Comprehensive Environmental Pollution Abatement Action Plan for Critically Polluted Industrial Cluster– PALI

Submitted to:
Rajasthan State Pollution Control Board

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REPORT & INVESTIGATORs DETAIL

Project Title: Comprehensive Environmental Pollution Abatement Action Plan for Critically Polluted Industrial Cluster of Pali

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Executive Summary

RPCB has entrusted MNIT to prepare revised environmental action plan for critically polluted clusters of Pali. Comprehensive Environmental Pollution Index CEPI is an environmental indicator to evaluate the quality of environment at a given location. It links source, pathway and receptor as in conceptual site model (USACE, 2012). An increase in value of CEPI score indicates increase in adverse effects on environment. Pali, an industrial city in Rajasthan, is the administrative headquarters of Pali District. It is situated on the bank of the river Bandi. Pali is about 70 km South-East of Jodhpur. It is famous for its textile units. The main industrial areas to be considered in this Cluster include Mandia Road, Punayata Road and Sumerpur Road.

To assess the pollution problem presently in Jodhpur, CEPI scores were calculated using the original and modified methodology of CEPI. While compiling data for CEPI calculations, it was observed that data for relevant signature pollutant must be considered for accurate CEPI score. The efforts were made to assign signature criteria pollutant and different CEPI scores were calculated using various combinations of the pollutants. Hence the pollutants selected and their order are very important in calculating CEPI score. THE CEPI scores for different components i.e. land, water and air in original methodology and ground water, surface water and air in modified methodology. Moreover, the comparison should be made only between similar types of methodologies e.g. scores from original CEPI methodology should be compared with the scores from revised CEPI methodology, as the two approaches are widely different. Finally an improved action plan has been suggested for the industrial cluster of Pali

1. INTRODUCTION

Comprehensive Environmental Pollution Index CEPI is an environmental indicator to evaluate the quality of environment at a given location. It links source, pathway and receptor as in conceptual site model (USACE, 2012). An increase in value of CEPI score indicates increase in adverse effects on environment. Furthermore, it also gives an indication of harmful effects on population, flora, fauna and archaeologically important buildings.Recently the methodology for estimation of CEPI score has been modified to make it more user-friendly.

Jodhur and Pali industrial clusters have been found to be critically polluted based on estimation of CEPI score in 2009, 2011, 2013 and 2018 (Fig. 1, (CPCB, n.d.)).

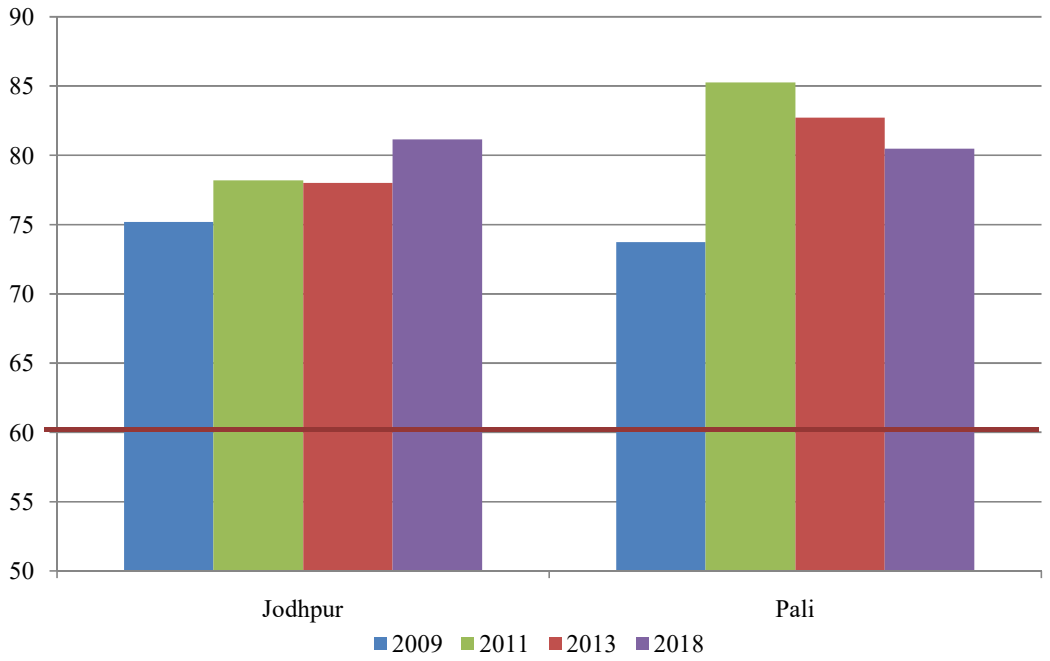

Figure 1: Biennial CEPI scores for industrial clusters of Jodhpur and Pali

As per directions from National Green Tribunal (NGT), Rajasthan State Pollution Control Board (RPCB) needs to take action to improve the environmental conditions in Jodhpur and Pali. RPCB has entrusted MNIT to prepare the revised action plan for the same.

2. PALI INDUSTRIAL CLUSTER

Pali, an industrial city in Rajasthan, is the administrative headquarters of Pali District. It is situated on the bank of the river Bandi. Pali is about 70 km South-East of Jodhpur. It is famous for its textile units. It has the biggest cotton mill of Rajasthan. It is also known as the textile hub of Rajasthan. Some other industries like marble related works have also developed recently. Besides this, leather based industries, agriculture instruments, chemical Industries, cement industry; minerals based units etc. also operate in Pali. The availability of raw materials and its geographical location make it suitable for stones, like granite industry.

2.1 Area and Demography

Pali district extends between 24° 45' and 26° 29' North latitudes and 72°47' and 74°18' East longitude covering a geographical area of 12,387 sq km. It falls in the Marwar region. The great Aravali hills link Pali district with Ajmer, Rajsamand, Udaipur and Sirohi Districts. The Aravalli Range forms the eastern boundary of the district and towards southern boundary it ends at Bamnera village in Sumerpur Tehsil. A zone of foothills lays to the west, through which run the many tributaries of the Luni River. The western portion of the district includes the alluvial plain of the Luni. It is bounded by eight districts, Nagaur District to the north, Ajmer District to the northeast, Rajsamand District to the east, Udaipur District to the southeast, Sirohi District to the southwest, Jalore District and Barmer District to the west, and Jodhpur District to the northwest.

The population of Pali is about 20.4 lacs (census 2011) with a population density of 165 persons per square km. Gender ratio is 987 females for every 100 males and literacy rate is 63.23 %.

2.2 Topography

Figure 2 shows the Digital Elevation Model (DEM) of the Pali industrial cluster and its surrounding area. Most of the Pali region is gently undulating erosional plain. The major part of the district has elevations ranging from 200 to 300 m above MSL, but in the east toward the Aravalli Range the elevation increases and the average is nearer 600 m and at some places the elevations exceed 1000 m.The highest point of Aravali hills in the

region measures 1099m. Pali town is located about 212 meters high above the sea level. There is no perennial river in the district. Four tributaries of River Luni viz; Sukri, Lilri, Bandi and Jawai flow in the district. Besides, there are a number of other seasonal rivulets and streams which traverse through the district. There is no lake or natural spring in the district. There are five dams in the district. The largest dams viz. Jawai Dam and Sardar Samand Dam are located in Pali District. Others dams are Jawai Raipur Luni, Hemawas, Kharda and Biratiya Khurd dams which are used basically for irrigational purposes.

