**	**10285**
2	**Water out of system, m3/d**		
2A	Effluent		
	Domestic sewage (80 % of water used)	40	110
	Factory effluent including floor wash & laboratory waste water	650	1400
	WTP drain	48	104
	Cooling tower blow down	492	1060
	Boiler Blow down	48	104
2B	Excess vapor condensate recycled back	1082	2330
2C	Water going along with Bagasse (losses at 15%)	975	2100
2D	Water going along with press mud & Molasses (losses at 3%)	185	420
2E	Losses		
	Vapor & drift from cooling tower	750	1400
	Vapor & drift losses at bearing tower (Mill and Turbine) cooling tower	112	161
	Steam losses at traps & vent at 3 % on cane	195	420
	Domestic water loss	10	27
	Vapor loss at crystallization & centrifugation (losses at 2.64 %)	140	369
	Flash vapor loss at clarifier (losses at 1.0 %)	50	140
	Vapor loss at mill (losses at 1.0 %)	50	140
	Total of 2A, 2B, 2C, 2D & 2E	**4827**	**10285**

3.10 Sources of Pollution and Their Mitigation Measures

The main objective of mitigation measures is to conserve the resources, minimise the waste generation, treatment of wastes, and recovery of by-products and recycling of material. Pollution sources are mainly due to generation and disposal of liquid, gaseous and solid waste products. The project itself will be incorporated with built in measures for waste minimisation, resource conservation and safe operation.

Built in Pollution Mitigation Measures in Industry

1. Recovery and reuse of inherent water present in sugarcane.
2. Complete recycle of vapour condensate water with cooling water.
3. Use of gotan lime instead of lime to avoid lime sludge.
4. Treatment and reuse of vapour condensate for reuse as boiler feed.
5. ESP and stack for air pollution.
6. Dust control in sugar grader unit.
7. Spent oil and grease recovery in mill plant.
8. Use of hot vapour-condensate for imbibitions in mill.
9. Use of mechanical seals in pumps to avoid liquid leakages and noise.

3.11 Effluent Management

3.11.1 Quantity of Effluent

Domestic Effluent

Domestic effluent is generated from residential quarters, factory canteen, rest rooms etc. The quantity of domestic effluent at different sources is given below.

Residential quarters : 190 no's
Number of persons 4/ quarters @ 135 lpcd : 102 m^3/d

Factory canteen & Rest room washings
in Co-gen sugar unit (777 no's @ 45 KLPD) : 35 m^3/d
Total water requirement : 137 m^3/d
Domestic sewage (80 % of water used) : 109.6, App 110 m^3/d

Co-Gen Sugar Unit

In plant measures adopted in the factory as enumerated elsewhere to reduce the quantity and contamination of waste water. Oil traps are provided in the mill house to minimize the contamination of oil and grease in the waste water. Small lumps are provided at suitable

location in the factory to receive the leakages, juice and syrup, which may be present at pumps and near some process equipment. The leakage of juice and syrup thus collected is recycled to process. Floor cleaning is done by dry baggage to minimize the quantity of waste water. Further hot condensates obtained from evaporators are recycled to the process to meet the requirement of imbibitions etc. in the process, and also to meet the makeup water requirement for cooling tower.

Evaporators, juice heaters, pans etc. are cleaned once in 50-60 days for removal of scale. To avoid shut down of production stand by evaporator and heaters are provided in the plant. These equipment's are cleaned periodically. Chemicals such as caustic soda, Sodium carbonate and hydrochloric acid are used for scale removal. Cleaning day effluent is highly contaminated with BOD, suspended solids and TDS. Cleaning day wastewater is discharged to drains along with other effluents and then lead to effluent treatment plant.

Plant washings, cooling water purge, boiler blow down and pump sealing are the plant effluents generated in co-gen sugar unit. The total quantity of effluent generated is 2668 m^3/d, further the quantity of condensate water generated after re-use in the plant is 2330 m^3/d. The quantity of effluent generated from different source is given in above water balance chart.

3.11.2 Characteristics of Waste Water

Co-Gen Sugar Unit

The waste water generated in sugar factory is relatively less toxic and less hazardous. Further the sugar processing does not involve any process water discharges. The waste water generated is mainly due to washing of floors and equipment in addition to boiler and cooling water purge.

Waste from domestic source is received in septic tanks. It has low dissolved solids and moderate BOD. The overflow from septic tank is sent to effluent treatment plant.

Evaporators, juice heaters, pans etc. are cleaned once in 50-60 days for removal of scale. To avoid shut down of production stand by evaporator and heaters are provided in the plant. These equipment's are cleaned periodically. Chemicals such as caustic soda, Sodium carbonate and hydrochloric acid are used for scale removal. This is highly alkaline and contains high concentration of BOD, suspended solids and TDS. This waste water is discharged to drains along with other effluents and then lead to effluent treatment plant. The characteristics of these effluent streams are given in Table-3.6.

