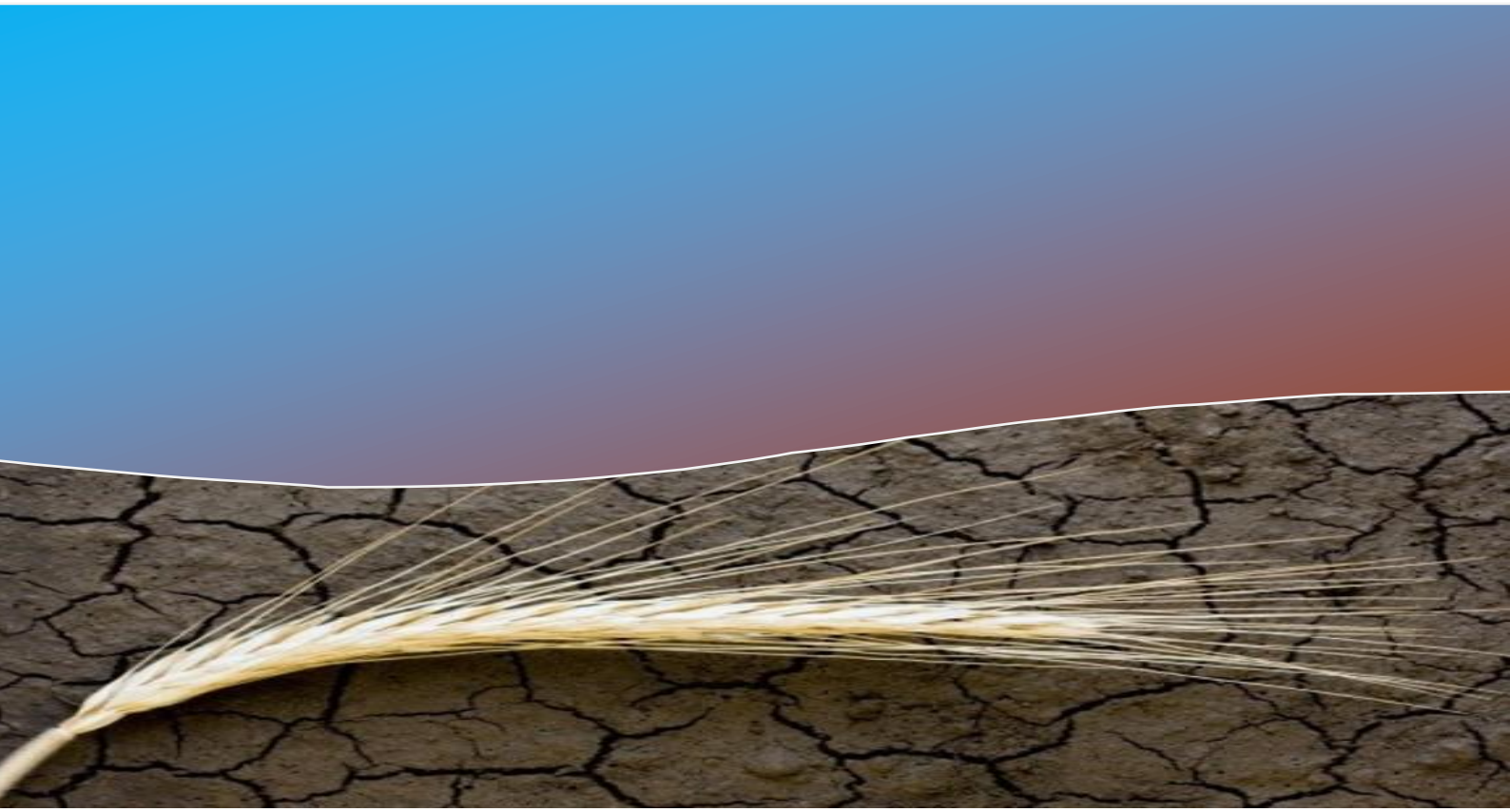

Rapid Climate Risk Analysis of Industrial Parks - Experiences made in Telangana

Part of the Study on Baselining and Selection of IPs for the CCA Project in the State of AP and TS

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List of Abbreviations

TSIIC	Telangana Industrial Infrastructure Corporation Limited
CCA	Climate Change Adaptation
DRM	Disaster Risk Management
IALA	Industrial Area Local Authority
IMD	Indian Meteorological Department
IPs	Industrial Parks
IT	Information Technology
ITeS	Information Technology enabled Services
PCB	Pollution Control Board
SEZs	Special Economic Zones
APIIC	Andhra Pradesh State Industrial Infrastructure Corporation Limited

Executive Summary

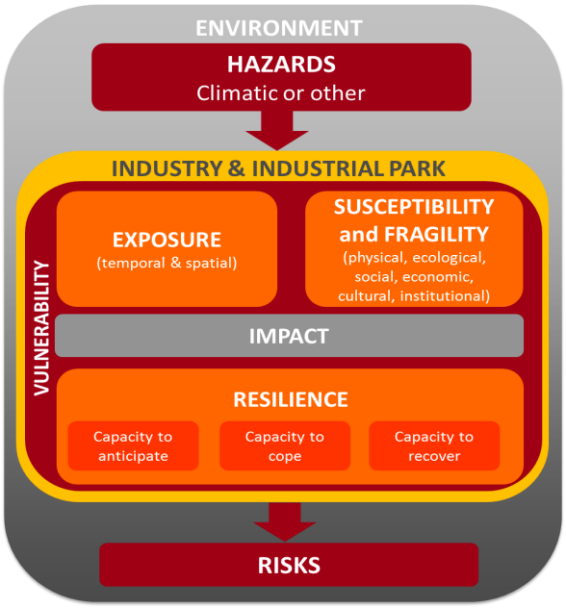
Background and aim of this study

In spite of significantly visible climatic hazards in Telangana and Andhra Pradesh, India, there is a lack of representative data available on climate change impacts and the respective preparedness of industrial parks to cope with. The project ”Climate Change Adaptation in Industrial Areas in India” (CCA project) therefore developed and tested a methodology that allows to gather such climate risk data in a structured and comprehensive manner generating comparable information for the Industrial Areas analysed. The findings thereof are summarised in this study which aims at:

- Describing a replicable approach for a rapid climate risk assessment methodology for industrial parks in India;
- Showing the results of the assessments carried out in Telangana;

Rapid climate risk assessment approach

The climate risk assessment approach depicted in this study is based on a 7-step process as shown in the figure on the right:



Process of Climate Risk Analysis

Step 1: Identify relevant *climatic hazards* in the area
Step 2: Determine temporal and spatial *exposure* of the IP to these hazards
Step 3: Determine *susceptibility and fragility* of the IPs
Step 4: Combine exposure and susceptibility to expected *impact*
Step 5: Determine *resilience* of the IP
Step 6: Combine impact and resilience to derive *vulnerability* of the IP
Step 7: *Risk* analysis

Chapter 2 of this study guides through these seven steps and also provides detailed background on the underlying questionnaire and scoring methodology applied.

Telangana case study

Chapter 3 of this report provides findings of the application of the rapid risk assessment approach in industrial parks in Telangana. Five IPs were selected through a preliminary screening process (as described in – please refer to the report) and have been analysed in more detail through the Rapid Climate Risk Analysis Methodology described in (please refer to the respective report).

The IPs for which a rapid climate risk analysis was carried out in Telangana are:

Sr No	**Existing IPs**		**New IP**	
1	IP Pashamylaram	Patancheru	IP Sulthanpur	Patancheru
2	IP Jeedimetla	Jeedimetla	IP Buchinelly	Patancheru
3	Hitech City Madhapur & Software Units layout	Cyberabad	Mega Food Park	Warangal
4	IP Rampur & IP Madikonda	Warangal	Hyderabad Pharma City	Shamshabad
5	IP Cherlapally	Shamshabad		

Focus Group stakeholder consultations with industrialists, IALAs, TSIIC zonal officers were conducted between 21st of December 2015 and 30th of January, 2016. The stakeholder consultations were guided by a climate risk adaptation questionnaire designed for the study.

Key findings related to each element of the risk assessment approach for existing IPs in Telangana are summarised in below table:

Element	**Key findings**
Exposure	• Droughts: the frequency of drought incidents has increased; drought causes reduction in ground water level and several other water quality and availability issues • Heat waves: heat wave situations have become worse in last decade; during consultations IP Jeedimetla, IP Madhapur and IP Pashamylaram experienced high exposure levels to heat wave. Heat waves can potentially worsen drought conditions and may result in fatigue and heat stroke of employees. • Precipitation: Overall, the rainfall pattern of Hyderabad and other regions in Telangana has changed with delayed monsoon, more wide spread rainfall and decreased overall rainfall. Thus, the instance of water logging and flash flooding that IPs get exposed got usually low scoring.

	• Salinization, lighting and thunderstorms not perceived as relevant or no changes experienced by the IPs. • IP Madhapur and IP Jeedimetla have highest exposure to climatic hazards.
Susceptibility	• IPs internal road systems, storm water management system, waste water management system and energy were found to be climatically most susceptible areas among the main 9 climatic susceptibility measures studied • Water management was found to be the next most susceptible parameter consistently across all IPs. • IP Jeedimetla has highest susceptibility. IP Cherlapally is ranked 2nd in susceptibility. Similarly, IP Rampur and IP Madikonda have high susceptibility. Age, design and type of industries are influencing this ranking.
Resilience	• IP Jeedimetla and IP Rampur and IP Madikonda are least resilient to climatic changes across all six parameters. Governance and management, human resource, awareness and knowledge levels at this IP are poor. • IP Madhapur is financially robust, it has a well-designed system for supply of essential services, thus the resilience of this park is highest and ranked as number 5.

The scoring and subsequent ranking of IPs has resulted in prioritising "**Jeedimetla" as the most vulnerable existing IP**. It is proposed that the baseline documentation will be conducted for IP Jeedimetla.

Climatic Vulnerability Ranking of IPs based on the risk assessment tool

Order Based on exposure	Susceptibility Score			Impact ranking	Resilience Score			Vulnerability Ranking
Madhapur	6	3	0	5	3	2	1	5
Jeedimetla	3	4	2	1	0	5	1	1
Pashamylaram	4	3	2	3	2	2	2	4
Rampur & Madikonda	6	1	2	4	0	4	2	3
Cherlapally	4	2	3	2	1	2	3	2

In case of upcoming IPs, the methodology focuses on three reinforcing pillars that collectively contribute to the understanding of IPs risk: a hazard impact assessment, an institutional assessment, and a socioeconomic assessment. All the new industrial parks identified for the study are exposed to similar climatic hazards.

A participatory stakeholder consultation was conducted with the TSIIC team and concluded that all the new industrial parks are exposed to similar climatic hazards. It was also concluded that Hyderabad Pharma city will be considered for the next level of baseline assessment because it represents one of the most important industrial sectors of Telangana and is envisaged to be a world class IP.

The participatory stakeholder consultation concluded that all the new industrial parks are exposed to similar climatic hazards. It was also concluded that Hyderabad Pharma city will be considered for the next level of baseline assessment because it represents one of the most important industrial sectors of Telangana and is envisaged to be a world class IP. It is also currently in the master planning stage which is the ideal time for development of baseline documentation on CCA, identification of adaptation measures and also implementation of the same.