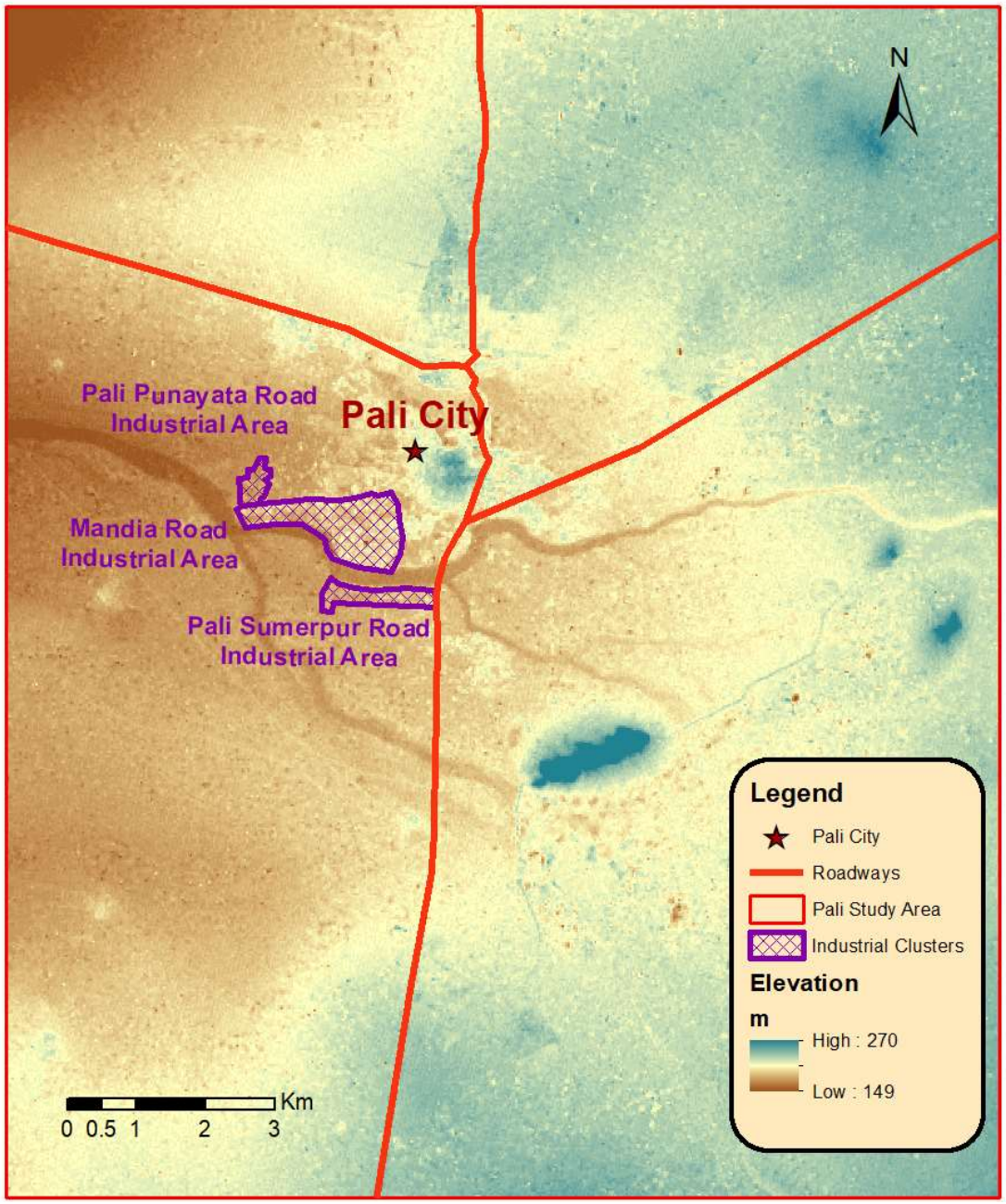

Figure 2: Pali Industrial Cluster Location Map

2.3 Climate

The climate of the district is on the whole dry and is very hot in summer and cold in winter. January is the coldest month while May to early June is the hottest period of the year. Normal annual rainfall in the district is 50 to 60 cms. During the south-west monsoon period, humidity, in general, is high. In the rest of the year, the air is dry. The average humidity for the district is nearly 60 to 70%.The climatic conditions of Pali region are somewhat different from the rest of Western Rajasthan. The climate here is semi-arid. Although the temperature in summers rises up to 46-47 ^{o}C, a large variation in temperature is observed due to adjoining green and hilly areas of the Aravalli Range. Winters are moderately cool during December-January lowering the mercury to 4 to 5 ^{o}C occasionally (PDCORE and IL&FS, 2013).

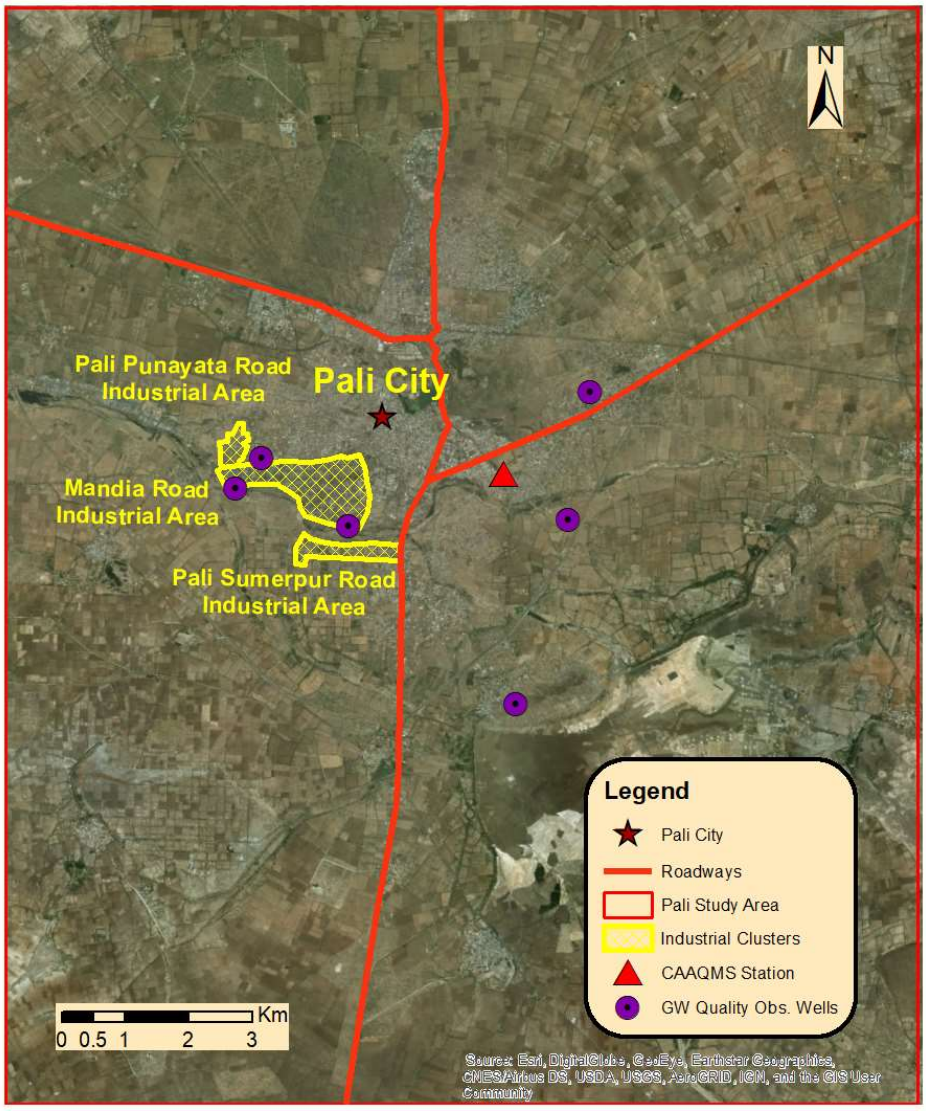

Figure 3: Google Earth image of Pali Industrial Cluster Location

2.4 Geology and minerals

Figure 3 shows the Google Earth image of Pali industrial clusters and its surrounding area. In the Pali region, Quaternary deposits and marine and continental sedimentary rocks of late Purana rest on a basement of Archaean metamorphic rocks and late Purana intrusive and volcanic rocks. Quaternary deposits include intercalated lenses of stream laid clay, silt sand and gravel and windblown sand (generally above the regional water table) which form a thin blanket over bed rock formations in much of the region. Younger alluvium yields moderate to meager supplies of salty water to shallow wells from discontinuous underflow conduits along large water courses. Older alluvium yields moderate to meager supplies of salty brackish water to wells where present in the zone of saturation.

The geological formation of the district is represented by different igneous, sedimentary and met sediment rocks. The Delhi Super Group rocks represented by the Ajabgarh Group occur near the eastern border of the district and consists of schists, phyllite, marble and basic volcanic. They are intruded by granites and rhyolites. The predominant of which is the Erinpura Granite which cover the south and south-eastern parts of the district. The Jalore type of granites is exposed south of Pali town and is generally pink in colour. The Marwar Super Group occurs in the northern part of the district and is represented by limestone, dolomite, sandstone and shale.

2.5 Industrial Development

Pali is known as textile hub of Rajasthan.Pali is famous for its textile industries. Some new industries have also been developed like marble cutting, marble finishing, etc. in the industrial areas in Pali. One of the biggest composite textile mills of India 'M/s Maharaja Shri Ummaid Mills' (established in the year 1940) is also situated at Pali. However, the industry is not within the limits of the CEPI study and hence not covered in this study.

The main industrial areas to be considered in this Cluster include Mandia Road, Punayata Road and Sumerpur Road. All these three industrial areas are located towards the South of the City; in close proximity to the BandiRiver.The industrial scenario of Pali is dominated by small scale textile units. The RSPCB has identified 628 units in the industrial area of Pali.

There are approximately 364 units in textile dyeing and printing units in this cluster who are engaged in manufacturing. Rajasthan State Industrial Development and Investment Corporation Ltd. (RIICO) is main agency involved in industrial development. Mandia Road is the largest Industrial Area among the three areas mentioned above. At present there are no units operating at Sumerpur Road. Sumerpur Road had all highly polluting textile units (12-14 nos.) which were directed to shift by a High Court Order in 2007. As a result, Punayata Road Industrial Area was developed for accommodating all industries from Sumerpur Road. In Punayata Road, a total of 304 plots were planned by RIICO, 269 plots were allotted but, only about 14 units are presently operational and 35 plots are still vacant. As per future development plan of RIICO these vacant plots shall be allotted for establishment of dying and printing units.