Table-3.6 Characteristics of Waste Water

Parameters	Domestic	Sugar plant	Sugar condensate
Flow rate, m^3/d	50	370	850
Temperature ^0c	32	38	72
pH	7.2	5.5	6.6
TDS, ppm	640	2270	368
SS, ppm	56	88	36
BOD, ppm	330	2040	480
COD, ppm	482	3150	692
Oil, ppm	20	24	nil

3.11.3 Effluent Treatment

The quantity of waste generated from different sources is given in water balance chart and their characteristics are given in Table 3.6 for the ease of treatment and disposal effluent from different sources is segregated in to following streams.

An ETP plant of 3000 m^3/d will be designed for the treatment of plant effluents & ETP plant of 2500 m^3/d will be designed for condensate water. The flow charts of effluent treatment scheme for plant effluent & condensate water are given Figure- 3.5.

1. Domestic Effluent (Stream -A, 110 m^3/d)

Domestic effluent is generated at different locations in the industry. This is stabilized in septic tanks located near the sources. The over flow from septic tank is lead to sugar plant ETP for further treatment. Total quantity of domestic effluent will be 110 m^3/d. Septic tanks are designed as per BIS specifications.

2. Plant Effluent (Stream -B, 2668 m^3/d)

Effluents to be treated in Sugar plant ETP consists of,
Plant effluents from sugar unit : 2668 m^3/d

The effluent plant will be designed with 15 % higher capacity to accommodate peak load and eventualities. The characteristics of treated & untreated effluent considered for design of ETP is given below.

Characteristics of Raw and Treated Effluent for Sugar ETP (Stream-A)

Sl. No.	Characteristics	Quality,	
		Raw effluent	Treated effluent
1	pH	5.5	5.5-9.0
2	Total suspended solids(mg/L)	350	100 max
3	Total dissolved solids (mg/L)	1500	2100 max
4	BOD (mg/L)	1800	100 max
5	COD (mg/L)	2700	250 max
6	Oil & grease (mg/L)	35	100 max

3. Condensate Treatment Plant (Stream-C, 2330 m^3/d)

Effluents to be treated in Condensate ETP consists of,
Excess condensate water from juice evaporator of sugar unit : 2330 m^3/d

The effluent plant will be designed with 10 % higher capacity to accommodate peak load and eventualities.

Characteristics of Raw and Treated Effluent for Condensate ETP (Stream-B)

Sl. No.	Characteristics	Quality	
		Raw effluent	Treated effluent
1	pH	7.5 -9.0	5.5 -9.0
2	Total dissolved solids (mg/L)	750 -1900	< 2100
3	BOD (mg/L)	5-15	100
4	COD (mg/L)	60-100	250
5	Oil & grease	< 5	10 max

4. WTP Effluent (Stream-E, 104 m^3/d)

About 104 m^3/d of waste water will be generated from water treatment plant. This water is collected in a sump and used for ash quenching and dust suppression on roads. It can also be treated in ETP along with sugar unit effluents.

Table-3.7 Effluent Treatment Scheme

Sl.No.	Applications	Quantity, m^3/d	Treatment & Utilization
1.0	**Domestic Effluent, Stream - A**	110	Domestic effluent generated at different locations lead to common septic tanks and stabilized. The septic tank outlet is sent to sugar plant ETP for treatment.
2.0	**Plant Effluent, Stream -B**		
2.1	Plant effluents from sugar unit	2668	Treated ETP consisting of bar screen, oil separator, equalization, neutralizer, anaerobic digester and aerobic reactor with secondary clarifier. Treated effluent is used land for green belt, greenery and sugar crop development. Stabilized domestic effluent and power plant effluents are treated along with plant effluents.
3.0	**Condensate water from evaporator, Stream-C**		
3.1	Condensate water from sugar plant evaporator	2330	Treated to irrigation standards in condensate water treatment plant consisting of cooling unit, neutralizer and then treated in ASP consisting of bio-aeration tank and secondary clarifier. For reuse the clarified effluent is further treated in sand and carbon filter and then disinfected with sodium hypochlorite or bleaching powder solution. The treated condensate is used for greenery development or reused in plant for cooling water make up and other applications.
4.0	**WTP Effluent, Stream-E**	104	Collected in a sump and used for ash quenching and dust suppression on roads.