1. Introduction and Background to the Study

1.1 Background of the report

Climatic conditions are never static. Historically, the climate has been changing at natural pace. However, human activities have increased the pace of these changes several times through the emission of greenhouse gases. The scientific community has predicted that if human intervention were to continue in the same shape and form the impacts will become harsher and more unbearable with time; magnitude of loss of infrastructure, human life, business could be several times larger and more unpredictable. In the wake of these changes, communities need to assess the risk, and their current ability to cope with climatic changes, small and large, and not just address disasters post-fact-to. Such a pro-active and structured approach will lead to more resilience and sustained growth.

The solution, through policies or measures, although may be good to reduce greenhouse gas emissions and to adapt to climatic impacts, it will not necessarily be easy to implement it. Adaptation to Climate Change (CCA) will require investment. A decision has to be made by the government and industry on how much effort it is prepared to make, and how to prioritize this issue in relation to its other objectives. An assessment of the risks will be a necessary basis for judging what would be a proportionate response.

Integration has been entrusted by GIZ the task of developing demonstration projects or pilot cases on climate change adaptation in the industrial parks in the state of Telangana. The first step in this process was to select IPs to be further analyzed, the second step was to establish the baseline documentation for subsequent elaboration of climate change adaptation plans and identification and implementation of climate change adaptation measures in the identified industrial parks.

Integration has commissioned Core CarbonX Solutions Pvt Ltd to identify one existing and one upcoming industrial park in the State of Telangana and to undertake the baseline study for climate change adaptation planning.

The study involves below mentioned tasks:

- Main task 1: Developing methodology for Rapid Climate Risk Analysis for direct and indirectly induced climate hazards and vulnerabilities with respect to geographical location, industries types and set up, land use, logistics, environment and socio economic conditions for existing and upcoming IPs of Telangana state (TS).

- Main task 2: Preliminary screening of climate risks in existing and upcoming industrial parks / SEZs in the States of TS.

- Main task 3: Selection of one existing and one upcoming industrial area in each of the states of TS.

- Main Task 4: Conduction of the Rapid Climate Risk Analysis and baseline for the 2 study cases.
- Main Task 5: Consultants should also assist the partners for various financing instruments available for implementing the project.

Task1 and Task 2 have been completed. Results of Task1 and Task 2 are available in the report titled 'Preliminary Risk Assessment of the Industrial Parks in Telangana'. Task 1 and 2 has resulted in selection of six existing and four upcoming parks based on the preliminary findings on climate exposure and impact data on the adaptive capacity status of the industrial park.

This report illustrates a methodology for a rapid climate risk analysis for IPs and it has been tested on 5 IPs in Telangana. This tool together with establishment of a baseline will provide key input for the elaboration if Climate Change Adaptation Plans and identification, planning and implementation of priority measures both in the planning and management of Industrial Parks.

Because the CCA plans and measures shall only be implemented in pilot parks, the second task of the study is to identify the parks best suitable for this purpose. Some of the parameters describing the best suitable park are it's representativeness, exposure to widest range of climatic risks possible, and capability and willingness to support the project and implement the pilot measures.

The report is divided into three chapters:

- **Chapter 1: Introduction and background**

  This chapter provides a background of the climate change adaptation project, objectives and the key aspects of this report

  This chapter provides in brief an overview of the earlier steps in the project i.e. Preliminary screening report, current industrial park set up in Telangana, climatic trends as found during the study are also briefed here.
- **Chapter 2: Development of Rapid climate risk analysis methodology and tool**

  This chapter explains in detail the rapid climate risk analysis methodology development process and the methodology applied to this project. A customized questionnaire has been developed to conducted risk analysis. The questionnaire development is also discussed in this chapter.

- **Chapter 3: Rapid Climate Risk Analysis of IPs in Telangana state**
  This chapter describes in brief the key observations from stakeholder consultation process. The climate risk assessment methodological tool is applied to the identified IPs in Telangana. The results of this analysis are a Climatic risk rating of identified IPs.

1.2 Results and overview of Preliminary Screening of IPs

The State of Telangana is the youngest state in India, formed in the year 2014. It is the twelfth largest state by size and population. The service sector, industries and agriculture are the three main economic drivers of the state. The state has 10 districts which are located in semi-arid and arid climatic zones. In Telangana, water availability and quality of water are two of the primary areas of concern.

The state of Telangana has over 131 Industrial Parks (IPs) areas ranges from 15 acres to 2500 established throughout the State. Several new industrial parks are also under different stages of planning. Telangana State Industrial Infrastructure Corporation Limited (TSIIC), an undertaking of Government of Telangana State, is a premier organization in the state, vested with the objective of providing Industrial infrastructure through the development of Industrial Parks and Special Economic Zones. To develop and manage the industrial parks TSIIC has divided these IPs into six industrial zones namely Jeedimetla, Karimnagar, Patancheru, Shamshabad, Warangal and Cyberabad. Most of these industrial zones are in the periphery of Hyderabad. http://tskpi.apiic.in:8111/KPI/apiicfi/employeeloginforKPI.jsp

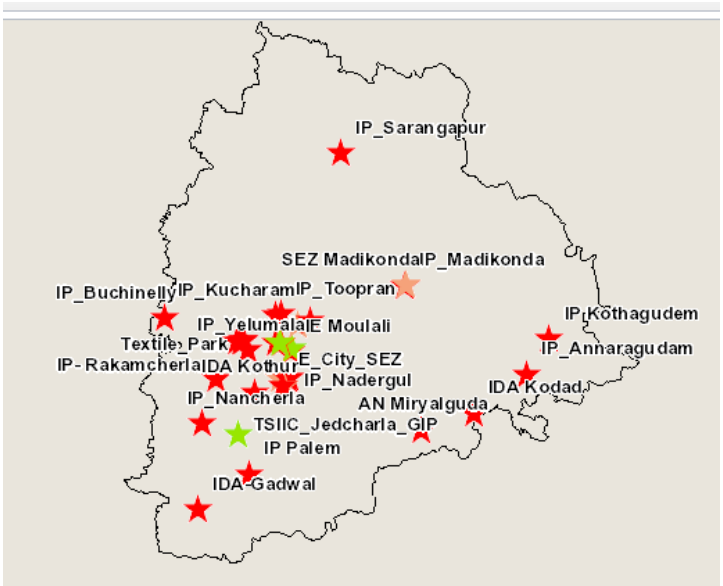


Figure 1: Illustration on spread of Industrial Parks in Telangana[1]

[1] http://tracgis.telangana.gov.in/TIS/TISNEW/tsiic/default.aspx

Hyderabad is a well established hub for pharmaceutical and associated industries. In last two decades Hyderabad has gained international recognition as an information technology hub as well. Details of industrial sectors present and proposed in each of the industrial zone are presented in the table below:

Table 1:Zone-wise distribution of industrial sectors

Industrial Zones	Existing industrial sectors	Proposed industrial sectors[2]
Jeedimetla	Automotive based Industries, General Engineering, Steel Re rolling, R & D of Biotech, Pharmaceuticals, Vaccines, Chemicals, Paints, Pesticides, Bulk Drugs	Pharma, Food processing, Chemicals, Engineering
Karimnagar	General engineering, Rice mills, Oil mills, and other agro based industries, Pipes, Paints, Granite etc.,	Fertilizer, Power, Cement, Textiles, Paper, Minerals and Food processing
Patancheru	Pharmaceutical, Chemical, Textile, Logistics and warehousing, Edible Oils, General Engineering, Steel rolling, Paints, Rubber and Tyre	Chemicals, Engineering, Automobiles and Pharmaceuticals
Shamshabad	Pharmaceutical, Auto ancillary, chemicals, Warehousing, Food processing and Beverage industry, Aerospace, Solar Equipment, Electronic Hardware, Bulk Drugs	IT, Pharma, Food processing, Defense and Aerospace, Textiles, Consumer products
Warangal	General Engineering, Agro based industries, Plastic, granite based, Warehousing	Mineral, Food processing, Textile and Leather, Cement, Pharma, Granite, Power, Metallurgy and Paper
Cyberabad	IT & ITeS (Information Technology & Information technology enabled services)	

The Task 1 and Task 2, has resulted in a two-step preliminary screening methodological tool for screening of IP based on their climatic exposure, climatic impact and capability to adapt. The field-based preliminary screening methodology was tested and applied to 53 IPs in the state, spread across all zones. To reduce the effort for the field-based preliminary screening Before preliminary screening, a desk based first screening (first step) was performed to arrive at IPs which are significant for the CCA project in size and the allotment of industrial plots to

[2] Conceptual plan for district development, Pg 117, Socio Economic Outlook 2015

industries. The field step of the preliminary screening methodology was conducted through one to one interview process with the stakeholders by means of a structured preliminary questionnaire. Zonal manager and officers at zonal office were the key stakeholders identified for this survey. Information of Climatic changes and weather pattern data were also recorded from the revenue department and IMD. The field level information was corroborated with secondary data available with these departments. For the upcoming IPs/new IPs, no climatic impact history and capability information were available through the one to one interview. Hence, the new IPs were assessed based on data from secondary sources on climatic exposure, accompanied with the inputs from corporate office of TSIIC on planning process of IPs. Existing IPs were scored under each section i.e. climatic exposure, climatic impact and capability. Finally, geometric mean of each IP was arrived at and used for ranking the IPs. The IPs finally chosen for climate rapid risk analysis are presented in the table below.

Table 2: List of IPs selected for rapid climate risk analysis study

Sr. No.	Name of IP	Industrial Zone	Preliminary Screening Score	Name of IP	Industrial Zone
	Existing IP			**New IP**	
1	IP Pashamylaram	Patancheru	0.89	IP Sulthanpur	Patancheru
2	IP Jeedimetla	Jeedimetla	0.76	IP Buchinelly	Patancheru
3	Hitech City Madhapur & Software Units layout	Cyberabad	0.61	Mega Food Park at Buggapadu	Warangal
4	IP Rampur and IP Madikonda	Warangal	0.46	Hyderabad Pharma City	Shamshabad
5	IP Cherlapally	Shamshabad	0.32		

2. Rapid Climate Risk Analysis Methodology

2.1 Seven steps and underlying parameters

Assessments of climate change related risks consists of both, “impacts driven” or “vulnerability driven‟ approaches,. In the climate risk analysis both the impacts and the general vulnerability of the IPs need to be understood in order to initially identify the main risks for which more detailed risk assessment can be carried out. In order to assess how industrial parks may be affected by changes in climate, and thus understand how big a threat may exist, how urgent the task may be, and to duly decide whether we need to adapt and how, then we clearly need methods and tools with which we can generate an evidence base, to start answering these kinds of questions. This chapter provides a discussion of the rapid climate risk analysis method that is being developed in support of assessing climate risks.

The rapid climate risk analysis aims primarily to further our understanding of the plausible climatic issues faced by IPs and the capabilities that already exist to address them; at the same time, it may provide insight into the nature of the solutions. The Rapid climate risk analysis is being carried out based on the elements of Climatic hazard and vulnerability. Vulnerability is a function of exposure, susceptibility, fragility, impact and resilience of the system towards climatic change. A schematic presentation of the same is provided in the figure 1.

A 7-step approach was followed to derive risks:

- Step 1: Hazards
- Step 2: Exposure
- Step 3: Susceptibility and Fragility
- Step 4: Combining exposure and susceptibility to expected impact
- Step 5: Resilience
- Step 6: Vulnerability
- Step 7: Risk Analysis

These seven steps are described in more detail in the following.

Step 1: Hazards

Hazards included in the screening exercise

- Heavy rainfall inducing floods, landslides, and other events
- Droughts
- Heat waves

Hazards not yet included, because they are either of less relevance in the state, could not yet be observed, or reliable and applicable data are not available:

- Thunderstorms and stroke of lightning (availability of climate data questionable)
- Wildfires (availability of climate data questionable; The problem of wild fires is not relevant to Telangana)
- Salinization (most probably only existing observations)
- Sea level rise (for sea level rise usually global models, Telangana is landlocked)
- Cyclones and storms including storm surges (The state of Telangana, is a land locked state. Cyclones and storms including storm surge do not impact the state.)