2.5.1 Types of Industries

Major identified industrial units in Pali Cluster are textiles and dyeing industries (Table 1). The main reason for such a large number of textile units is the availability of cheap labour during peak season – April to October and the suitability of the groundwater for dyeing and block printing. Mandia Road is the major Industrial Area and has 350 units; out of which 335 are Textile units. Nearly 80% of the industries in Mandia Road are Red Category units. Punayata Road Industrial Area has 191 units, all of which are Textile units falling in the Red Category. There are no highly polluting industries in this Cluster as per the CPCB categorization.

Table 1: Information about pollution sources in Pali impact cluster

S. No.	Information about	Details
1	Name of Polluted Industrial Area (PIA)	Mandia Road Industrial Area
		Punayata Road Industrial Area
		Sumerpur Road
2	Demarked Area of the PIA in Sq KM	Radius of 03 KM
3	Number of 17 Category industries covered under the area	Nil
4	No. of Red Category industries covered under Area	584* (Small Scale) + 01 (Large Scale) = 285
5	Total Human Population	230075**

* Information is based upon inventory maintained by CETP Trust. All these textile processing units are both air and water polluting in nature.

** As per district census handbook 2011.

2.6 Total Population and Sensitive Receptors

The industrial areas in Pali, included in the CEPI study are mostly located in and near the Pali City. Based on the suggestion in the Framework of Model Action Plan for Critically Polluted Industrial Areas / Cluster by CPCB, the geographical area of the industrial cluster and its impact zone has been considered here. A radius of 3 kms has been considered to fully cover the Industrial Clusters as well as the sensitive receptors in the area.

3. ESTIMATION OF CEPI SCORE

For CEPI calculation, data regarding quality of air, surface water, groundwater and soil need to be collected. Moreover, information has to be collected for number and type of industries in the area, patients visiting hospitals in the area with ailments owing to air and/or water pollution, ecological features in the area and places of historical importance. These data were provided to MNIT by RPCB offices in Jodhpur and Pali.

3.1 Air Environment

3.1.1 Wind rose for the area

The wind data of the region indicate that the dominant wind blows from SW to NE direction (almost 30% time of the year). Other two prevailing directions are SSW and WSW (almost 35% of the year). Figure 4 shows the wind diagram for Pali derived by MNIT Jaipur from the wind data provided by the RPCB. The wind velocity is low (up to 5 KMPH) during most periods of the year.

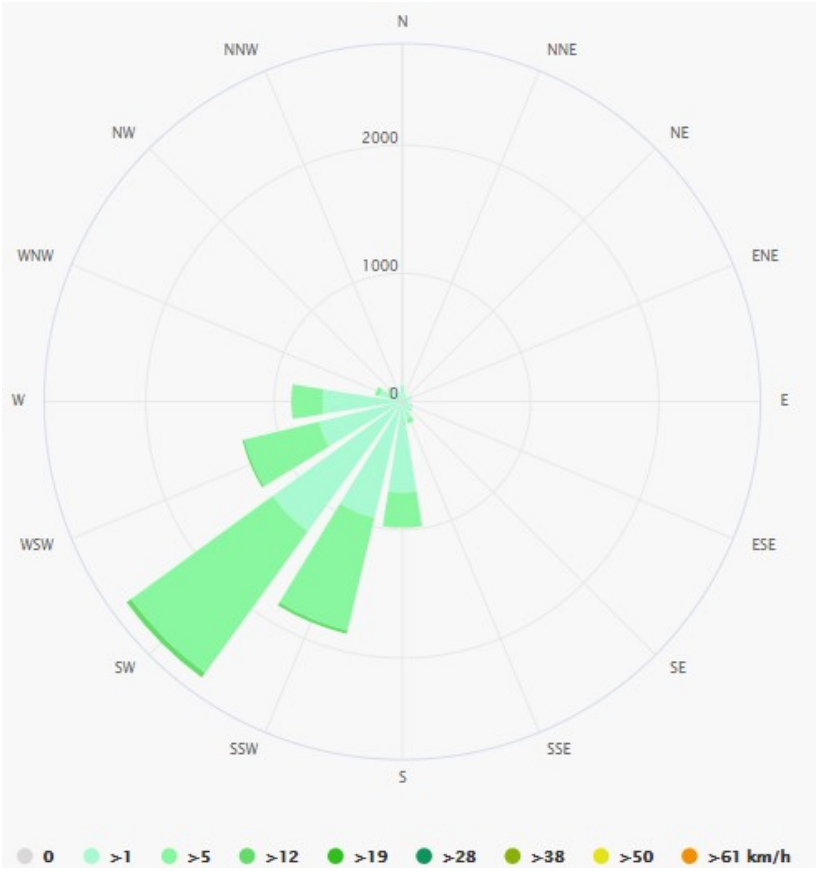

Figure 4: Wind rose for Pali

3.2 Water Environment

3.2.1 Major water bodies (Rivers, lakes, ponds etc)

Pali District is situated on the banks of Bandi River. Western Rajasthan's famous river Luni and its tributaries Jawai, Mithadi, Sukadi, Bandi and Guhiabala which are all ephemeral streams, flow through Pali district and drain the district. These streams and the principal confluents rise on the western slopes of Aravali range, whose elevation is 2,000 to 3,000 feet above the mean sea level. The largest dams of this area i.e. Jawai Dam and SardarSamand Dam are also located in Pali district.

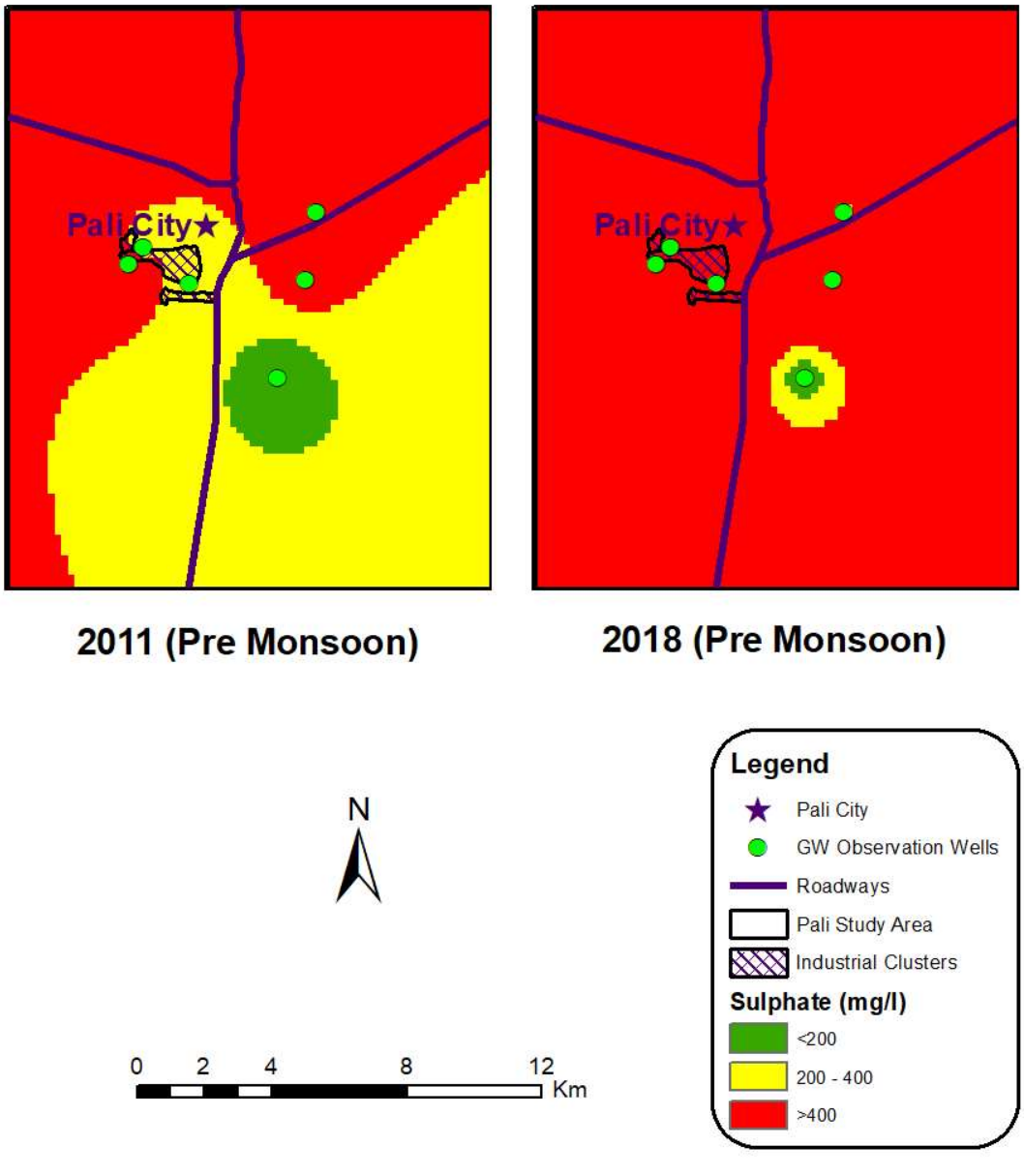

Figure 5: Groundwater quality in terms of sulphates in the Pali study area

For groundwater, maps showing contours reflecting different concentrations of environmental parameters have been prepared by us for years 2011 and 2017/18. For a year, a plot indicates the relative concentrations of a specific environmental parameter e.g. sulphatesin the study area. The comparison over time reflects the attenuation or augmentation for a parameter in a particular part of study area.