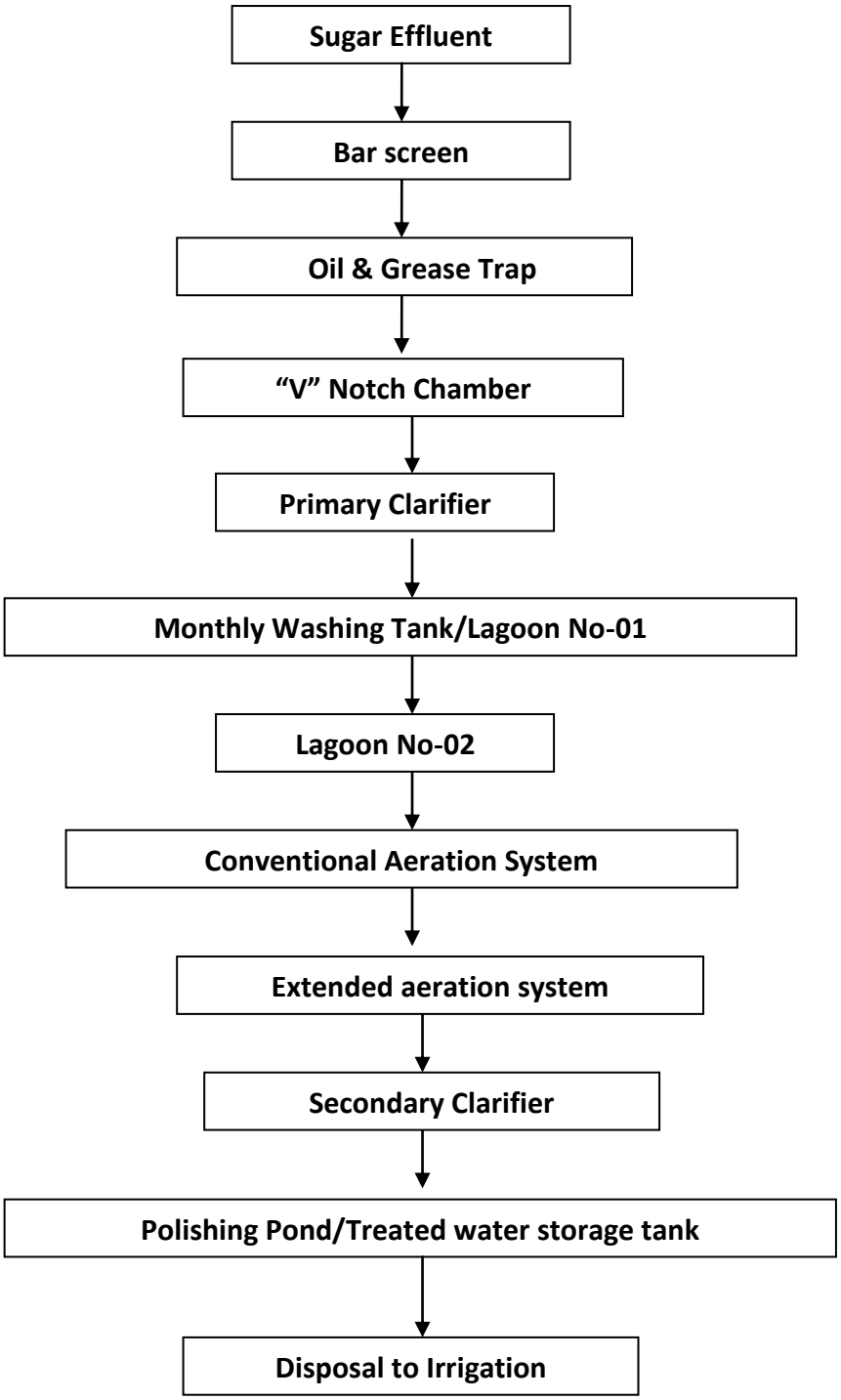

Figure 3.5 Flow Chart for Effluent Treatment Plant for Sugar Unit

3.12 Air Emission & Air Pollution Control Measures

1. Flue Gases from Boilers

The industry is already provided with high pressure boiler with a capacity 105 TPh at 67 kg/cm2 pressure and 510 ^{0}C temperature and now proposed an additional boiler of capacity 240 TPh at 87 kg/cm2 pressure and 510 ^{0}C. The boiler is fired with bagasse during season and off-season. Sulphur and nitrogen content in bagasse is less. SPM and sulphur dioxide

are the main emission in flue gases.. The boiler is provided with Electro Static Precipitator (ESP) to trap the SPM and a chimney of 65 m height is already provided for the existing Boiler and chimney of 77 m height is newly proposed to dissipate the emissions.

Stack height calculation

During season and Off-Season:
Fuel used – Bagasse = 112.1 TPH

Relation for stack height

$$H = 74 (Q)^{0.27}$$

Where, H = Height of Stack in m & Q = Ash produced in TPH

As per KSPCB norms, for agro based fuels ash produced per ton of fuel burnt = 6.5 kg
However assuming ash produced per ton of fuel burnt = 10 kg

Ash produced = 112.1 x 10 = 1121.2 kg/hr = 1.12 TPH

Therefore Q = 1.12 TPH

Hence, $H = 74 (1.12)^{0.27} = 74 (1.03)$ m $=$ 76.22 m

Or say 77 m AGL (Proposed for 240 TPH Boiler)

2. Smoke from Diesel Generators

A diesel generator of 1250 KVA is provided at co-gen sugar unit and a diesel generator of 500 KVA is provided at distillery unit. The D. G. sets operate only during the emergency of power failure to run the essential services. The sources of emission and APC measures for boiler and diesel generator are given in Table-3.13.