The IPs are generally not located near any major river. Thus, the event of flooding and landslide are not applicable.

Step 2: Exposure

Exposure means "The **presence** of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets **in places and settings that could be adversely affected**." (IPCC (2014), p. 5). It is a look from the outside, not including man made systems and structures as "active" elements, but as objects which can be hit. The analysis includes past and projected future exposure; and checks, which hazards exist and which areas can be hit.

Information on temporal exposure (past, present, future) of IPs to climate hazards has already been collected during the screening phase. During the base line study additional information on such temporal exposure can be collected; e.g. information on frequency of smaller flooding etc. In course of the base line study the spatial exposure to climate hazards has to be further analysed. The following table provides an overview on data already collected and to be collected during field work and indicates sources of information. Exposure should be classified in three-(five) classes, as a combination of both temporal and spatial dimension. In case a spatial differentiation is not possible, exposure class will be based on temporal dimension only**: (very low)-low** – **medium** – **high – (very high**). Criteria leading to the classification have to be clearly defined and documented.

Exposure		Spatial dimension		
		(very low)-low	medium	high – (very high)
Temporal dimension	(very low)-low	Low	low	Medium
	Medium	Low	medium	High
	high – (very high)	Medium	high	High

Outputs of the step:

1. Description of the various parameters explored, clearly indicating the temporal (past, present, and future) and spatial dimension of exposure and resulting in the exposure class.
2. Exposure maps for the hazards wherever the hazard can be measured in a spatial manner

Table 3: Data for analysis of exposure to climate hazards

Hazard	Temporal dimension	Spatial dimension of exposure within an IP
Heavy rainfall inducing floods, landslides, rock falls, subsidence etc.	*Parameters to be analysed:* • Frequency • Strength / intensity • Duration (already collected during screening, can be amended, detailed through interviews at site)	Spatial differentiation regarding events induced by heavy rain *Parameters to be analysed:* • Contour line • Natural draining system / water courses • Morphology of terrain, steepness of slopes and valleys • Rocks • Types of soils • Vegetation cover • Type and status of vegetation • Google Earth, Aerial Images, field visit, experts
Droughts	*Parameters to be analysed:* Frequency • Strength / intensity • Duration (already collected during screening, can be amended, detailed through interviews at site)	Spatial differentiation within the IP is not possible

Hazard	Temporal dimension	Spatial dimension of exposure within an IP
Heat waves	*Parameters to be analysed:* • Frequency • Strength / intensity • Duration	Spatial differentiation within the IP is not possible

Step 3: Susceptibility and Fragility

Susceptibility describes the predisposition of a system, e.g. an ecosystem or the society to suffer harm from a hazardous event. Or according to the IPCC: “Degree to which a system is open, liable, or sensitive to climate stimuli (similar to sensitivity, with some connotations toward damage).” (IPCC (2014), Table 18-5). Hence, in opposite to exposure, now the features and conditions of the system (i.e. industrial area) are analysed. Following table provides a first overview, what elements should be included in the analysis. Salinization should not be further analysed.

Potential susceptibility of industries related to the various hazards shall be determined through a preliminary classification of the various branches represented in the IPs of AP and TS (plus the respective list for India, in order to include such branches which are not yet represented, but could be in the future.). Existing classifications, e.g. related to environmental risks, or disaster risks can be used as basic input. This will be then relevant to determine susceptibility of sub-systems like storage buildings, processes etc.

Susceptibility should be classified in three-(five) classes: **(very low)-low** – **medium** – **high – (very high)**;

Outputs of the step:

1. List indicating potential susceptibility of the various branches in relation to the hazards, if possible this can be differentiated to specific sub-systems, e.g. storage / production buildings and infrastructure and handling of hazardous materials, or materials sensitive to specific hazards (fire, water etc.).
2. Description of the various parameters explored, clearly indicating the susceptibility and fragility of the objects explored resulting in the susceptibility class.
3. Susceptibility maps for the hazards.

Table 4: Data for analysis of susceptibility and fragility of sub-systems

Hazards: Systems:	Heavy rainfall, floods, landslides, rock falls, subsidence etc.	Drought	Heat wave	Stroke of lightning
All kinds of buildings	Location, Design, Dimensioning, Site drainage, Foundation, O&M, Refurbishing, Specific use (e.g. storage of sensitive / hazardous materials)	Specific use (e.g. storage of sensitive / hazardous materials) Capacity of water supply Source of water supply	Insulation, AC capacity Specific use (e.g. storage of sensitive / hazardous materials)	Status of lightning conductors Status of fire protection Specific use (e.g. storage of sensitive / hazardous materials)
Roads	Location Foundation Drainage Status of O&M	n/a	Quality and type of pavement	n/a
Drainage systems Sewers	Location Capacity Design Operability O&M	n/a	n/a	n/a
Energy and water supply	Location Resistance against extreme weather events (design, dimensioning, O&M) Operability, operative readiness Age Refurbishing /Rebuilding Susceptibility of infrastructures in direct proximity Sources of supply, bottlenecks, security, reliability, Performance, back-ups	Susceptibility of power generation capacities / water sources Sources of supply, bottlenecks, security, reliability, Performance, back-ups		Status of lightning conductors Status of fire protection; Susceptibility of infra-structures in direct proximity

Hazards: Systems:	Heavy rainfall, floods, landslides, rock falls, subsidence etc.	Drought	Heat wave	Stroke of lightning
Greenery	Location, Status, Health Maintenance Age	Location, Status, Health Maintenance Age	Location, Status, Health Maintenance Age	Location, Maintenance
Production / value chain / Machines Equipment	Sensitivity against interruptions in energy, water, material supply Sensitivity of storage facilities (including waste) against flooding and demolition of containment / pipelines etc.	Sensitivity of manufacturing processes against shortage / interruptions in energy and water supply and increasing temperatures. Sensitivity of storage facilities (including waste) against high temperatures and shortages in energy and water supply.		Sensitivity of manufacturing processes and storage facilities (including waste) against interruptions in energy supply and fire.
Workforce	Early warning system in place Working conditions, OHS and susceptibility to climate hazards (HVAC etc.) Existing shelter centre			
Industrial community at site	Linkages between companies / industries (e.g. people living on site) Resource mobilisation and coordination during the climate change and extreme weather event			

Step 4: Combining exposure and susceptibility to expected impact

In the next step exposure and susceptibility will be combined to deduct the impacts to be expected. Depending on the specific information available on both exposure, and susceptibility of the respective object, analysis and classification can be quite general, e.g. „possible impact to all kinds of buildings exposed to the specific hazard (e.g. cyclones)", or, if more details are available with more detail, e.g. "possible damage to roofs of storage buildings due to strong winds from cyclones."

Analysis will be done by using following combination rule:

Expected impact		*Susceptibility*		
		(very low)-low	medium	high – (very high)
Exposure	(very low)-low	Low	low	Medium
	Medium	Low	medium	High
	high – (very high)	Medium	high	High

Outputs of the step:

1. Impact matrix, including the various systems and hazards and indicating class of expected impacts with a description as detailed as possible considering the input information / data.
2. Impact maps for systems and exposure to hazards.

Step 5: Resilience

Next step analyses the resilience of the sub-systems against the various hazards and impacts. Resilience has three dimensions: capacity to anticipate, capacity to cope and capacity to recover.

Resilience shall be explored primarily at park level (IALA, Zonal Office). However, some additional information should also be collected from industries, particularly from those highly susceptible to the hazards identified, as defined under step susceptibility.

Resilience of the sub-systems should be classified in three-(five) classes: **(very high)-high** – **medium** – **low – (very low)**

Outputs of the step:

1. General assessment of resilience of the site
2. Specific assessment of resilience of the various systems explored

Table 5: Parameters to analyze the resilience of IPs against climate hazards

Capacities	Parameters
Rules and Regulations	• Floodplain regulation (if situated in a floodplain) • Building code including standards for resilient design (storms, cyclones, heat waves) • Rebuilding restrictions (regarding location, design, dimensioning)

Capacities	Parameters
Supply structures (particularly water and energy / power)	• Alternative supply paths and / or options • Procedures and / or options to reduce demand and dependency (e.g. energy generation on site) • Climate resilience of the supply network
Governance and management	• Existing management and development plans, procedures and standards • Existing DRM plans, procedures and standards • Information generation, distribution, fed-back • Existing protection infrastructures (dykes, dams, etc.) and services (fire fighters, para medicals etc.) • Emergency Preparedness Plan/Early Warning System/Evacuation Plans • Signage • OHS measures and standards followed • O&M plan for the site and specific critical parts/infrastructures • Communication plans and lists; communication infrastructures
Resources	• Human resources to act (O&M, preparedness, first response, recovery including the required backstopping and management) • Level of skills and knowledge • Climate resilient facilities • Financial resources • Insurances
Awareness, knowledge	• Awareness / sensitization • Willingness of stakeholders to act for adaptation and risk reduction
Spatial	• Availability of land to establish additional structures (greenery, drainage, construction of RE, water tanks etc.)
Production	• Options for adaptation of product portfolio to climate change impacts

Step 6: Vulnerability

In the next step impact and resilience will be combined to deduct the vulnerability. This will be done by using following combination rule:

Vulnerability		Resilience		
		(very high)-high	**medium**	**low – (very low)**
Impact	**(very low)-low**	**Low**	**low**	**Medium**
	Medium	**Low**	**medium**	**High**

	high – (very high)	Medium	high	High

Outputs of the step:

1. General assessment of the vulnerability of the site
2. Specific assessment of vulnerability of the various systems explored

Step 7: Risk Analysis

For the risk analysis, vulnerability will be combined with the probability of the various events and monetarization of the expected impacts.

Future probability of the various events is already included in the first step, specifically in the future part of the temporal dimension. Hence, there is no need to again consider probability.

For the current project, it seems to be highly ambitious to include the economic dimension into the analysis. However, an exchange with stakeholders would allow performing a preliminary, rough quantification; this can be included and combined with the vulnerability analysis.

2.2 Questionnaire and scoring methodology

The objective of a rapid climate risk assessment tool is to be able to quantify the climatic risk of IP. Quantifying vulnerability helps in comparing and ranking the climatic problems of IPs. The objective of this tool is to provide IPs and decision makers a method to assess their vulnerability to climate change and undertake adaptation measures, if they need to. Under this project the tool will be applied and tested on six IPs in the state of Telangana.

Stakeholder engagement is a must. It provides data, statistics and information on the ground truth. It reveals the real concerns of the stakeholders, their understanding on the subject of climate change and their interest and ability to implement climate change adaptation measures. To ensure that the data collected across stakeholder groups is consistent a structured and participatory stakeholder consultation is needed.

Thus, development of stakeholder consultation has two components to it:

1. Development of a rapid climate risk analysis questionnaire for stakeholder consultation
2. Development of a standard scoring and ranking methodology to quantify vulnerability

The survey questionnaire was developed by team of experts from Core CarbonX Sols Pvt Ltd, INTEGRATION Environment and Energy GmbH, adelphi consult and ifanos concept & planning, Germany, in consultation with TSIIC environmental engineers (elaborated in table 3).