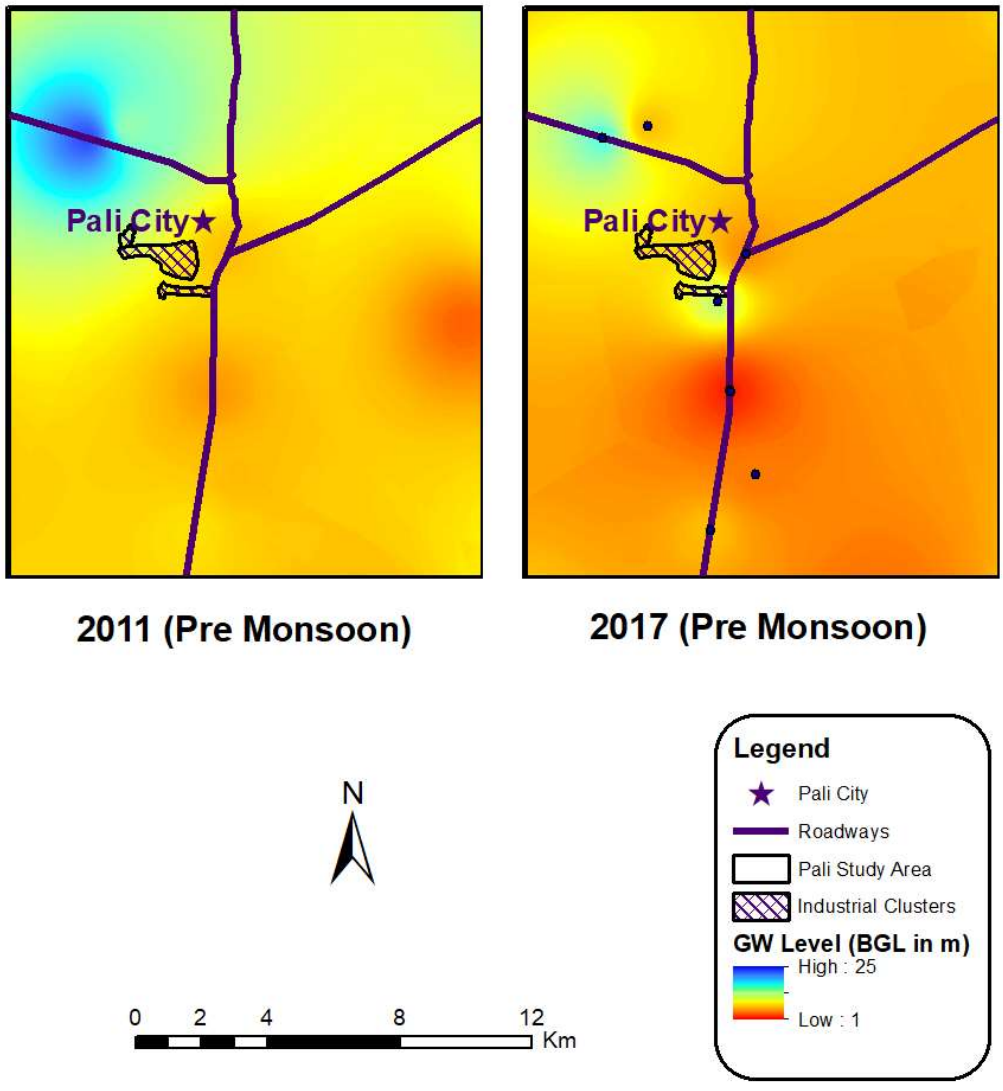

Figure 6: Groundwater level {BGL in m) in the Pali study area

Figs. 5 to 9 show the interpolated maps of groundwater quality of Pali study area derived by us for years 2011 and 2017/2018 in terms of TKN, BOD, ground water level, sulphate and TDS. Interpolated maps are obtained based on groundwater quality data of observations wells of State Ground Water Board and Central Ground Water Board, as

obtained from CGWB. Location of CWGB wells are shown in Fig. 7. Interpolation is carried out using Inverse Distance Weighted algorithm and values are classified into different groups based on Indian Standard. For example, TDS maps are classified with green colour, where TDS values are lower than 500 mg/l, yellow colour where TDS values are between 500mg/l and 2000mg/l and red colour where values are greater than 2000 mg/.