Table- 3.13 Emissions and APC Measures for Boiler and Diesel Generators

Sl. No.	Source, air Pollution	Fuel, T/h	Emissions	Air pollution control system
1	105 T/h boiler at co-gen power unit (Existing)	During season and Off-Season Bagasse: 1050 T/d	SPM, SO_2 and NO_x	Chimney of 65 m ht and ESP
2	240 T/h boiler at co-gen power unit (Proposed)	During season and Off-Season Bagasse: 2400T/d	SPM, SO_2 and NO_x	Chimney of 77 m ht and ESP
3	1000 KVA D.G. Set	HSD	SPM, SO2 and NO_x	Chimney Ht :30 m AGL and acoustic control measures

3. Fugitive Emission

The industry maintains utmost care to prevent fugitive emission in all possible sources. The main sources of fugitive emissions are storage and handling of fuel and movement of vehicles. Arrangements are made to sprinkle the water periodically on roads to avoid fugitive emission. In addition, fuel conveyors are covered with hoods which ensure no particles are escaping at the time of transportation. The boiler fly ash quenched periodically with water to suppress the fugitive emission. The fugitive emission from boiler bottom ash is controlled by submerged ash conveyor system.

3.13 Noise Level and Control Measures

1. Sources & Noise Level Generation

The source and quality of noise in the distillery are given bellow.

i. Steam turbines : 85-90 dB (A)
ii. Diesel Generators : 75-80 dB (A)
iii. Fans, blowers and compressors : 80-85 dB (A)
iv. Sugar graders : 85-90 dB (A)
v. Centrifuges : 80-85 dB (A)

The sound intensity appears to be at moderate level in co-gen plant. In general at the locations of turbines, compressors, fans etc., the sound intensity generally exceeds the limit. Control measures will be adopted to reduce noise level within the permissible limits at the source itself. These machineries are installed on vibration proof foundation and base. Steam turbine and diesel generators are located in isolated and acoustic building. The workers engaged in such locations are provided with earmuffs to have additional safety against noise nuisance. These units will be manufactured to meet the noise levels as per MOEF/ CPCB guidelines.

DG sets will be provided with in-built acoustics measures. Also ambient noise levels will be ensured within the ambient standards by inbuilt design of mechanical equipment and building apart from vegetation (tree plantations) along the periphery and at various locations within the industry premises.

3. Noise Control Measures

- Acoustic barriers / shields provided to the machineries.
- Heavy foundations for vibration absorption of Steam Turbines, etc.
- Provision of Acoustical walls roofs to buildings.
- Segregation of machineries like Turbine having high noise level in a separate enclosure.

- Provision of Silencers and sound absorbers to inlet and outlet of fans, blowers and compressors.
- Sound control measures to steam vents.
- Proper maintenance of machineries especially oiling and greasing of bearing and gears etc.
- Use of personal protective aids to ear for the persons working in the boiler &turbine locations.
- Plantation of green trees around the factory building to absorb the intensity of noise carried to the surrounding premises.

3.14 Solid Wastes Management

The solid wastes or by-products produced in sugar industry such as bagasse, press mud and molasses are made use as valuable resources as discussed below. Other solid wastes in the industry are boiler ash, lime/ETP sludge. Spent lubricating and cooling oils produced in the industry are specified as hazardous wastes and these are disposed as per the prescribed guidelines. The details of solid waste for Sugar & Cogeneration power plant are given in Table- 3.7.

Bagasse

Bagasse is the fibre material left out after extraction of the treated sugarcane juice. The average bagasse content in sugarcane is 30%. Major quantity of the bagasse produced will be utilized in the plant itself as a boiler fuel. A small quantity of bagasse will also be used as filter aid in the plant. The saved bagasse will be stored on the storage yard for use in off season.

Molasses

A total of 630 T/d of Molasses (including Existing and proposed Expansion) will be produced in the industry at average of 4.5 % on sugarcane crushed. It contains large percentage of non crystallisable sugar and is a valuable source of raw material for manufacture of ethyl alcohol or other products such as oxalic acid, lactic acid etc. Molasses is also used as nutritive additive in manufacture of cattle feed. In the present industry the molasses is used in own distillery for production of ethanol.

Press mud

A total of 560 T/d of press mud is produced in the industry at an average 4 % on cane crushed in the sugar plant including Existing and proposed Expansion. It contains fibrous material and crop nutrients such as phosphorous and potassium and therefore it is issued to

farmers for use in agricultural land. The press mud will also supply to required distillery for composting.

Boiler ash

Boiler ash is un-burnt matter left out in the furnace after complete burning of bagasse in the boiler. Ash produced from bagasse will be 2.0 % on wet basis. Bagasse consumption in boiler is about 2450 T/d (Existing and Expansion). The ash contains silica, and other metal oxides. It is a non-toxic material. It can be used as soil conditioner in agriculture land or in road formation. It can also be composted along with press mud to produce bio-manure.

ETP & lime sludge

Small quantity of sludge is produced from primary and secondary clarifiers in the industry. Major quantity of the sludge from secondary clarifiers is re-circulated to the aeration tank. Excess of sludge from clarifiers is dewatered and partially dried in sludge drying beds. The sludge with an average moisture content of 70% produced from ETP will be 300 kg/d and will be utilized as manure to tree plantation.