Table 6: Team involved in development and validation of questionnaire

Name of the Experts	Organization
GM(EMP) & Environment Engineers	APIIC
Environment Engineers	TSIIC
Dieter Brulez, S. Vara Prasad, Hrishikesh Mahadev, Rajani Ganta	INTEGRATION Environment and Energy GmbH
Peter Bank	Ifanos concept & planning of Germany
Sibylle Kabisch	adelphi consult
Niroj Mohanty, Shaily Maloo	Core CarbonX Sols Pvt Ltd

The rapid climate risk analysis questionnaire is provided in Annexure I. The survey questionnaire has four sections general, exposure to climatic changes, susceptibility to climate change and resilience to climate change. Some of the questions in the questionnaire are quantifiable while others are qualitative in nature. The qualitative questions were used to better understand the situation but did not form a part of the scoring and ranking.

For most of the questions the score are as provided below:

- Very high =5, high =4, medium =3, low =2 and very low =1, No response =0.
- Yes =1, No =0
- In some case, a reverse scoring is also possible, meaning Yes =0, No =1
- Certain question specific scoring has also been developed

The question wise scores are added at subsection level. For example: under hazard exposure, the exposure of an IP to heat wave is calculated using the sum total off the points obtained for the questions under this category. The maximum score possible under each subsection is calculated and divided into 5 scoring ranges; starting from very high to very low.

The scoring methodology followed is summarized in the below table.

Table 4: Climatic Hazard exposure ranking methodology

Hazard Exposure Assessment	Maximum cumulative score possible in each exposure category			
Heat waves	**18**			
Heat wave exposure grouping				
very low	**low**	**medium**	**high**	**very high**
<4	4 to 8	9 to 12	13 to 16	>16
Drought	**28**			

Drought exposure group				
very low	**low**	**medium**	**high**	**very high**
<6	6 to 12	13 to 18	19 to 24	>24
Heavy rainfall		**17**		
Heavy rainfall exposure grouping				
very low	**low**	**medium**	**high**	**very high**
<5	5 to8	9 to 12	13 to 16	>16

The climatic hazard exposure from each subsection is represented in a color coded grid provided below. Since, spatial differentiation is not possible, the exposure is primarily based on temporal dimension. In the below table, IPxxi represents an IP and the colored text represents the exposure of that IP to each type of climatic hazard.

Table 7: Sample Climate Hazard Exposure Assessment and Ranking Table

Climatic Hazards	IP XX	IP XX1	IPXX2	IPXX3
Heat Wave	**Medium**	**Low**	**Very low**	**Very high**
Drought	**Very low**	**Very high**	**Low**	**Medium**
Heavy rainfall and flash floods	**High**	**Medium**	**High**	**Low**
XX	**Very low**	**Very high**	**Low**	**Medium**
Ranking				

Climatic susceptibility

Climatic susceptibility scorings will be carried out for nine susceptibility parameters:

- Building infrastructure
- Road infrastructure
- Storm water management
- Water management
- Waste water management
- Energy management
- Workforce and industrial community
- Production area
- Open spaces and greenery

Higher the score more is the susceptibility of that parameter towards climate change. The scoring and ranking method would be the same as that described for climatic hazard.

Table 6: Building infrastructure susceptibility

Climatic Susceptibility Assessment				**Maximum score**
Building infrastructure				**20**
Building infrastructure grouping				
very low	Low	medium	High	very high
<5	5 to 8	9 to 12	13 t o16	>16
Road infrastructure				**12**
Road infrastructure exposure grouping				
very low	Low	medium	High	very high
<2	2to4	5to7	8to10	>10
Storm water management				**26**
Storm water management grouping				
very low	Low	Medium	High	very high
<6	6to10	11to15	16 to 20	>20
Water management				**12**
Water management grouping				
very low	Low	medium	High	very high
<2	**3to5**	6to8	9to11	>11
Waste Water management				**4**
Waste Water management grouping				
very low	Low	medium	High	very high
1	**2**	3	4	-
Energy System				**26**
Energy management grouping				
very low	Low	Medium	High	very high
<3	3to5	6to8	9to11	>11
Workforce and industrial community				**19**

Workforce and industrial community grouping				
very low	Low	medium	High	very high
<4	4to7	8 to 11	12 to 15	>15
Production				**8**
Production grouping				
very low	Low	Medium	High	very high
<2	**2to3**	**4to5**	**6to7**	**>7**
Production				**8**
Open spaces and Greenery grouping				
very low	Low	Medium	High	very high
<2	**2to3**	**4to5**	**6to7**	**>7**

The climatic susceptibility of each of the parameters is calculated and ranked as in the table below. The process is same as that applied in climatic hazard exposure. A more the number of parameters with high and very high susceptibility and medium susceptibility the higher will be the rank. Rank 1 will imply that the susceptibility to climatic impact is highest in the group.

Table 8: Climate Hazard Exposure Assessment and Ranking

Susceptibility Parameters	IP XX	IP XX1	IPXX2	IPXX3
Building infrastructure	Medium	Low	Very low	Very high
Internal Roads	Very low	Very high	Low	Medium
Storm water management	High	Medium	High	Low
Water management	Medium	Low	Very low	Very high
Waste water management	Very low	Very high	Low	Medium
Energy	Very High	Medium	High	Low
Workforce and Industrial Community	Medium	Low	Very low	Very high
Production	Very low	Very high	Low	Medium
Open spaces and Greenery	High	Medium	Very High	Low
Parameters with High and very high susceptibility				
Parameters with Medium Susceptibility				
Susceptibility ranking				

Resilience to climate change

Climatic resilience is scored against six parameters listed below:

- Financial
- Rules and regulations
- Supply structure
- Governance and Management
- Human resource, awareness and knowledge
- Production

Unlike, exposure and susceptibility, a very low and low climatic resilience indicates critical situation. The IP with low climatic resilience are not well equipped to handle sudden incidents and in general scenarios occurring out of climatic exposure. Scoring for climatic resilience is presented in the tables below.

Table 9: Financial Resilience

Climatic Susceptibility Assessment				**Maximum score**
Financial Resilience				**8**
Financial resilience grouping				
very low	Low	Medium	High	very high
<2	**2to3**	**4to5**	**6to7**	**8**
Rules and Regulations				**6**
Rules and Regulation grouping				
very low	Low	Medium	High	very high
1	**2**	**3**	**4**	**>4**
Supply structure				**6**
Supply structure grouping				
very low	Low	Medium	High	very high
<3	**3to4**	**5to6**	**7to8**	**>8**
Governance and Management				**7**
Governance and Management grouping				
very low	Low	Medium	High	very high
0 to1	**2to3**	**4to5**	**5to6**	**7**

Human Resource, Awareness and Knowledge		**9**
Human resource, awareness and knowledge		
very low / **0 to1**	Low / **2to3**	Medium / **4to5**	High / **5to6**	very high / **7**
Production		**5**
Production grouping		
very low / **1**	Low / **2**	Medium / **3**	High / **4**	very high / **5**

Climatic resilience of each parameter is arrived as explained above. It is consolidated in the table matrix below to arrive at the consolidated ranking. In resilience very low-low and medium resilience are critical in determining the rank.

Table 9: Climate Resilience Ranking

Resilience assessment parameters	IP XX	IP XX1	IPXX2	IPXX3
Financial	**Medium**	**Low**	**Very low**	**Very high**
Rules and Regulations	**Very low**	**Very high**	**Low**	**Medium**
Supply structure	**High**	**Medium**	**High**	**Low**
Governance and Management	**Very low**	**Very high**	**Low**	**Medium**
Human resource ,awareness and knowledge	**High**	**Medium**	**High**	**Low**
Production	**Very low**	**Very low**	**Very low**	**Medium**
Parameters with **very low – low** resilience				
Parameters with **Medium** resilience				
Resilience based ranking				

Vulnerability Assessment

Vulnerability is a function of climatic impact and resilience. A tabular vulnerability matrix has been developed and presented in table below.

Table 10: Climatic Vulnerability Ranking of IPs based on the risk assessment tool

Order Based on exposure	Susceptibility Score			Impact ranking	Resilience Score			Vulnerability Ranking
IP XX1	XX	X	X	XX	XXX	XX	X	XX
IP XX2	X	X	X	X	X	XXX	X	
IP XX3	XXX	X	XX	XXX	XX	XX	XX	XXX

2.3 Upcoming Industrial Parks

With the increasing focus on industrialization in the state of Telangana, there will be a greater demand not only for new industrial parks but also sustainability of these industrial parks. One of the major sustainability components of these upcoming industrial parks has to be addressing issues related to drought and availability of water which are the major factors in the context of climate change. However, there is no defined approach for addressing the CCA measures in the IPs development project cycle. The rapid and often unplanned expansion of industrial parks is exposing a greater number of economic assets and people to the risk of disasters and the effects of climate change. This sections proposes a framework for carrying out rapid climate risk analysis, and seeks to strengthen coherence and consensus in how industrial parks can plan for natural disasters and climate change.

The Rapid Climate Risk Analysis presents an approach that decision makers and authorities can use to identify feasible measures to assess upcoming IP's risk. The methodology focuses on three reinforcing pillars that collectively contribute to the understanding of IP's risk: a hazard impact assessment, an institutional assessment, and a socioeconomic assessment. However, it was observed that collecting reliable and timely data is a challenging task although there are fundamental changes to overall data collection and publication in the recent past in the state of Telangana.

The purpose of the study is to identify one of the industrial park in consultation with TSIIC which will be considered for the CCA baseline study for the CCA measures. This will help in establishing mechanism for intervention of CCA measures in IP.

The industrial park exposed to climate change, that has achieved certain significant milestones in planning process can be a good candidate for the baseline study. The analysis of existing industrial parks provides an overview of the industrial mix in the state. Generally, pharmaceutical and allied sector and IT/ITES industrial sector dominate the industrial landscape in the state

followed by other sectors. The approach should be to identify a new/upcoming industrial park which will house the main industrial sector of the state and also process and technology wise critical industrial sectors.

Stakeholders of the upcoming industrial parks are mainly TSIIC, industries department, State government/ central government and industrialist. They determine the vision for the new/upcoming industrial parks. Vision defines business potential, expected financial situation etc for an industrial park.

The baseline documentation for upcoming parks will provide not one time but will contribute in establishing policy and procedure documents of TSIIC for CCA measures. In view of this, an open consultation is needed with various departments of TSIIC to determine the process of development and decision making for an IP.

A group stakeholder consultation was conducted for the new IPs.

3. Rapid Climate Risk Analysis for Telangana

3.1 Rapid Climate Risk Analysis Process in Telangana

Rapid climate risk analysis methodology and tool developed in Chapter 2 were applied to the identified existing IPs in Telangana. By applying the above tool to the chosen industrial parks following was achieved:

- The climatic vulnerability of the industrial parks could be established
- The most critical parks could be chosen for pilot study
- The methodology and tool developed (Chapter 2) was tested

A focused group consultation was proposed to enable a complete view of all relevant stakeholders for each IP. The relevant stakeholders who were consulted are presented in the table below.