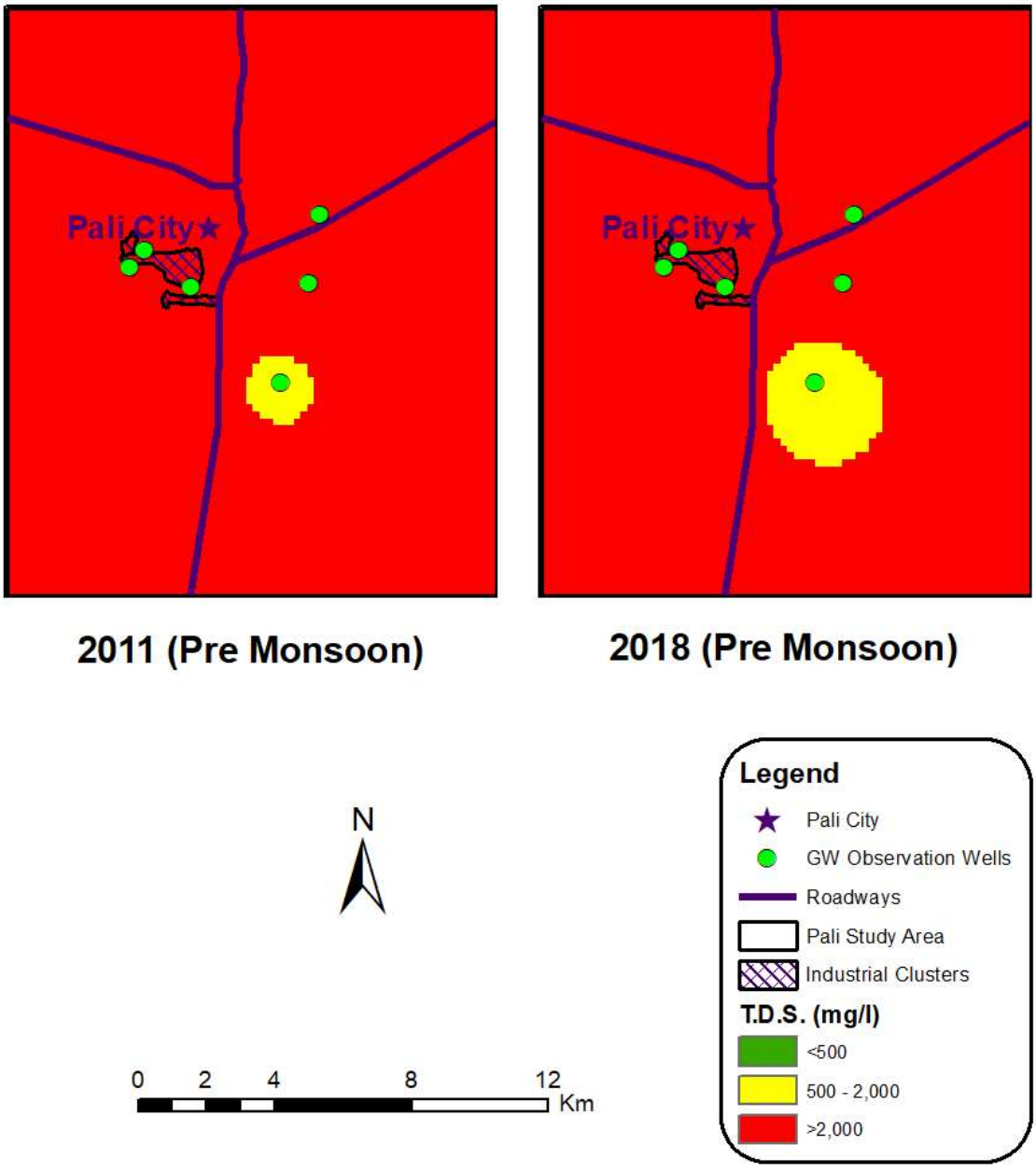

Figure 7: Groundwater quality in terms of TDS in the Pali study area

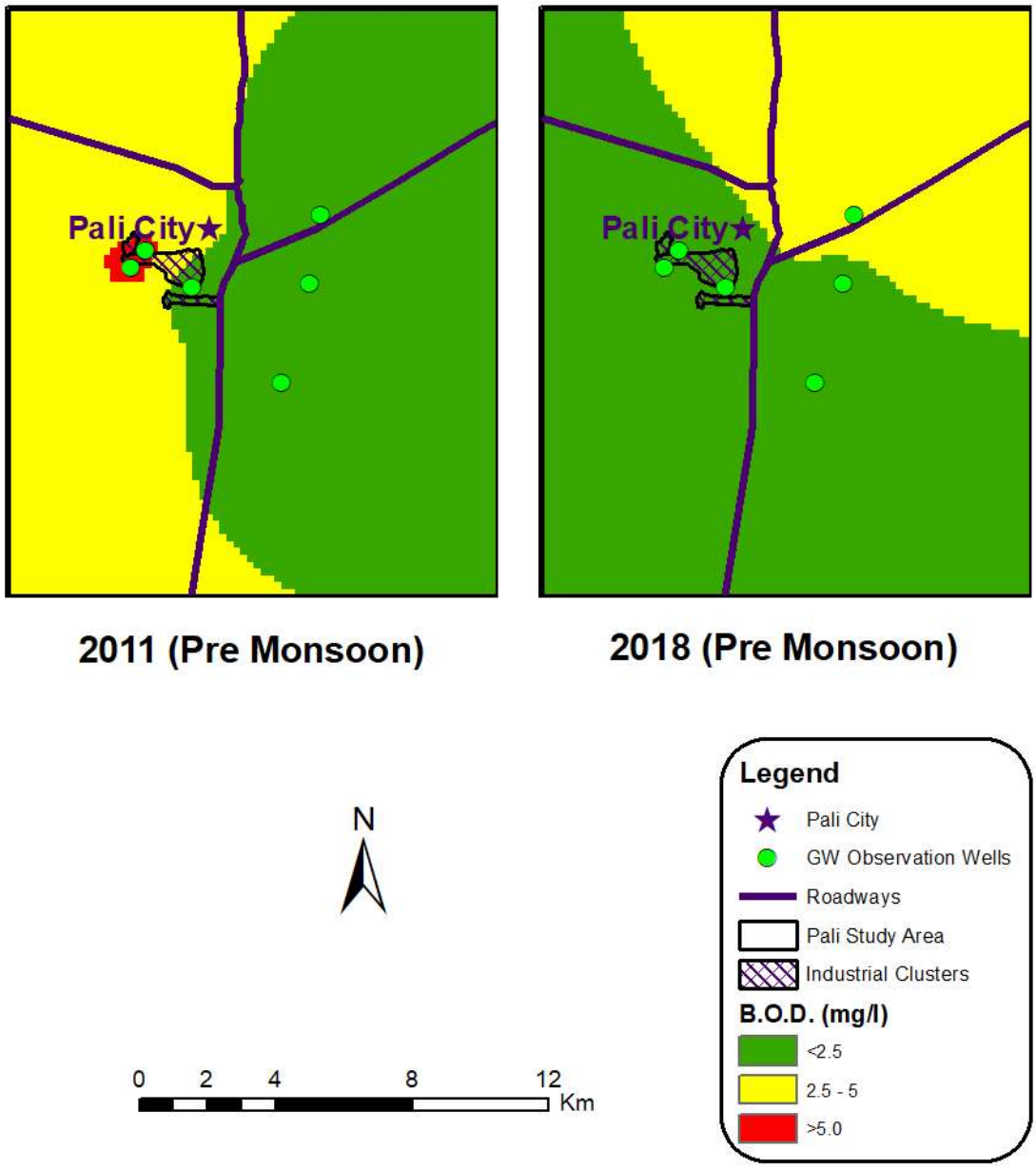

Figure 8: Groundwater quality in terms of BOD in the Pali study area

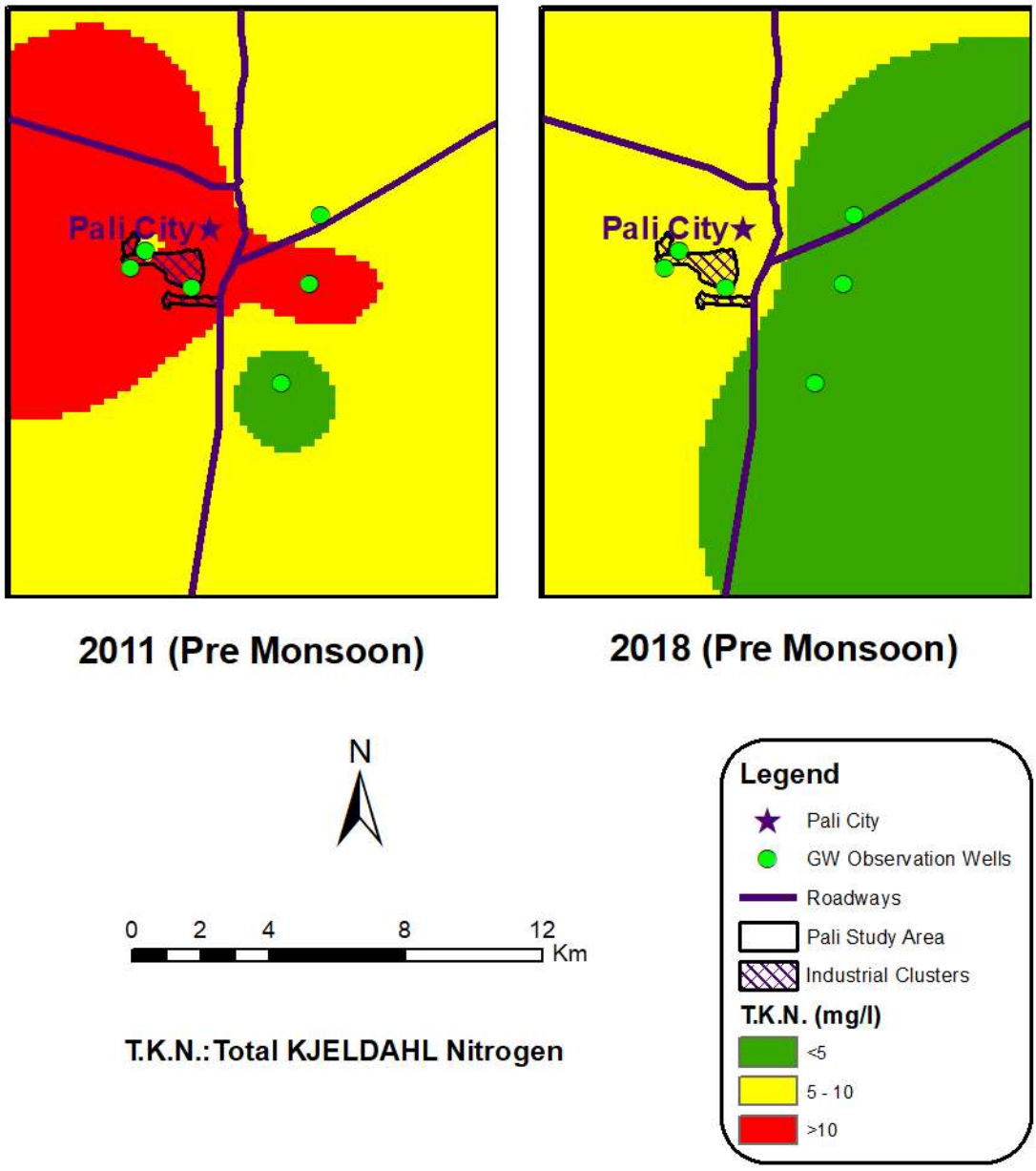

Figure 9: Groundwater quality in terms of TKN in the Pali study area

3.3 CEPI Score with revised methodology

Pali City and industrial areas have been classified as critically polluted area with the CEPI score of 73.73 as per the report prepared by CPCB for the Pali Industrial Cluster. The report ranks Pali as the 31st most polluted city in the list of critically polluted industrial clusters in India. Following tables give the parameter- wise CEPI scores for Pali as per the CPCB report.

Table 2: Details of CEPI Scores of Polluted Industrial Areas (PIAs) monitored during 2018 (Date: 10/4/2019)

S. No.	Name of Polluted Industrial Areas (PIAs)	Environment	Criteria pollutants selected on the basis of monitoring carried out during 2018	EPI Score	CEPI Score	Status of Environment	Demarcation of boundaries/ industrial clusters/ potential impact zones
1	Pali	Air	**PM_{10}, $PM_{2.5}$, NO_2**	66.00	80.48	Ac_Wc_Lc	- Existing Industrial Areas: Mandia Road, Puniyata Road, Sumerpur - Pali town
		Water	**T. Phos., TDS, TKN**	65.00			
		Land	**TDS, B, T. Hard.**	65.50			

Notes:

- The overall CEPI is presented in the alpha numeric form stating the score along with the status of Air, Water and Land environment in terms of subscript as critical/severe/normal. A sub-index score of more than 60 shows a critical level of pollution in the respective environmental component, whereas a score between 50-60 shows a severe level of pollution with reference to the respective environmental component.