Lime with higher CaO% is used in the plant for purification of juice and therefore, the quantity of lime sludge produced from the plant is small. The sludge with an average moisture content of 70% will be produced from lime plant. A maximum of about 0.6 T/d of sludge will be produced from lime plant.

Table 3.6 : Solid Waste Source & Utilization in Sugar Unit

Parameters	Bagasse	Press mud	Molasses	Boiler Ash	Lime sludge
i. Moister content %	50	75	20	-	50
ii. % of cane	30	4	4.5	2.0	-
iii. Quantity, T/d	4200	560	630	69	0.6
Storage	Closed yard	Prepared yard	Steel Storage Tanks	Prepared yard	Prepared yard
Utilization	As fuel in boiler	As manure preparation or as soil nutrients	As raw material in distillery	Cane growers use as manure.	In road preparation or as soil nutrients

Spent Oil and Grease.

Spent oil and grease will be generated from the lubricating systems such as D. G. set and gear units. An average of 0.4 T/year of spent oil will be produced in the industry. This is stored in M.S drums and disposed to the authorized agencies for their reprocessing and reuse.

Municipal Solids Waste

Municipal solid waste is generated in residential quarters, factory office and store. The quantity will be about 473 kg per day. The solid waste collected will be segregated to separate glass. Plastic metal and other recyclable matter from bio-degradable matter. Bio-degradable matter, 250kg/ d will be composted with agro mass such as press mud. The composted manure thus produced will be used in greenery development

Chapter 4
Site Analysis

4.1. Description Of Location

M/s Nandi Sahakari Sakkare Karkhane Niyamit is located at a distance of 48 Km from Vijayapur city and is located at East of SH-55. Vijaypur is the District headquarters. The location of site in the district map of Vijayapur is shown in Figure-4.1. The location details of the site is given in Table-4.1.

The factory is geographically located at 75^{O} 28' 46.05" East longitude and 16^{O} 27' 00" North latitude and an elevation of 537 meters above MSL. The factory is surrounded by agricultural lands with sugar cane as main crop. There are 34 villages in study area which has about 50,000 hectares of cultivation land.

Figure-4.1 Location of site in the district map of Vijayapur District

Table-4.1 Location Features of the Site

Sl. No.	Feature	Particulars
21.	Name of the Industry	M/s Nandi Sahakari Sakkare Karkhane Niyamit
22.	Location of the Industry	Survey Nos. 90,92, Krishnanagar ,Hosur Post, VijayapurTaluk and District, Karnataka State
23.	Latitude / Longitude Altitude	75^{O} 28' 46.05" East and 16^{O} 27' 00" North 537 m above MSL
24.	Toposheet	47 P/6, 47 P/7, 47 P/10, 47 P/11.
25.	Present use of land	The Factory Site (Existing) is an industrial land surrounded by rain fed dry agriculture lands.
26.	Daily average temp. in ^{0}C	Min: 9.7^{o} C- 16.1^{o} C during January. Max. 31.8^{0} C- 39.9^{0} C during May
27.	Relative humidity	72.8 %
28.	Annual rain fall in mm	400 to 700 (Average 620.44mm)
29.	Predominant wind & direction	5.8 to 7.6 km/h, predominantly from W and WSW
30.	Soil type	Majority of the soil are Black Cotton which are suitable for the cultivation of sugarcane crop.
31.	Topography	Moderately undulated topography with small hillocks.
32.	Nearest highway	SH 55 (W)
33.	Nearest railway station	Telgi Railway station, Bagavadi Road - 55 KM (E)
34.	Nearest airport	Belgaum - 120 KM (SW) & Hubli - 130 Kms (SW)
35.	Nearest village	Jambagi - 2 KM (S)
36.	Nearest City	Bagalkot - 36 Km (S) Vijayapura (Bijapur) - 48 KM (N)
37.	Nearest industry	Pabhulingeshwara Sugars and Chemicals Ltd, siddapur – 27 Kms
38.	Nearest water body	Alamatti Reservoir – 1.5 Km (E) Krishna River Bank -1.5 Km (E)
39.	Environmentally sensitive locations such as Archaeological structures, Historical places, Protected forests, Sanctuaries, and Sensitive bio-spheres	None within 10 Kms
40.	Seismic characteristics	Seismic Zone-II as per Indian Seismological Institute (relatively safe region)

4.2. Topography of the Site:

The proposed expansion of Sugar and Cogen are within the Sugar Complex at existing location. The area around has normal flora consisting of Sugarcane, Paddy, wheat, groundnut, Maize, sunflower, onion and banana and various other vegetable are commonly grown in the area. Generally the soil type at factory site is reddish brown to blackish soil with loamy texture. The soil in the region is of black cotton and reddish brown with loamy texture. Sugarcane is the most important crop in the area and dictates the economy of the farming community.

4.3. Climatic conditions:

4.3.1 Surface wind speed and Direction

The mean monthly wind speed values ranges between with the highest of above 11 Kmph and lowest of 1-5 Kmph with an average wind speed of 5.8 -7.6 Kmph. Wind directions is W → E and WSW→ENE.