Table 11: List of stakeholders identified for the rapid climate risk analysis consultations

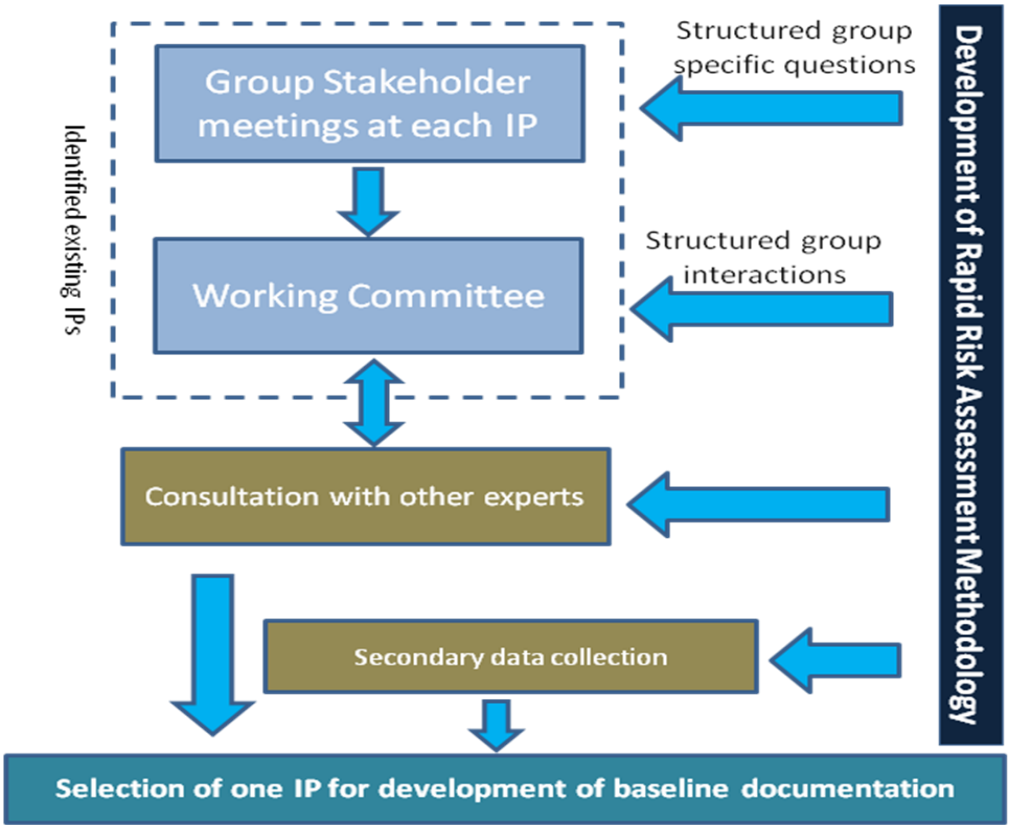
Participants for group consultation at IP	Working Committee	External experts
Zonal manager	GM(EMP) & Environment Engineers, APIIC	Pollution control board representative
IALA commissioner	Environment Engineers, TSIIC	Institutional experts like ASCI, EPTRI and others
Zonal environmental engineers		Industries Department
Industry representative		Industry associations like Bulk drug manufacturers association

The key steps in the study are (described in the graph below):

- The stakeholder consultations were taken up for each of the identified IP's.
- Rapid climate risk analysis questionnaires developed for the group stakeholder consultation process was applied to the IPs in Telangana.
- The risk assessment methodology was the guiding document throughout the Rapid Climate risk analysis exercise and enabled the collection of data. Information collected from all the sources was synthesized to understand the exposure of IP, its vulnerability and hence, the risk related to climate change.

- The information received from the consultation was presented to the working committee for any further comments and clarifications. The vulnerability of IPs was established through a vulnerability matrix. The views of external experts from TSIIC and other institutions were gathered through steering committee meeting.

Figure 2: Approach to Rapid Climate Risk Analysis of IPs in the State of Telangana



The focus group stakeholder consultations process was conducted between 21st of December 2015 and 31st of January 2016, on the dates mentioned in the table. On the request of stakeholders at some of the IPs, the stakeholder consultation was conducted in two rounds.

Table 12: Stakeholder consultation schedule in Telangana

Sr. No.	Name of IP	Industrial Zone	Number of consultation rounds	Consultation dates
1	IP Pashamylaram	Patancheru	1	22/12/ 2015
2	IP Jeedimetla	Jeedimetla	2	19/01/2016,30/01/2016
3	Hitech City Madhapur & Software Units layout	Cyberabad	1	18/01/2016
4	IP Rampur	Warangal	1	29/12/2015
5	IP Cherlapally	Shamshabad	2	21/12/2015,08/01/2016
6	IP Madikonda	Warangal	1	29/12/2016

3.2 Stakeholder consultations at IPs in Telangana

In stakeholder consultations, the participants were briefed on climate change and its relevance for the industries and people, the objective of the Climate Change Adaptation (CCA) project, work completed so far and the need for this stakeholder consultation meeting. The risk analysis questionnaire was explained to all participants to enable them to respond appropriately to the questionnaire. A brief overview of the stakeholder consultation meetings conducted at each of these parks is provided below.

Some of the common observations from stakeholder consultation process at the six IPs in Telangana are:

- **All industrial parks are facing water scarcity;**
- **Source of water and alternate source for all industrial parks are either ground water, municipal tankers (or few piped sources) and private tankers;**
- **Road condition, it's operation and maintenance, is generally an area of concern;**
- **The industry feels there is a need to improve governance and operational arrangement between IALAs and TSIIC**

3.2.1 Case 1: IP Pashamylaram

IP Pashamylaram is located in Patancheru industrial zone in Medak district of Telangana. It is a large industrial park spanning an area of about 1645acres and a working population of about 50,000 people. It houses some of the important industrial sectors of Telangana like bulk drug and pharmaceutical, chemical, engineering, automobile and foundry. This industrial park was established about 30-40 years ago.

In addition to the climate related response, the stakeholders expressed concerns regarding entry/exit as the IP has only one entry and exit. Daily, about 15000 trucks and vehicles ply in and out of the industrial estates. Some of these trucks carry hazardous chemicals. A single road, for a large industrial estate leads to traffic jams leading to very slow movement of vehicles during peak hours. This may be a critical aspect in case of a climate change related natural disaster considering limited access and exit to industrial park and escape routes.

Some other findings were:

- The Industrial association described that a land has been identified within the IP for installation of effluent treatment plant (ETP).
- The overall greenery in the IP is less and should be increased.
- IP has a small dispensary and an ambulance to manage medical situations. However, single entry and exit point could be a hazard incase of medical situations.

3.2.2 Case 2: IP Jeedimetla

IP Jeedimetla was established more than 40 years ago. It is located in the Rangareddy district of Telangana. In the last 4 decades, Hyderabad city has expanded in size and the industrial park is now within the city limits. Population density around the park has also grown and the area has become densely populated. IP is about 900 acres in area and houses nearly 1100 industries.

The groundwater in and around IP Jeedimetla has been polluted due to industrial growth and is not suitable for any use. This leaves the industries in IP with only two options for obtaining water; one is supply from municipality (mainly through tankers) and other being private tankers. At the same time, IP Jeedimetla is home to many small and big companies which need high quality process water like bulk drug, pharma, chemicals and pesticide industry. The water crisis accompanied by climatic changes impacts increases the concerns related to water.

During stakeholder consultation it was established that IP Jeedimetla is the only IP which has a common effluent treatment plant for the IP. It is operated by an independent entity called Jeedimetla Effluent Treatment Limited (JETL). There a need to review the adequacy of the ETP's ability to handle and treat all the wastewater generated from the IP.

3.2.3 Case 3: IP Hi-tech city Madhapur and Software Unit Layout, Madhapur

Hi tech city Madhapur and software unit layout, Madhapur are young industrial parks which were established in the late 1990's i.e. around 1998 (about 18 years ago). These parks are unique as they do not have any manufacturing units. They are specially designed for Information Technology (IT) and ITES type of companies. They span in an area of about 215 acres.

This IP does not have any process water requirement. The energy consumption is also limited to office spaces. HVAC cooling system, computers and laptops are the major consumers of power in this IP. From the stakeholder consultations it was found that:

- The IP has a better financial capability to address climate change
- The road and building infrastructure of this park was better maintained as compared to other parks.
- The storm water drainage systems are in place and development of a common sewerage treatment plan is under process.

Along with GIZ, TSIIC has initiated a five point program in the IPs in Cyberabad zone. Five points of the program are:

- Retrofitting of existing office/factory building to green buildings and barrier free work spaces
- Solid waste management and e-waste management
- Promotion of "cycle to work"
- Greening of industrial parks
- Storm water management and rain water harvesting

3.2.4 Case 4: IP Rampur and IP Madikonda

In Telangana, most of the IPs are located in four industrial zones which are within 40 to50 km radius of Hyderabad city. Two industrial zones Karimnagar and Warangal are the only two zones which are located beyond 100 km distance from Hyderabad. IP Rampur and IP Madikonda are located at Warangal, which is the next big city after Hyderabad in Telangana.

IP Rampur and IP Madikonda are similar in size (about 180 acres each), with similar type of industries and are located nearby. Thus, the stakeholder consultation for both these industrial parks was conducted through a joint meeting and is considered as one consultation meeting in the Rapid Climate risk analysis. Both the IPs have granite sheet cutting, polishing, rice mills and other processing industry.

Stakeholders have cited scarcity of water as one of the major concerns in these industrial parks. The ground water is depleting fast, forcing the industries to rely on private water tankers to meet their water demand. Unlike, other industrial zones, municipal water supply is unavailable at these parks. Industries and TSIIC observe the need to have a good storm water management system in place to partially meet the need for water.

3.2.5 Case 5: IP Cherlapally

IP Cherlapally like IP Jeedimetla and IP Pashamylaram is more than 40 years old and is home to chemical, pharma, engineering, electronic, food processing, engineering and many other types of industries.

The industry and association pointed out that under Harita Haram, flagship project of government of Telangana, large plantations were undertaken at the park. However, it could not be sustained as the tender for watering the plants took a long time for clearance. It was pointed out that the governance system like powers of IALA need to be strengthened to enable speedier implementation of time bound activities. The stakeholder also identified issues of ground water pollution at some places.

3.3 Climatic risk analysis results for existing IPs

During the focused group stakeholder consultations, rapid climate risk analysis questionnaires were elaborated and responded by group of participants. The responses were consolidated. Based on the methodology defined in chapter 2, a score was provided to each of the questions. Further, sub-section and section wise scores were calculated. These score were in five categories i.e. very low, low, medium, high and very high. Detailed scoring table for all the six IPs is provided in Appendix I of the report.

Section wise scoring and ranking is provided in below.

3.3.1 Climate Hazard Exposure Assessment

Telangana has the history of experiencing droughts in a cyclic manner. However, in the recent decades the frequency of these drought incidents has increased. Drought causes reduction in ground water level and several other water quality and availability issues. In non-agriculture sectors drought is experienced through water stress conditions. During stakeholder consultation IP Madhapur and IP Jeedimetla were found to have high exposure to these hazards.

Similarly, heat wave situations have become worse in last decade. During consultation IP Jeedimetla, IP Madhapur and IP Pashamylaram experienced high exposure levels to heat wave.

Overall, the rainfall pattern of Hyderabad and other regions in Telangana has changed with delayed monsoon, more wide spread rainfall and decreased overall rainfall. Thus, the instance of water logging and flash flooding that IPs get exposed got usually low scoring.

Other climatic or climate-induced drivers that were queried are thunderstorm and stroke of lightening and salinisation. In 2015, certain incidents of deaths due to lightening were reported in Nizamabad district. However, stakeholders during the study responded that no IPs had experienced any significant exposure or change in exposure to these conditions. Since, salinization and thunderstorm were not found relevant to the study they were eliminated in exposure assessment.

IP Madhapur and IP Jeedimetla have highest exposure to climatic hazards. Climatic hazard exposure and ranking is presented in table below.