- As per communication with CPCB officials, it was clarified that the water and land in the original CEPI framework correspond to surface water and groundwater components in modified CEPI

If we look at the CEPI calculations, we find that PM_{10}, $PM_{2.5}$ and NO_x were taken as the criteria pollutants. However, as per the philosophy of CEPI, we have to assume a primary parameter, which is a signature pollutant for the industries of concern. It is to be pointed out that the major industrial clusters in Pali belong to textile dyeing & printing industries. The contribution of these industries to PM_{10} and/or $PM_{2.5}$ would be minimal as only a boiler for preparing hot water used for fixing of color during the processing of cloth is required. These units were earlier using wood or pet coke, which have now been replaced with relatively cleaner fuels and hence not contributing significantly to PM fractions. Although, the concentration of PM_{10} is observed as high but its role as a signature pollutant for CEPI calculation was discarded as its origin does not lie in the industries (MHIPE, 2018) (USEPA, 2014). In fact, textile industries process raw cloth at a high pH and lot of ammonium salts are used in different steps leading to emissions of ammonia, which is a pH driven reaction:

$$NH_3 + H^+ = NH^+_4$$

Thus free ammonia is liberated at high process pH from theseunits, which is evident not only from its relatively high concentration in ambient air than other cities (though

still well within the ambient standards) the wastewater when disposed of has resulted in high concentrations of TKN and NH4-N in groundwater.Despite the fact that the major contributions for ammonia in atmosphere are considered as emissions from agriculture and animal sources as well as from vehicles, the textile cluster is also contributing to it significantly(Sarayu & Sandhya, 2012).Ammonia as a major contributor to secondary aerosol formation in the atmosphere. Ammonia reacts rapidly with both sulfuric and nitric acids to form fine particles.

$$NH_3 + H_2SO_4 \Rightarrow NH_4HSO_4 + NH_3 \Rightarrow (NH_4)2SO_4$$

$$NH_3 + HNO_3 <= \Rightarrow NH_4NO_3$$

We have prepared the following table to indicate large variations in CEPI calculations with different sets of parameters to stress upon the aforementioned point (Table 4, Figs 10-13).While estimating the CEPI score in 2013, the pollutants considered were PM_{10}, $PM_{2.5}$ and NO_x for air. As per the discussion above, it is suggested to calculate the CEPI score considering NH_3, $PM_{2.5}$ and NO_2 as the criteria pollutants (scenario 7 in Table 4).

Table 3: CEPI Scores of Pali using revised methodology for different pollutants (Year 2018)

Group No.	Criteria Pollutants (Primary, Secondary, Secondary)			Scores			CEPI Score
	Air	Surface Water	Ground Water	Air	SW	GW	
1	Benzene, PM_{10}, $PM_{2.5}$	TKN/N, BOD, TDS,	NH_3, Nitrates, TDS	46.00	71.50	73.25	82.0
2	NH_3, NO_2, O_3,	TKN/N, BOD, TDS,	NH_3, Nitrates, TDS	18.75	71.50	73.25	76.8
3	NH_3, PM_{10}, $PM_{2.5}$	TKN/N, BOD, TDS,	NH_3, Nitrates, TDS	38.00	71.50	73.25	80.5
4	PM_{10}, $PM_{2.5}$, NO_2	TKN/N, BOD, TDS,	NH_3, Nitrates, TDS	64.75	71.50	73.25	85.6
5	PM_{10}, $PM_{2.5}$ Benzene	TKN/N, BOD, TDS,	NH_3, Nitrates, TDS	62.00	71.50	73.25	85.1
6	$PM_{2.5}$, Benzene, NO_2	TKN/N, BOD, TDS,	NH_3, Nitrates, TDS	55.75	71.50	73.25	83.9
7	NH_3, $PM_{2.5}$, NO_2	TKN/N, BOD, TDS,	NH_3, Nitrates, TDS	29.75	71.50	73.25	78.9