4.3.2 Temperature

The sugar cane crop requires good sunshine during the day time for its growth and cooler nights for better accumulation of sugar. The location is an ideal place with congenial climate for sugar cane cultivation for its increased yield and also for high sugar content. The highest temperature recorded in summer of a year is April / May with maximum of 31.8 ^{0} C - 39.9^{0} C. The minimum temperature in the month of Dec / Jan is around 9.7 ^{o} C - 16.1^{o} C, which helps in the sugar built-up and accumulation.

4.3.3 Relative Humidity

Relative humidity generally ranges throughout the year between 60 % to 80 %.

Table 4.2: The Year-Wise Maximum, Minimum Temperature and Total Rainfall for 5 Years in Vijayapur District

S.no	Year	Temperature(Deg.C)		Total rainfall (mm)
		Max	Min	
1.	2011	32..90	14.8	239..9
2.	2012	33.50	14.6	370
3.	2013	32.40	14.8	597.6
4.	2014	32.50	16.2	1272.80
5.	2015	34.40	21.3	621.9

4.3.4. Rainfall

The area receives well distributed rain fall during North East monsoon period i.e., from the month of Oct to Dec and South west monsoon period from June – Aug to some extent. Summer shower rains are also received in the month of March to May which helps in the cultivation of sugarcane by distributed precipitation. The average rainfall in the year 2015 is about 620.44 mm. rain fall details are given in Table 4.3

Table 4.3 Rainfall Details from 2013 to 2015 (IN MM)

Year	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Total
2013	--	0.2	5.2	46.4	46.2	110.8	105.6	19.6	130.4	131.0	2.2	-	597.6
2014	--	9.6	30.4	37.2	99.4	93.2	123.1	511.6	113.3	229.1	10.5	14.5	1271.9
2015	3.5	--	5.3	26.7	23.7	76.9	18.0	3.0	301.9	153.9	17.5	--	630.4

4.4 Demography

The factory is located in a predominantly agricultural and rural area. The main crops are Sugarcane, Ground Nut, Onion, Maize, Banana, Sunflower, Paddy and wheat etc,.In majority of the villages education facility are in the level of primary schools only. Education literacy levels are medium.

Income levels are in the range of Rs .30, 000 to 75,000 per annum per family. A family consists of about 4 to 6 persons. The source of water is generally from rainfall, irrigation canal, wells and ponds. Majority of the house holds rear domestic animals such us cow, buffalo, goat, sheep and poultry.

All the village area enjoys telecommunication facilities. Health care facilities are also available at Primary Health Centre and taluk head quarters hospital.

All villages are electrified but power supply shortage prevails. Source of drinking water in all villages are bore wells, dug wells and protected water supply schemes provided by the Government.

4.5 Social Infrastructure in the Region

Infrastructure is the basic physical and organizational structures needed for the operation of society or enterprise or the services and facilities necessary for an economy to function.

Social infrastructure typically refers to the technical structures that support a society, such as roads, water supply, sewers, electrical grids, telecommunications and so forth and can be defined as "the physical components of interrelated systems providing commodities and services essential to enable, sustain, or enhance societal living conditions.

Viewed functionally, infrastructure facilitates the production of goods and services, and also the distribution of finished products to markets, as well as basic social services such as schools and hospitals; for example, roads enable the transport of raw materials to a factory.

Education facilities are limited to primary and high schools. Primary education is available in most of the villages. For higher secondary and pre degree courses the villagers depend on nearby Mantur, Bagalkot and Bilgi from project site. Higher education including engineering, medical and other professional facilities is available at Bagalkot (36 Km, S), Vijayapura / Bijapur(48 Km, N). Some of the villages in the vicinity are Hosur (3.0 km, SE), Jambagi (2.0 km S) Galagali (5.0 km, SW), Badgi (3.5 km, SE), Budihal (5.0 km, SE), yadahali (6 km, SW).

Primary health centers are located in villages. For higher health care, people have to depend on nearby towns namely (20-25 km). Various private and public sector banks and also post offices are located in surrounding villages. Fire stations are available at Telgi, Vijayapur, Jamakhandi, Mudhol. Railway stations are available at Telgi & Bagalkot. Airports are available at Hubli & Belgaum. SH-55 is located West of the project site.

Chapter-5
Planning brief

5.1 Planning Concept

Sugar industry is an essential and sizable sector for industrialized economies. Since it is capital and energy extensive, companies have been putting consistent emphasis on technology advances in the production process to increase productivity and to save energy.

- Ensuring Complete Order Entry
- Ensuring Quality Assurance
- Production Execution & Energy Management
- Planning & Scheduling
- Decision Support

5.2 Population Projection

The existing manpower in the industry is 697 no's (Sugar Co-Gen and Distillery), 627 no's all alone for Sugar Co-Gen. The additional direct man power to the industry after expansion programme will be 150 no's. The employees stay mainly in nearby villages. With project development the associated activities and economy in the region is expected to increase. This is likely result in marginal enhancement in the population of the region**.**

5.3 land-use planning

The industry is envisaged adequate area for landscape, process section and utilities, storage areas for raw materials, finished products and internal movement of vehicles .