Table 13: Climate Hazard Exposure Assessment and Ranking

Climatic Hazards	IP Pashamylaram	IP Rampur and IP Madikonda	IP Cherlapally	Software unit layouts, Madhapur	IP Jeedimetla
Heat Wave	High	Medium	Medium	High	High
Drought	Medium	Medium	Low	High	High
Heavy rainfall and flash floods	Very low	Very low	Very low	Low	Low
Ranking	**3**	**4**	**5**	**1**	**2**

3.3.2 Climate Susceptibility of IPs

IPs internal road systems, storm water management system, waste water management system and energy were found to be climatically most susceptible areas among the main 9 climatic susceptibility measures studied. Water management was found to be the next most susceptible parameter consistently across all IPs. Climatic susceptibility table below explains the susceptibility of each IP against each susceptibility parameter.

Table 14: Climate Susceptibility of IPs

Susceptibility Parameters	IP Pashamylaram	IP Rampur and IP Madikonda	IP Cherlapally	Software unit layouts, Madhapur	IP Jeedimetla
Building infrastructure	Low	Very low	Medium	Low	Medium
Internal Roads	Medium	High	High	Low	Medium
Storm water management	High	Low	High	Low	High
Water management	Medium	Medium	Medium	Medium	Medium
Waste water management	Low	High	High	Medium	Low
Energy	High	Very low	Low	Low	High
Workforce and Industrial Community	Low	Very low	Low	Medium	Medium
Production	Medium	Low	Low	Very low	Very low
Open spaces and Greenery	Low	Low	Low	Low	Low
Parameters with High susceptibility	**2**	**2**	**3**	**0**	**2**
Parameters with Medium Susceptibility	**3**	**1**	**2**	**3**	**4**

Susceptibility ranking	**3**	**4**	**2**	**5**	**1**

IP Jeedimetla has highest susceptibility (High plus medium) i.e. 6 out of nine parameters are under high and medium susceptibility. Thus, it is ranked 1st i.e. most susceptibility IP. Among IP Cherlapally and IP Pashamylaram, IP Cherlapally has three parameters under category high whereas IP Pashamylaram has only two parameters under category high. Thus, IP Cherlapally is ranked 2nd in susceptibility. Similarly, among IP Rampur and IP Madikonda and IP Madhapur, two parameters from IP Rampur and IP Madikonda have high susceptibility thus, it is ranked 4th.

3.3.3 Climatic Resilience of IP

Climatic resilience works inverse to climatic susceptibility. Higher resilience implies that the IP is better prepared to handle climatic risks. Six parameters (as mentioned in the table) were applied to ascertain the climatic resilience of IP. IP Jeedimetla and IP Rampur and IP Madikonda are least resilient to climatic changes across all six parameters. Governance and management, human resource, awareness and knowledge levels at this IP are poor. Hence, it is rated as least resilient park. IP Madhapur is financially robust, it has a well-designed system for supply of essential services. Thus, the resilience of this park is highest and ranked as number 5.

Table 15: **Climatic Resilience assessment of IPs**

Resilience assessment parameters	IP Pashamylaram	IP Rampur and IP Madikonda	IP Cherlapally	Software unit layouts, Madhapur	IP Jeedimetla
Financial	**Low**	**Medium**	**Low**	**High**	**Medium**
Rules and Regulations	**Medium**	**Medium**	**Medium**	**Very high**	**Medium**
Supply structure	**High**	**Medium**	**High**	**Very high**	**Medium**
Governance and Management	**Very low**	**Very low**	**Very low**	**Medium**	**Very low**
Human resource ,awareness and knowledge	**Medium**	**Low**	**Medium**	**Medium**	**Medium**
Production	**High**	**Medium**	**Low**	**Low**	**Medium**
Parameters with **low** resilience	**2**	**2**	**3**	**1**	**1**
Parameters with **Medium** resilience	**2**	**4**	**2**	**2**	**5**
Resilience based ranking	**4**	**1**	**3**	**5**	**2**

3.3.4 Climatic Vulnerability of IP

Some of the observations of rapid climatic risk vulnerability assessment are:

- IP Madhapur and IP Jeedimetla have highest exposure to climatic hazards
- Due to the age, design, type of industries the susceptibility of IP Jeedimetla is highest and that of Madhapur is lowest, leading to IP Jeedimetla being the climatically worst impacted IP and IP Madhapur being climatically lest impacted IP
- Similarly, IP Jeedimetla has highest impact of climate change and lowest resilience towards climatic events, hence it is the most vulnerable park or the park at highest risk on account of climate change
- IP Madhapur has lowest impact and highest resilience, thus it is least vulnerable to climate change and ranked last in the list.

Table 16: Climatic Vulnerability Ranking of IPs based on the risk assessment tool

Order Based on exposure	Susceptibility Score			Impact ranking	Resilience Score			Vulnerability Ranking
Madhapur	6	3	0	5	3	2	1	5
Jeedimetla	3	4	2	1	0	5	1	1
Pashamylaram	4	3	2	3	2	2	2	4
Rampur & Madikonda	6	1	2	4	0	4	2	3
Cherlapally	4	2	3	2	1	2	3	2

It is proposed that IP Jeedimetla should be chosen as the existing industrial park for undertaking climate change adaptation (CCA) project. Choosing IP Jeedimetla, does not imply that other industrial parks do not need CCA measures. It indicates that other parks also need CCA measures, which TSIIC may ponder through and implement later. It may use some of the best practices and measures identified under this project.

Study suggests that IP Madhapur is least vulnerable to climate change. From the table above, it is evident that IP Madhapur has high climatic exposure however, due to the nature of its operations and the proactive measures being adopted it's susceptibility to climate change is low and it's resilience is high. The industries operating at IP Jeedimetla and IP Madhapur are completely different. IP Jeedimetla is dominated by manufacturing industry where as IP Madhapur house only office based, non-manufacturing type of industries. Thus, the CCA learning's of IP Jeedimetla may not apply to IP Madhapur. Also IT and ITES is a growing industry. Thus, the baseline documentation would be carried out for IP Madhapur as well.

The next steps in the process, would be preparation of baseline documentation to establishment baseline conditions at the identified park, so that adequate climate change adaptation measures may be suggested.

3.4 Results for upcoming Industrial Parks in Telangana

A participatory stakeholder consultation meeting for upcoming industrial parks was conducted on 15th of February at TSIIC office. The meeting was attended by several representatives of TSIIC i.e. TSIIC Consultant (Projects), General Manager, (Prsnl & Admin), Deputy General Manager (EMP), Manger (Projects), Manager (Finance), Env. Engineer (EMP).

The stakeholders explained the process of development of new industrial parks. An overview of the processes is presented below:

1. Based on industrial demand land is identified and finalized by TSIIC

If the land available in existing land bank of TSIIC is not sufficient or not suitable, new or additional land is identified for this purpose. Following this, a site analysis report may or may not be taken up at this stage which is based on reconnaissance survey and secondary information. Objective of the report is to analyse the availability of important infrastructure like road and rail connectivity, water availability, power line etc.

2. Land pricing

Asset management division has the primary responsibility of ascertaining the right market price of land. It undertakes this task parallel to the process of technical DPR preparation. Land pricing report is taken up either internally or through external consultants.

3. Development of Master plan

Detailed project report (DPR) is prepared to assess the technical viability of the project. It also provides a layout for the project. This is usually done by engaging a third party consultant. Civil Engineering departments lead the DPR development process.

4. Project clearances

Apart from internal approval by managing director of TSIIC, several other clearances are required for the project. The above documents are required for the approval process. Environmental clearance may be needed for some of the IPs. Environmental impact assessment (EIA) report is prepared wherever an EC is required. This report is usually developed through EIA consultants.

5. Implementation of new IP

After completion of all approvals including approval of master plan for the IP, the sale of plots is initiated. Simultaneously, infrastructure development process gets initiated.

The roles and responsibilities of different departments of TSIIC and the government departments responsible for approval of new industrial parks are provided in Annexure II.

3.4.1 Conclusion

Based on the participatory stakeholder consultation process, it is concluded that consideration of climate change is not one of the criterions in the current process of planning and development of IPs. However, the planning of new IP's does take into consideration some of the

climatic measures like storm water management system and wastewater treatment system, There are no current system in place which demonstrate consideration of climate change vulnerabilities assessment and CCA measures in the planning process of Industrial parks.

Table 17: Upcoming IPs proposed for baseline study

Industrial Park	Zone	Climatic exposure	Type of industries	Stage of planning
IP Sulthanpur (~415 acres.)	Patancheru	Yes	Medical Devices	Draft Layout is ready (Yet to approve officially)
IP Buchinelly (314.40 acres)	Patancheru	Yes	Auto, Auto ancillary units of M/s. MAHINDRA Suppliers & Edible oil units	100ac of Layout approved and allocated to Mahindra The remaining area proposed for Edible oil units is yet to get Environmental Clearance from Regulatory body
Mega Food Park (203.50 acres)	Warangal	Yes	Food processing units	Total Park area Divided into 2 parts. 1. MSME Cluster 142.54(layout approved and submitted to DTCP) 2. Mega food park 60ac layout prepared and submitted for VC&MD's approval
Hyderabad Pharma City (~12,000 acres)	Shamshabad	Yes	Pharma and all associated pharma sectors	Yet to prepare the layout

The participatory stakeholder consultation concluded that all the new industrial parks are exposed to similar climatic hazards. It was also concluded that Hyderabad Pharma city will be considered for the next level of baseline assessment because it represents one of the most important industrial sectors of Telangana and is envisaged to be a world class IP. It is also currently in the master planning stage which is the ideal time for development of baseline

documentation on CCA, identification of adaptation measures and also implementation of the same.

The study has concluded that new industrial parks need a two-level approach to climate change adaptation:

1. Baseline study for Hyderabad Pharma city industrial parks
2. Framework document to assess the challenges, possibility and opportunities by introducing these options in the planning and implementation stage of all industrial parks in a structured manner to have measurable results.

Based on the information so far, CCA aspects can be introduced during site analysis, DPR preparation and master layout planning, environmental clearance, and construction of the IP. This would be studied further in the next step of the study to provide interventions and intervention plan.

Annexure I

Rapid Climate Risk Analysis Questionnaire for the Existing Industrial Parks in the State of Telangana

This questionnaire aims to assess the exposure, susceptibility, fragility and resilience of each identified industrial park to climatic changes. The answers to this questionnaire would be applied to determine the vulnerability and hence the risks to each park on account of climate change.

Who should answer the questionnaire?

The questionnaire targets to get the feedback from multiple stakeholders through participatory consultation method. Primarily the zonal manager, environmental engineer, IALA commissioner and other industry representatives should be part of the consultation process.

1.	General	
1.1	Name of IP and Zone :	1.2 Manual :
1.3	Number of industries:	1.4 District:
1.5	Area:	1.6 Vacant space:
1.7	Worker population at IP:	1.8 Residential colony(Y/N) If Y, no. of families residing:
1.9	Industries in each category:	
	a.	b.
	c.	d.
	e.	f.
	g.	h.