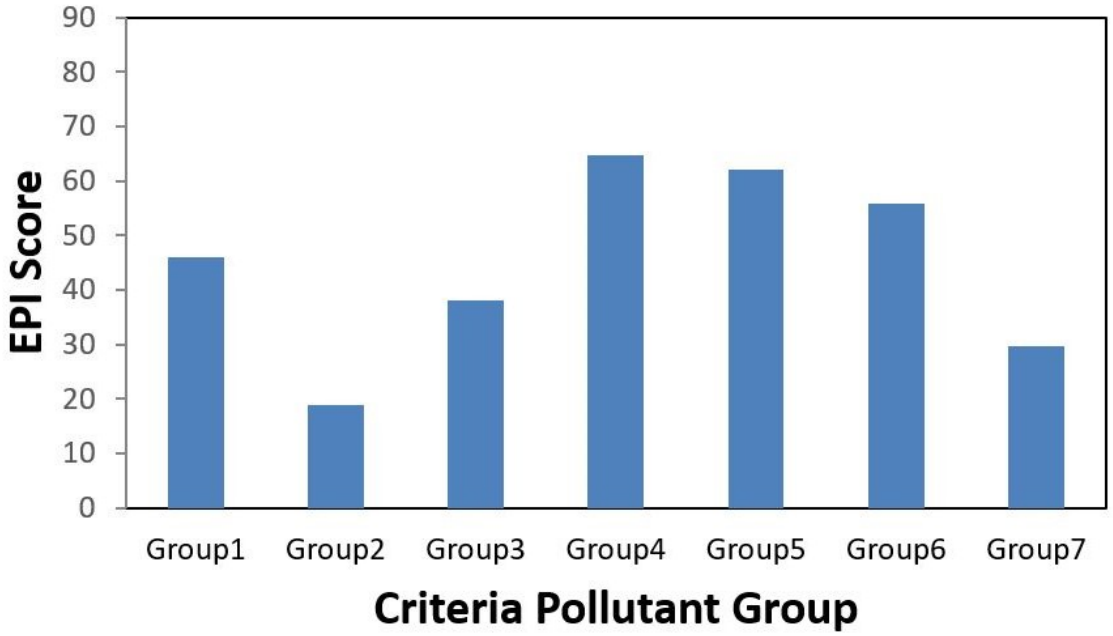

Figure 10: Variation in EPI score of Air for different pollutants

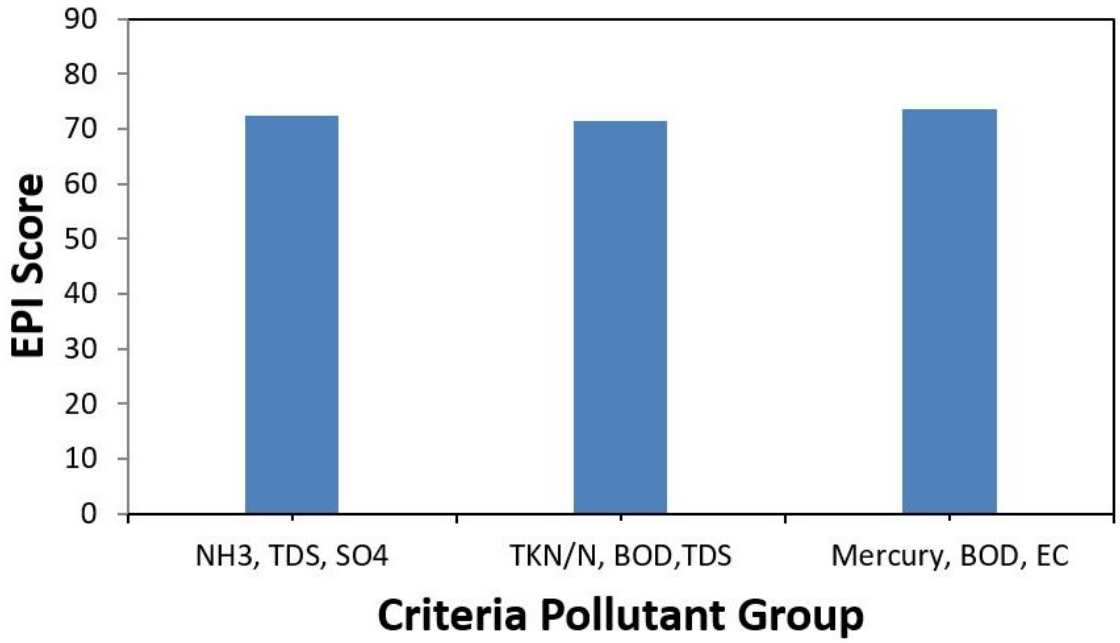

Figure 11: Variation in EPI score of Surface Water for different pollutants

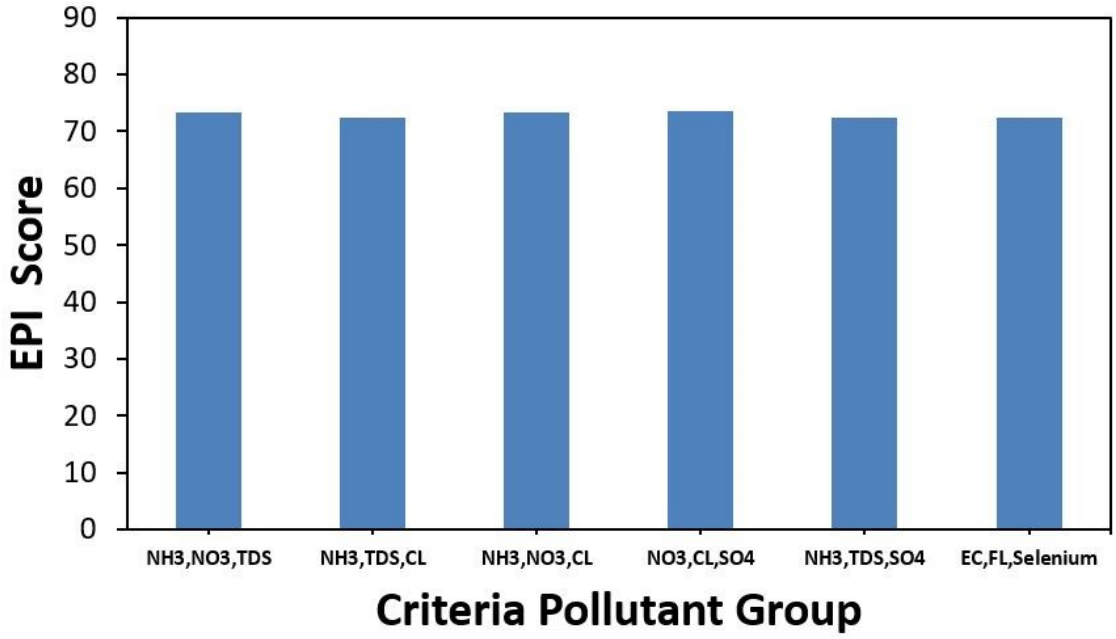

Figure 12: Variation in EPI score of Ground Water for different pollutants

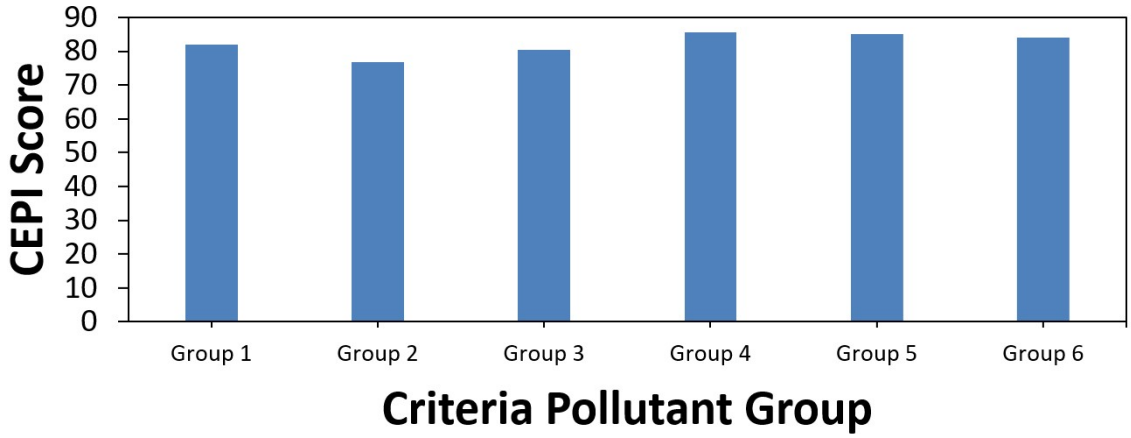

Figure 13: Variation in CEPI score for different pollutants

Table 4: Criteria pollutants used for CEPI calculation (in figure 13)

Criteria Pollutant used for CEPI calculation						
Environment	**Group 1**	**Group 2**	**Group 3**	**Group 4**	**Group 5**	**Group 6**
Air	Benzene, PM_{10}, $PM_{2.5}$	NH_3, NO_2, O_3	NH_3, PM_{10}, $PM_{2.5}$	PM_{10}, $PM_{2.5}$, NO_2	PM_{10}, $PM_{2.5}$, Benzene	$PM_{2.5}$, Benzene, NO_2
Water	TKN/N, BOD, TDS	TKN/N, BOD, TDS	TKN/N, BOD, TDS	TKN/N, BOD, TDS	TKN/N, BOD, TDS	TKN/N, BOD, TDS
Land	NH_3, Nitrates, TDS	NH_3, Nitrates, TDS	NH_3, Nitrates, TDS	NH_3, Nitrates, TDS	NH_3, Nitrates, TDS	NH_3, Nitrates, TDS

From the above discussion, the following can be inferred:

- It was observed that data for heavy metals and pesticides were not available for surface and ground. It is recommended to collect the data regarding these hazardous pollutants.
- As the methodology of the CEPI calculation depends on the exceedance factor of the criteria pollutants selected, the concentration of the pollutants is a major factor. Hence the selection of criteria pollutants should be a rigorous exercise.
- The methodology for CEPI score has been modified recently. While comparing CEPI scores, it should be kept in mind that the scores to be compared, have been calculated from same type of CEPI methodology.

4. ACTION PLAN FOR PALI INDUSTRIAL CLUSTER

4.1 Summary of Proposed Action Points

Short Term Action Plan- Air

S. No	Action points (Including source and mitigation measures)	Suggested Responsible stakeholders/ Agency involved	*Remarks*	*Tentative Tine Frame**
1	Performance monitoring of major air polluting industries for assessment of compliance of the notified air emission standards	Industrial Association of Pali	-	1 year
2	Up-gradation of the air pollution control measures e.g., dust collector, multi cyclone etc. with the non-compliance industries.	Industrial Association of Pali	-	1 year
3	Installation of additional ambient air quality monitoring station	RSPCB	Ambient air quality monitoring station should be sited in ENE to NNE direction of the industrial clusters to pick up hot spots.	1 year
4	Adoption of measures to curb vehicular pollution in which following actions are desired to be taken: To repair, widen and maintain the existing roads in the industrial cluster or to enforce One way traffic system with traffic signals	District administration, Traffic department, Industrial Association of Pali	-	1 year

Long Term Action Plan-Air

S. No	Action points (Including source and mitigation measures)	Suggested Responsible stakeholders/ Agency involved	*Remarks*	*Tentative Tine Frame**
1	Cleaner fuel availability for industry	Industries Department, Industrial Association of Pali	-	3 year
2	Promotion of Clean Fuel and latest technology (boiler/ thermopack by the industry)	Industries Department, Industrial Association of Pali	-	3 year

Short Term Action Plan- Water

S. No	Action points (Including source and mitigation measures)	Suggested Responsible stakeholders/ Agency involved	*Remarks*	*Tentative Tine Frame**
1	Assessment of the compliance of the effluent quality standards of the water polluting industries with the prescribed standards of effluent quality for inlet to CETP as specified under EP Rules.	RSPCB, Industrial Association of Pali, CETP Trust	Groundwater sources especially in the critically polluted regions should be assessed for certain heavy metals like Cr, Cu, Znetc as signature pollutants to assess the impact of industrial (textile) discharges. This is also mandated in CEPI.	1 year
2	Up-gradation of the overall treatment process e.g., physicochemical treatment etc. with the non-complying industries	RSPCB, Industrial Association of Pali, CETP Trust	It is important to improve on the primary treatment facilities to reduce the load on the treatment plant through appropriate choice of mixed coagulants, introduction of some additional pre treatment step (e.g., partial chemical oxidation etc) to improve the subsequent biological treatment step.	1 year
3	Installation of Flow meter / Water mater with the remaining member units of CETP trust and provisions for measurement of pH and TDS of the effluent from the units	Industrial Association of Pali, CETP Trust	-	1 year
4	Development of Sewerage System	RUIDP, Municipal Corporation	-	1 year
5	Commissioning of Sewage Treatment Plant (STP)	RUIDP, Municipal Corporation	Construction and commissioning of one STP has been completed while the other STP is expected to be commissioned in the near future. All STPs should meet prescribed standards for BOD/fecal coliform.	1 year