5.4 Assessment Of Infrastructure Demand

M/s Nandi sahakari Sakkare karkhane Niyamat is an existing integrated sugar industry has proposed for expansion of 6500 TCD To 14000 TCD and enhance the performance and economic viability of the project. The infrastructure demand for the project is detailed in the following sections.

5.4.1 Roadways

Roadways are required for:

- Transportation of employees to & from the industry during the operation phase.
- Transportation of raw materials to the industry during operation phase.
- Transportation of finished products from the industry during operation phase.

5.4.2 Water Supply & Sewerage Infrastructure

Water demand for the Sugar Co-Gen industry will be Government of Karnataka Neeravari Nigam Limited . The domestic sewage generated will be treated in septic tank and soak pit at respective places. The industrial wastewater will be collected in guard ponds & re-used for green-belt development, dust suppression & road cleaning.

5.5 Amenities/Facilities

Amenities like, Library, Canteen, Toilets, Indoor Sports Room, Gymnasium, Plant Medical Equipment, Drinking Water Facilities & usual Employee welfare activities are available at present in the existing industry will be utilized for the expansion project.

Chapter 6
Proposed Infrastructure

M/s Nandi Sahakari Sakkare karkhane Niyamat is an existing integrated sugar industry has proposed for expansion of 6500 TCD to 14000 TCD and enhances the performance and economic viability of the project. The infrastructure demand for the project is detailed in the following sections. The infrastructure facilities such as roads, greenery & green belt, storm water management, water supply, bulk storage facilities etc have been already provided. Infrastructural facilities already provided will be further enhanced as discussed below.

6.1 Factory Premises

The industrial processing premise will be provided with internal roads, road side gutters, Storm water gutters, sewage lines, Street lights, Flood lights, Parking area.

- Landscaping, lawn and greenery will be developed in the premise.
- Rain water harvesting and rain water reservoir of adequate capacity will be built.
- Fire fighting and disaster management facility will be provided.

4.2 Green-Belt

Green belt and greenery will be developed in about 84 acres of land. The species developed will be as per CPCB guide lines. Assistance and guidelines will also be availed in development of greenery in the industry.

All the premise green belt of about 20 m will be developed. Line trees will be developed on either side of the internal roads as well on all approach roads to the industry. Lawns will be developed around plant and administrative buildings. Green belt of 10 to 20 m will be developed around open bulk storage yards.

4.3 Social Infrastructure

Canteen, health care medical centre, Drinking water facility, transportation facility will be provided in the industry.

4.4 Connectivity

A good quality tar road is developed adjacent the site i.e SH -55 which is West of the project site for transportation of Raw materials and Products . Existing road inside the site will also be up graded.

6.5 Environmental Management Plan

A comprehensive environmental management plan will be adopted consisting of environmental protection and monitoring measures as indicated below.

- Establishment of pollution control facilities.
- Green belt and greenery development in and around the factory site
- Storm water management & Rain water harvesting
- Paving and lining of roads and fuel storage yards so as to avoid fugitive emissions.
- Fugitive emissions within the factory and storage yards are controlled by good house keeping, water spraying and sprinkling.
- Regular Monitoring of stack emissions.
- Dust extraction at dust generating machinery/equipment.
- Safety & Occupational health care programmes, emergency management plan and safety management systems will be implemented in the distillery.

6.6 Environmental Management System

The existing industry has already established Environmental Management System to implement and monitor environmental policy and programmes. It consists of the following.

6.6.1 Environmental Cell

Environmental cell consisting of Unit Head and departmental heads. The responsibility of the Environmental cell is to effectively manage the environmental activities in the industry.

6.6.2 Environmental Department

Environmental department consisting of Environmental Manager, laboratory chemists and operators. The responsibility of the Environmental department is to implement and operate pollution control and environmental protection measures.

6.7 Environmental Monitoring Programme

The existing industry has already implemented self monitoring system with man power and facilities to ascertain the compliances of environmental norms and standards. A laboratory is present in the industry to analyze waste water, soil, stack emission, ambient air etc. The parameters will be regularly monitored as per MoEF/KSPCB guidelines during operation of the industry.

6.8 Environmental Records

Environmental department will maintain log sheets and manuals for operation and maintenance of pollution control and related facilities. Progress reports and statuary records as per environmental acts will also be maintained.

6.9 Investment on Pollution Control Facilities

Total capital investment on project will be Rs 3275 Lakhs and the investment on Environmental management plan will be Rs 600 Lakhs, Recurring cost on EMP will be about 75 Lakhs per year.

6.10 Socio-Welfare Activity

The Company has adopted a management policy to involve in Socio Welfare Activities. The Sugar industry is basically agro based one and directly associated with farmers and other inhabitants of the region. The industry has proposed to take up socio-welfare activities as below over a period of 5 years.