2.	Hazard Exposure Assessment
2.1	**Heat waves**
2.1.1	Whether there are instances of heat waves in the region? Yes ☐ No ☐

	If yes, How do you rate the intensity of heat wave? **very low☐-low ☐ medium ☐ high ☐ very high☐** Whether the duration of experienced heat waves has increased during the past years? Yes ☐ No ☐ If yes, How do you rate the increase in duration of heat wave? **very low☐-low ☐ medium ☐ high ☐ very high☐**
2.1.2	Whether the frequency of heat waves has increased during the past years? Yes ☐ No ☐ If yes, How do you rate the increase in frequency of heat wave? **very low☐-low ☐ medium ☐ high ☐ very high☐**
2.2	**Drought**
2.2.1	Whether there are instances of drought in the region during the past years? Yes ☐ No ☐ If yes, How do you rate the intensity of drought? **very low☐-low ☐ medium ☐ high ☐ very high☐** Whether the duration of drought has increased during the past years? If yes, How do you rate the increase in duration of heat wave? **very low☐-low ☐ medium ☐ high ☐ very high☐**
2.2.2	Whether the frequency of drought has increased during the past years? Yes ☐ No ☐ If yes, How do you rate the increase in frequency of drought? **very low☐-low ☐ medium ☐ high ☐ very high☐**
2.2.3	If yes, how do you rate the strength/intensity of these events? **very low☐-low ☐ medium ☐ high ☐ very high☐** Have you experienced increase in duration of these events in the past years? If yes, how do you rate it? **very low☐-low ☐ medium ☐ high ☐ very high☐**
2.2.4	Whether there are increase instances/frequency of flood and rainfall related events? Has there been an increase in such incidents during the winter season? Yes ☐ No ☐ If yes, How do you rate the increase in frequency of heat wave? **very low☐-low ☐ medium ☐ high ☐ very high☐**

2.2.5	Please identify hot spots associated with rain fall (low line area which is being frequently getting water logged or experiencing flash floods or other event is happening)If yes, indicate the area where water logging is usually experience? *(provide a map indicating exact location)* Roads ☐ Industries ☐ Open Space ☐ Others ☐
2.3	**Thunderstorm and Stroke of Lightening**
2.3.1	Does the region experience thundering and stroke of lightening frequently? Yes ☐ No ☐ If Yes, inside the IP boundary ☐ IP's vicinity (5-10 km) ☐
2.3.2	Have there been any impacts associated with thundering and stroke of lightening within the IP? Yes ☐ No ☐ If yes, how often are these experienced? Once or twice a year ☐ Randomly ☐
2.3.3	Is it perceived that the frequency and intensity of such incidents increased in last few years or decades? Yes ☐ No ☐
2.3.4	If answer to 2.3.3 is Yes, then quantify Deaths☐ Injury ☐ Infrastructure damage ☐ Fire ☐ Others _____ What kind of damage was observed? Roads ☐ Buildings ☐ Facilities ☐ Falling of trees☐ Falling of electric poles☐ Other ☐ Describe:
2.4	**Salinization (***Some of the indicators of salinization are premature breaking of roads and formation of potholes, corrosion and rupture of pipes before their end of life, drying up of trees, shrubs and greenery, formation of white salt on degraded land patch, on walls etc.)*
2.4.1	Have there been signs of salinization within the IP or its vicinity? Yes☐ No ☐
2.4.2	If yes, has this been established through a study either done for the IP or one of the industries in the IP? *If yes, then provide a copy of the study or a brief of its findings.* Yes☐ No ☐
2.4.3	If the answer to 2.1 is yes, then which areas in the IP experience salinization? Please Describe. (*Indicate the same in layout of the IP.*

2.4.4	Is part or whole of IP build on waste land or degraded land? Yes☐ No ☐ If yes, quantify the percentage of the same. *(Mark the same on IP's layout)* _____
2.4.5	Are the areas in vicinity (i.e. 5 -10km radius) of the IP wasteland or degraded land? Yes☐ No ☐ If yes, quantify the percentage of the same *(Provide map of the same)* _____
3.	**Susceptibility and Fragility assessment** *(Susceptibility describes the predisposition of a system, e.g. an ecosystem or the society to suffer harm from a hazardous event.)*
3.1	**Building infrastructure**
3.1.1	What is the average age of industries located within the IP? < 10 years ☐ 10 to 20 years ☐ 20-30 years ☐ 30-40 years > 40 years ☐
3.1.2	a. Is an assessment of the stability of IPs building infrastructure available? Yes ☐ No ☐ *(This could be in the form of any building stability assessment reports with individual industries)* b. If yes, what is the frequency of such assessments _____ c. If yes, how many industries have undertaken such an assessment_____ d. Is such a report available for the common infrastructure of the IP as well? _____
3.1.3	a. Have there been any incidents of infrastructure damage on account of flood and other natural events? Yes☐ No ☐ b. If yes, which part of the building was affected roof ☐ windows ☐ doors ☐ foundation ☐ boundary wall ☐ b. If yes, describe the loss _____ c. Reason for damage: flash flood ☐ heat wave ☐ salinization ☐ thunder and lightning ☐ others ☐ d.How do you rate these damages **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**

3.1.4	Is seepage or leakage a problem in the infrastructure at the IP?	Yes☐ No ☐
3.1.5	What percentage of industries have lightening conductors installed on their buildings? 0-20%☐ 20%-40%☐ 40%-60% ☐ 60%-80%☐ 80%-100%☐	
3.1.6	What percentage of industries have fire fighting system in place and operational? 0-20%☐ 20%-40%☐ 40%-60% ☐ 60%-80%☐ 80%-100% Does the IP as a whole have any fire fighting system? Fire extinguishers ☐ Fire fighter ☐ Ambulance ☐ Others ☐	Yes☐ No ☐
3.2	**Infrastructure for Storage of various items**	
3. 2.1	a. Are there any underground storage systems for storing chemicals, inflammables, hazardous substances, water or hazardous waste? b. If yes, list the type of items being stored and type of industry Chemicals _____ Inflammables _____ Hazardous substances _____ Water _____ Waste _____ Please elaborate.	Yes☐ No ☐
3. 2.2	Have there been any past incidents where storage facilities in the industries or IP got affected? If yes, describe the impact Leakage of pipes ☐ rupture of storage tanks ☐ water logging in storage areas ☐ flooding ☐	Yes☐ No ☐
3. 2.3	How do you rate storage system in existing industries prone to natural disaster specially events like heat wave? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**	
3. 3	**Road infrastructure (Spatial location)**	
3.3.1	Are all roads inside the IP and industries inside the IP paved? Yes☐ No ☐ What kind of pavement is used?	
3.3.2	What is the mechanism of O& M for the roads within the IP? Pre-defined regular maintenance ☐ Needs based maintenance ☐ Others ☐	

3.3.3	Do the roads in the IP have a proper drainage system? Yes☐ No ☐ How do you rate the drainage system in the IP? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**
3.3.4	Which roads within the IP experience water logging *(Locate in map or layout)?*
3.3.5	Whether any instances of uprooting of roads, increase in cracks in road or melting of roads surface due to increase climatic temperature? Yes☐ No ☐ If yes, describe:
3.4	**Storm water management**
3.4.1	a. Do the IP or its industries have storm water management system or storm water drains? Yes☐ No ☐ b. What percentage of area has storm water management system? _____ 0-20%☐ 20%-40%☐ 40%-60% ☐ 60%-80%☐ 80%-100% c. Is the storm water being used by the industries? Yes☐ No☐
3.4.2	Where does the water from the storm water drains find its outlet? Open areas within the IP ☐ Well structured pond or lake within the IP ☐ Into open space outside the IP ☐ Municipal sewers ☐ Others ☐
3.4.3	a. Does the IPand its industries have rainwater harvesting system in place? Yes☐ No ☐ b. What percentage of area has rain water harvesting system in place? _____ 0-20%☐ 20%-40%☐ 40%-60% ☐ 60%-80%☐ 80%-100%
3.4.4	a. How often the drainage systems is being cleanedin the IP? Predefined regular interval ☐ When clogged ☐ Others ☐ How do you rate adequacy of cleaning of drainage system? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**
3.4.5	Do industries pactice waste water segregation, reuse, and recycle option? If yes, rate the efficacy of the same. **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**
3.5	**Water Management**

3.5.1	What are the sources of water for industries and IP? *(Tick mark the main source/s of water supply)* Private Tanker☐ Municipal Tanker☐ Ground water ☐ Municipal supply☐ Others ☐
3.5.2	Are their interruptions experienced in regular water supply forcing industries to switch to alternate sources of water supply? Yes ☐ No ☐ Do you think the shortage of water is on account of climate change? Yes ☐ No ☐ If yes, how do you rate water scarcity for industries? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**
3.5.3	Has the frequency of these interruptions increased in last 5 -10 years? Yes☐ No☐
3.6	**Waste water management**
3.6.1	Does the IP have a Common effluent treatment plant (CETP)? Yes☐ If yes, where is it located? *(Mark on layout or map)* No ☐ _____ Yes☐ — No ☐ If yes, do all industries sent effluent to CETP?
3.6.2	If answer to 3.1.4.1 is yes, please describe the O&M of CETP?
3.6.3	Has the CETP ever been impacted by climatic events? Yes ☐ No ☐ How do you rate impact of climatic events on operation of CETP? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐** If there are any impacts, what type of impact was there? Flooding of CETP ☐ Seepage or rupture of infrastructure ☐ Machinery failures ☐ Others ☐
3.6.4	How is wastewater handled incase of temporary breakdown of CETP? Stored at site ☐ send to alternate facility ☐ discharge untreated waste into sewer lines or on land ☐
3.6.5	If no CETP is present, how do the industries treat its effluent? On site ETP ☐ Off site ETP ☐ Discharge in sewerage line without treatment ☐

	Discharge in sewerage after treatment ☐ Discharge in open area within the IP ☐
3.6.6	How do you rate impact of climatic events on operation of ETP? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐** If there are any impacts, what type of impact was there? Flooding of ETP ☐ Seepage or rupture of infrastructure ☐ Machinery failures ☐ Others ☐
3.6.7	In such an event, what do industries do with the effluent? Sent it to alternate facility ☐ store at site ☐ discharge in sewer ☐ discharge in open space ☐ others ☐
3.7	**Energy**
3.7.1	What percentage of industries has onsite power generation facilities? <20% ☐ 20-40% ☐ 40 -60%☐ 60-80%☐ >80% ☐
3.7.2	Whether any climatic event has resulted in power outage in the past? Yes☐ No ☐ If yes, this is associated with Grid failure ☐ failure of transmission line ☐ damage at the power generation unit ☐ damage at the transformer ☐
3.7.3	Whether location of sub station for grid connectivity for the IP and industries is vulnerable to climate hazard due to its location in low line area? Yes☐ No ☐ If yes , please rate the same. **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**
3.7.4	What percentage of industries in the IP has back up/ alternate power sources (assessing back up)? <20% ☐ 20-40%☐ 40 -60%☐ 60-80% ☐ >80%☐
3.7.5	Have the IP and industries located inside its boundary experienced incidents of power outage on account of nautral hazards like drought (leading to water shortage), floods, cyclone etc? *(These natural disasters need not occur at site but may still impact the power availability at site)* Yes ☐ No ☐ If yes, describe specific event:

	How do you rate occurrence of the same. **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**	
3.7.6	What is th age of the power generation infrastructure in the IP?	
3.7.7	What is the back up source of power supply in the IP (not inside the industries)?	
3.8	**Workforce**	
3.8.1	Do industries or IP have infrastructure or places which can function as emergency shelters? (*For example: In summer when heat waves are at extreme does the IP have shelters and availability of other fluids which can keep the worker hydrated in case of emergency.)* If yes, How do you rate the adequacy of these shelters: **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**	
3.8.2	Where do most of the shop floor workers reside?	
3.8.3	What is the common mode of transportation for employees?	
3.8.4	Does the transportation infrastructure in the vicinity of IP lead to commuting problems for employees in the event of any weather related event?	Yes☐ No ☐
3.9	**Industrial community**	
3.9.1	Is there any kind of disaster management system in place at IP level? If yes, How do you rate adequacy of disaster management system in place. **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**	Yes☐ No ☐
3.9.2	Is there any kind of disaster management system in place at individual industries? If yes, describe the general system: If yes, How do you rate adequacy of disaster management system in place. **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**	Yes☐ No ☐
3.9.3	Did the industry experience monitory loss on account of climatic event? If yes, How do you rate the impact of the loss?	Yes ☐