6	Up-gradation/ provision of the ETP of large scale polluting Industry of Pali	Industries Department	Any large scale or small scale industry may be instructed to install ZLD plant for recycling of their treated effluent.	1 year
7	Maintenance of the drains being used for transportation of untreated industrial effluent to CETP in the industrial area	RIICO, CETP Trust	The new effluent drains laid in PIA and MRIA must be regularly maintained and watched for overflow. Proper cleaning and maintenance schedule must be laid out. Effluent from RIICO industrial area (Ph I & II) is being conveyed through GPS based tankers and provision of new pipe lines for transporting effluent must be made.	1 year
8	Performance monitoring of CETPs and STPs	RSPCB, CETP Trust, Municipal Corporation	Some parameter(s) should be included for continuous monitoring with SCADA system representing 'signature pollutant(s)' for ascertaining realistic source apportionment, which would also help in CEPI calculations besides pin pointing violations by specific industry(ies) connected to SCADA.	1 year
9	Construction of a CETP – V of 12 MLD capacity	CETP Trust, Industrial Association of Pali	Construction work of CETP Unit V at Mandia Road Industrial Area was started but the work has been stopped due to land dispute. Efforts must be made to complete the work on an urgent basis.	1 year
10	Monitoring of groundwater quality	RSPCB, CETP Trust, RGWB	The number of monitoring stations may be increased. Groundwater sources especially in the critically polluted regions should be assessed for certain heavy metals like Cr, Cu, Zn etc as signature pollutants to assess the impact of industrial (textile) discharges. This is also mandated in CEPI.	1 year
11	Provision of potable water in affected areas	PHED	Villages like Bali, Ramawas Kalan, Prithvi Pura, Sewariya, Bithora Kalan, JadanKhalsa, Kharchietc where the ground water quality is very bad should be connected to the ongoing projects of the PHED Rajasthan of defluoridation/RO plants for supplying safe drinking water to the villagers so that they do not suffer from ill health due to water pollution	1 year

Long Term Action Plan- Land

S. No	Action points (Including source and mitigation measures)	Suggested Responsible stakeholders/ Agency involved	*Remarks*	*Tentative Tine Frame**
1	Development of Municipal Solid Waste (MSW) treatment and disposal facility	Municipal Corporation Pali	-	3 year
2	Augmentation of treatment and disposal facility for Bio-medical Waste	RSPCB, Medical and Health Department, Municipal Corporation, local self-governing bodies	The Biomedical waste from the health care facilities of Pali is being collected, transported and disposed with the authorized Common Bio Medical Waste Treatment and Disposal Facility located in Jodhpur i.e., at distance of approx. 85 km. The disposal facility requires augmentation for the compliance of CPCB guidelines for treatment and disposal facility of BMW.	3 year
3	Disposal/ Co-processing CETP sludge which is a hazardous waste as defined under HWMR, 2016	CETP Trust, Industries Department,	This sludge is presently collected, dried and transported to common treatment storage and disposal facility developed by Rajasthan Waste Management System near Balotra in accordance with the provisions of Hazardous Waste (Management, Handling & Trans-boundary Movement) Rules 2016. This sludge is also being co-processed in cement plants in this area. However, the sludge waste presently needs to be disposed or co processed at the earliest	3 year

Long Term Action Plan- Water

S. No	Action points (Including source and mitigation measures)	Suggested Responsible stakeholders/ Agency involved	*Remarks*	*Tentative Tine Frame**
1	Recycling of Treated Effluent of CETP	Industrial association, CETP Trust	Treated CETP effluent should be reused by the Member Industries to the extent possible. Analysis of "extra cost" versus "additional benefits" may be carried out to upgrade treatment from "disposal standards" to "reuse standards".	3 year

2	Installation of rain water harvesting system in the buildings and institutions	Industrial association, RIICO, Municipal Corporation	Allocation of new industrial plots by RIICO is being done with the condition for installation of proper rain water harvesting structures for the proposed industrial unit. The condition may be extended to the existing plots also and the services etc. may be continued on the basis of providing rain water harvesting system in the existing plots. The ongoing work of installation and construction of RWH must have a regular O&M plan as well.	3 year
3	Identification of industries which are not connected to the CETP system but discharge into the effluent drain thus affecting its quality	RSPCB	A study on mass balance may be conducted to catch such culprits and appropriate punitive measures must be taken besides planning to bring the entire cluster of industries under the ambit of CETP.	3 year
4	Tertiary treatment of the sewage and its utilization as raw water by the industries	CETP Trust, Municipal Corporation Pali	-	3 year

Long Term Action Plan- Others

S. No	Action points (Including source and mitigation measures)	Suggested Responsible stakeholders/ Agency involved	*Remarks*	*Tentative Tine Frame**
1	Development of green belt and tree plantation in industrial area	RIICO, Industrial Associations	RIICO Limited and CETP Trust is to develop & encourage road side plantation in the industrial cluster as well as to develop green spot in cluster for maintenance of ambient air quality. Arboriculture and Plantation or similar activities should be regularly promoted	3 year
2	Carryout of health study to establish causal relationship	Medical and health department	The present health data are classified in to general ailments observed in any habitation. Health studies should be carried out linking environmental/ occupational pollution due to industries and human health for establishing causal relationships.	3 year

* The given timelines are tentative and must be finalized by the responsible agencies.

Note: *While recommending the interventions to reduce CEPI, various studies, reports, Master Plans, RSPCB and RIICO data was referred to and wherever the information was available, the costs of interventions have already been included in the Final Action Plan. These interventions will be implemented by different agencies, including RIICO as identified in the action plan.*

4.2 Recommendations for practising long-term sustainability/ Research Points:

- Attempt should be made on solar energy as a replacement wherever feasible (eg Solar operated geyser). Sunlight all through the year is available in plenty in this region and plenty of roof area is available in the industry premises.

- A part of the treated sewage should be utilized for industrial purposes after carrying out appropriate tertiary treatment for ensuring long-term sustainability of groundwater in the region.

- If at all, some treated effluent is utilized for irrigation, it should be as per a detailed irrigation management plan prepared by experts of environment as well as agriculture.

- Co-treatment of organic solid wastes with industrial sludges may be tried for developing substitutes for energy in a scientific manner.

- The industry may adopt non-conventional and cleaner fuel for the production purpose and to upgrade the ETP to ZLD level. Use of cleaner fuel may be encouraged by providing soft loan for replacement / conversion of the existing boiler / thermo pack to cleaner fuel.

- Non polluting industries like weaving units / readymade garment manufacturing units etc. may be developed for diversion of industrial activities.

- Experiments may be conducted if ozonation for complete removal of organics and coliform would make it fit for reuse in the industry, it may incur marginal additional cost. Otherwise also, application of RO process may also be a competitive option since the water supply in the city is through Jawai dam, which contains low TDS. The sewage will be of much lesser TDS than the locally available groundwater, which has a TDS range of 4000-5000 mg/L and is brought to the industry through tankers. As these areas are already in the "over exploited (critical/semi critical)" zones as per groundwater extraction rates, and as such, this measure would go a long way in reducing the demand of water and hence would improve sustainability of the industry

- Mixture of coagulants (e.g., a new Aditya Birla product) of anionic as well as cationic and both monomeric and polymeric coagulants (flocculants) may be experimented in CETP laboratory to optimize the process. A frequent change of coagulant is practiced based on its availability (or cost) in the market, but pH correction required for optimal utilization of coagulant is ignored. Fresh Jar tests should be conducted with every new consignment of coagulant(s) for its optimum doses.
- Alternatively, technologies like nano-filtration and vacuum membrane distillation (examples are available in Tamil Nadu) may also be explored for their competitiveness to RO-MEE combination, which has its inherent limitations.
- TDS addition to the raw water during processing of cloth is much higher at Pali than that at Jodhpur. The strict volumetric discharge limit on industries has perhaps prompted some industries to adopt some measures for reduction in quantity of water used for processing the cloth. Though it is a good practice, but it results in a more concentrated effluent, which further requires upgrading the treatment strategy. Some of the possible alternatives are indicated below:
    - Acid activated sand filtration may be tried to improve the removal, which may prove as a less costly substitute to activated carbon and pressure filtration adopted presently.
    - Another option may be replacing this step by ozonation, which may be relatively costlier dye removal option, but it may again bring the quality of this treated water to an acceptable level for one reuse within the industry (TDS may govern this choice).
    - Chemico-biological or physico-biological sequences for more meaningful "treatment" rather than only "separation" (Ozonation followed by biological oxidation or cavitation followed by biological oxidation after the coagulation/flocculation/settling steps.

5. FUNDING SCHEMES/POLICIES

Funding for Support/Facilities is provided by Industries Department through various schemes such as:

1. Rajasthan Nivesh Protsahan Yojna (RIPS) 2014 and 2019

   Provides capital Subsidy on Zero liquid discharge based treatment plant.

2. Rajasthan MSME Policy 2015

   To encourage MSMEs/Handicraft/Handloom enterprises to attain international quality benchmark, the state government will endeavour to establish national laboratories. A 50% rate of DLC will be given to MSMEs setting Research, Development and testing laboratories.

3. Integrated Textile Processing Development scheme (IPDS)

   The primary objective of the IPDS is to facilitate the textile industry to become globally competitive using environmentally friendly processing standards and technology. The IPDS would facilitate the textile industries to meet environmental standards, create new processing parks, support the upgradation of existing clusters and promote R&D in the area of W&WW management.

4. Rajasthan Integrated CETP scheme (under discussion)

6. REFERENCES

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