Table-6.1 Socio Welfare Activity

Sl. No.	Particulars of activity	Budget, Rs. Lakhs
1	Drinking water facility with bore well, water storage tank and pump at isolated locations at 10 villages -Schools.	10.00
2	Assisting the village panchayat for cultural activities , 10 Nos.	10.00
3	Adopting school/students for development of quality education	25.00
4	Assisting local youths in development of technical skill and/vocational training, about 50 candidates	15 ,00
5	Assisting the village panchayat for development of greenery including medicinal and oil plants. 10 locations	10.00
6	Assisting the village panchayat for development Library facility, 10 locations	10.00
7	Need based assistance for benefit of the region	20.00
	Total	**100.00**

Chapter- 7
Rehabilitation & Resettlement plan

The expansion project is proposed in the existing industrial premise. No procurement of any additional land for the proposed project.

In view of the above, the proposed expansion project does not involve any displacement of persons and no rehabilitation or resettlements are necessary.

Chapter- 8
Project schedule & cost estimates

8.1 Project Schedule

Time schedule for implementation of the project is given in Table-8.1.

Table-8.1 Project Schedule

Sl. No.	Project activity	Proposed time
1	Submission of EC application to SEIAA, Karnataka.	September 2016
2	TOR deliberations and approval of scoping and ToR for EIA studies from MOEF GOI New Delhi	October 2016
3	Conduct of EIA studies and preparation of Draft EIA	November 2016
4	Conduct of public hearing	March 2017
5	Submission of final EIA report and Public hearing proceedings to MOEF GOI New Delhi	April 2017
6	EIA deliberations and grant of EC	May 2017
7	Submission of CFE application to KSPCB Bengaluru	October 2016
8	Deliberation of the proposal and grant of CFE to the industry.	December 2016
9	Commencement of proposed project construction	June 2017
10	Completion of project construction and submission of CFO application to KSPCB Bengaluru	September 2017
11	Grant of CFO from KSPCB and the Commencement of commissioning and production	October 2017

8.2 Cost Estimates for EMP

Table- 8.2 Cost Estimates of EMP for the Proposed Project

Sl.no.	Particulars	Amount in Lakhs
1	Capital Investment on EMP facilities	500.00
	Air Pollution Control	
	Water pollution Control	
	Laboratory & Monitoring	
	Green Belt & greenery development , rain water harvesting , landscape development	
2	CSR activity	100.00
	Total EMP Cost	**600.00**
3	Recurring Cost of Operation & Maintenance	75.00
	Air pollution Control	
	Water Pollution Control	
	Greenery , water harvesting and land scape maintenance	
	Laboratory & Monitoring of Environmental Quality	
	Total Recurring cost	**75.00**

8.3 Estimated Project Cost

Total capital investment on the proposed industry is detailed as under

Table 8.3: Capital investment for Expansion of the Capacity

Sl.no.	Particulars	Amount, Rs. in Lakhs
1.	Land	00.00
2.	Buildings & civil works	992
3.	Plant and machinery	30979
4.	Environmental management	600
5.	Interest & finance charges	1995
6.	Miscellaneous fixed assets	958
7.	Preliminary expenses	76
Total Project Cost		**35600**

Chapter-9
Analysis of Proposal / Conclusion

M/s Nandi Sahakari Sakkara Karkhane Niyamat is an agro based company focused on manufacture of Sugar and allied products. The Sugar Unit is already owning and running a 6500 TCD Sugar Plant with 18.14 MW/Hr Cogeneration and Distillery of 50 KLPD at Krishnanagar village, Vijayapur Taluk & District in Karnataka State. Now the project proponents have proposed to expand the Sugar Unit from 6500 TCD to 14000 TCD and 18.14 MW Cogeneration to 62.14 MW with no change to Distillery unit.

The agro based sugar industry has a national priority to over come energy and food crisis. Sugar industry also has export potentials to earn foreign exchange.

1. The by-product of the Sugar industry, the Bagasse, finds use as fuel in Cogeneration Boiler for production of power.
2. Boiler air emissions dealt efficiently using the high efficiency three fields Electro Static Precipitator (ESP) with ash handling system and Chimney.
3. The treated waste water from the Sugar plant and Cogeneration plant will be utilized for R & D Cane farm irrigation, Green belt development and ash quenching. The ash generated from the boiler finds utilization as agro manure in case of bagasse burning and in case of exclusive coal burning; it will be supplied to brick manufactures and cement industries.
4. In the vicinity of the factory there are no protected forests, sanctuary, archeological important structures and sensitive locations. Therefore, the proposed expansion of Sugar Plant from 6500 TCD to 14000 TCD and Cogeneration plant from 18.14 MW/h to 62.14 MW will not have any adverse impact on the environment or the eco system. As there is no industry exists around 10 KM vicinity of the Unit, the presence and operation of this industry will not have any negative impact and instead it will improve the economic status of the farmers of this rural un-developed region.
5. This Unit will not produce any toxic products and does not have any significant adverse effect on the quality of land, water and air etc., the industry will take care of all the necessary preventive measures to maintain the clean environment at all times.
6. Our humble submission is for the issue of Terms Of Reference (TOR) for obtaining the Environmental Clearance for the proposed Expansion of our Sugar Plant from 6500 TCD to 14000 TCD and expansion of Cogeneration of Power from 18.14MW/Hr to 62.14 MW/hr.

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