	(very low)-☐low ☐ medium ☐ high ☐ (very high)☐ Were these losses covered under insurance? Yes ☐ No ☐	No ☐
3.9.4	Have such events impacted companies insurability Increase in premium ☐ reduced willingness of insurance companies to provide insurance ☐others ☐	
3.9.5	Are there any early warning systems in place to alert industries/communities of upcoming climatic hazards? If yes, Heavy rains☐ Flood ☐ Heat wave☐	
3.9.6	Have extreme weather events impacted the surrounding population and surrounding areas?	Yes☐ No ☐
3.9.7	How does the industrial community within the IP collaborate in case of flash floods, heat wave or other such climatic events? If yes, How do you rate adequacy of disaster management system in place? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**	
3.10	**Production**	
3.10.1	Do the industries insulate critical processes from harm due to heat wave?	
3.10.2	Are the manufacturing processes susceptible to temperature changes especially, high temperature events occurring during heat wave or drought or flood or heat islands? Yes ☐ No ☐ If yes, How do you rate the impact? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**	
3.10.3	Are heat islands being experienced in IP? *(Locate them on the map)* If yes, have nay measures been taken or are underway to prevent them? Building material change ☐ Building color change☐ Greening ☐ Others ☐	Yes☐ No ☐
3.10.4	Have you experienced fire, rupture of pipelines etc associated with change in weather (heat waves, flood, other natural disasters) (for facilities located within the IP)? If yes, describe the incidents?	Yes☐ No ☐

3.11	**Open space/Greenery**
3.11.1	Is there any green patch along the periphery or near the boundary wall in IP? Yes☐ No ☐ What is the percentage of green cover in IP (excluding open spaces)
3.11.2	Whether the green cover be utilized for other purpose? Yes☐ No ☐
3.11.3	Whether green cover is being maintained as per the requirement of EC or it has been done beyond it? a. As per the EC the total green cover requirements☐ b. Total green cover in the IP☐ The targeted green cover in the IP☐
3.11.4	Does the location of green cover provide a barrier between industries to facilitate cooling and reduction of heat islands or reducing the impact of flood? Yes ☐ No ☐ How do you rate the impact of greenery on mitigating the climate hazard? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**

4.	**Resilience to climate change** *(This section would provide insights into IPs current ability to adapt to climate change)*
4.1	**Financial assessment**
4.1.1	a. Does the IP allocate funds for environmental related activities? Yes ☐ No☐ b. If yes, does it allocate funds for climate change related activities Yes☐ No☐
4.1.2	a. Does the IP have separate O&M budget? Yes ☐ No☐ b. If yes, do they meet all the O&M requirements? Yes ☐ No☐
4.1.3	What is percentage of IPs total budget that is being use for a. Environemental activities ☐% b. Infrastructure ☐%

	c. Capacity Developmenet ☐%
4.1.4	Whether there is an uregency to dedicate more OPEX for climate change adapation measures in and around the industry boundary ? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**
4.2	**Spatial resource**
4.2.1	Does the IP have open space for development of infrastructure for climate change readiness for addressing climatic events? a. For letting out excess water☐ b. As shelters center during flood☐ c. Shelter during heat waves ☐ d. Climate resilient grid infrastructure ☐ e. Drainage system ☐ f. water tanks ☐
4.3	**Rules and Regulations**
4.3.1	Whether Building code including standards for resilient design is being followed by IP and industries during IP layout and construction phase? Yes ☐ No☐
4.3.2	How do you rate necessity of enforcement for building code in the industrial park areas? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**
4.4	**Supply structures (particularly water and energy / power)**
4.4.1	Has the IP though off or is planning to develop alternate sources/options of water supply? Yes ☐ No ☐ How do you assess the necessity of alternate sources/options of water supply in the context of increasing frequency of climatic events? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**
4.4.2	How do you rate the current status of resilience/capability of the IP/ its industries infrastructure to cope with the problems of climate change? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**
4.5	**Governance and Management**
4.5.1	Does the IP have a mechanism in place to identify, report, monitor and initiate action plan in case of climatic events/ disasters etc. ? Yes ☐ No ☐ If yes , rate the level of satisfaction level of the system.

	(very low)-☐low ☐ medium ☐ high ☐ (very high)☐ If no, does it intend to develop one? Yes ☐ No ☐
4.5.2	Does IP management take up activities on occupational, health and safety? Yes ☐ No ☐ If yes, describe: If no, does it intend to take up any?
4.6.3	**Resource**
4.6.1	Is the capacity at the zonal office or IALA adequate for the implementation of the climate change mitigation/adaptation initiatives? Yes ☐ No☐ If yes, rate the capacity level of the system. **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**
4.6.2	a. Is any climate change mitigation or adaptation projects already under implementation? *(Like installation of renewable energy source, storm water drainage system etc.)* Yes ☐ No☐ b. If yes describe: c. Who is implementing? Individual industry ☐ At IP level ☐
4.6.3	Does the IP have human resource to undertake such activitss? Yes ☐ No ☐ Do you see a need to enhance the skill level of resources or add resources to implment these activities ? Yes ☐ No☐
4.7	**Awareness and Knowledge**
4.7.1	How do you rate current awarness and knowledge level of personnel of IPs and industries on climatic events and prepardeness for the same. **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐** Stakeholders who require awareness and knowledge on the topic of climate change and its possible impact /prepardeness for IP and industry? Zonal employees ☐ IALA members ☐ Industry ☐ Contractors ☐ If an other, please speicfy
4.7.2	Would the stakeholders be willing to undertake these activities? Yes ☐ No☐

4.8	**Production**
4.8.1	Whether there are willingness or desire or necessity among the industries to make their product portfolio more climate resilient? **(very low)-☐low ☐ medium ☐ high ☐ (very high)☐**

Participants name	Signature of the participants

Annexure II

Table 1: Climatic Hazard exposure ranking methodology

Hazard Exposure Assessment	Response scoring	Maximum score
Heat waves		**18**
Whether there are instances of heat waves in the region?	Yes = 1, No =0	1
If yes how do you rate the instances of heat wave?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Whether the duration of experienced heat waves has increased during the past years?	Yes = 1 No =0	1
If yes, how do you rate the increase in duration of heat wave?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Whether the frequency of heat waves has increased during the past years?	Yes = 1 No =0	1
How do you rate the increase in frequency of heat wave?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Heat wave exposure grouping		
very low <4	low 4 to 8	medium 9 to 12	high 13 to 16	very high >16		
Hazard Exposure Assessment	Response scoring	Maximum score
Drought		**28**
Whether there are instances of drought	Yes = 1, No =0	1

in the region during the past years		
If yes, how do you rate the intensity of drought?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Whether the duration of drought has increased during the past years?	Yes = 1 No =0	1
If yes, how do you rate the increase in frequency of drought?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Whether the frequency of drought has increased during the past years?	Yes = 1 No =0	1
If yes, how do you rate the increase in frequency of drought?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
If yes, how do you rate the strength/intensity of these events?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Have you experienced increase in duration of these events in the past years? If yes, how do you rate it?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5

Drought exposure group

very low	low	medium	high	very high
<6	6 to 12	13 to 18	19 to 24	>24

Hazard Exposure Assessment	**Response scoring**	**Maximum score**
Heavy rainfall		**17**
Whether there are instances of flood, landslide and other events during the past years in and around the IP?	Yes = 1, No =0	1
If yes, how do you rate the strength/intensity of these events?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Have you experienced increase in duration of these events in the past years? If yes, how do you rate it?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Whether there are increase instances/frequency of flood and rainfall related events?	Yes = 1 No =0	1
If yes, how do you rate the increase in frequency?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5

Heavy rainfall exposure grouping

very low	low	medium	high	very high
<5	5 to8	9 to 12	13 to 16	>16

Table 2: Climate Hazard Exposure Assessment and Ranking

Climatic Hazards	IP XX	IP XX1	IPXX2	IPXX3
Heat Wave	Medium	Low	Very low	Very high
Drought	Very low	Very high	Low	Medium
Heavy rainfall and flash floods	High	Medium	High	Low
Ranking				

Climatic susceptibility

Table 3: Building infrastructure susceptibility

Climatic Susceptibility Assessment	Response scoring	Maximum score
Building infrastructure		20
Have there been any incidents of infrastructure damage on account of flood and other natural events?	Yes = 1, No =0	1
How do you rate these damages	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Is seepage or leakage a problem in the infrastructure at the IP?	Yes = 1, No =0	1
What percentage of industries have fire fighting system in place and operational?	<20% =5, 20% to 40% = 4, 40% to 60% = 3, 60% to 80% = 2, >80% =1	5
Does the IP as a whole have any fire fighting system?	Yes =0, No =1	1
Are there any underground storage systems for storing chemicals, inflammables, hazardous substances, water or hazardous waste?	Yes = 1, No =0	1
Have there been any past incidents where storage facilities in the industries or IP got	Yes = 1, No =0	1

affected, if yes, describe the impact		
How do you rate storage system in existing industries prone to natural disaster specially events like heat wave?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5

Building infrastructure grouping

very low	Low	medium	High	very high
<5	5 to 8	9 to 12	13 t o16	>16

Table 4: Road infrastructure exposure

Climatic Susceptibility Assessment	Response scoring	Maximum score
Road infrastructure		**12**
Are all roads inside the IP and industries inside the IP paved?	Yes = 1, No =0	1
What is the mechanism of O & M for the roads within the IP	Planned maintenance =1, Need based maintenance =2, others =3	3
Do the roads in the IP have a proper drainage system?	Yes =0, No =1	1
How do you rate the drainage system In the IP?	Very high =1 , high =2 , medium =3, low =4 and very low =5, No response =0	5
Which roads within the IP experience water logging (Locate in map or layout)?	Yes = 1, No =0	1
Whether any instances of uprooting of roads, increase in cracks in road or melting of roads surface due to increase climate temperature?	Yes = 1, No =0	1

Road infrastructure exposure grouping

very low	Low	medium	High	very high
<2	2to4	5to7	8to10	>10

Table 5: Storm water management

Climatic Susceptibility Assessment	Response scoring	Maximum score
Storm water management		**26**
a. Do the IP or its industries have storm water	Yes =0, No =1	1

management system or storm water drains?		
b. What percentage of area has storm water management system?	Planned maintenance =1, Need based maintenance =2, others =3	5
c. Is the storm water being used by the industries?	Yes =0, No =1	1
Do the IP and its industries have the rainwater harvesting system in place?	Yes = 1, No =0	1
What percentage of area has rain water harvesting system in place?	<20% =5, 20% to 40% = 4, 40% to 60% = 3, 60% to 80% = 2, >80% =1	5
How often the drainage system is being cleaned in the IP?	Predefined regular interval =1, When clogged =2, Others =3	3
How do you rate adequacy of cleaning of drainage system?	Very high =1 , high =2 , medium =3, low =4 and very low =5, No response =0	5
Do industries practice waste water segregation, reuse, and recycle option? If yes, rate the efficacy of the same	Very high =1 , high =2 , medium =3, low =4 and very low =5, No response =0	5

Storm water management grouping

very low	Low	Medium	High	very high
<6	6to10	11to15	16 to 20	>20

Table 6: Water management

Climatic Susceptibility Assessment	Response scoring	Maximum score
Water management		**12**
What are the sources of water for industries and IP?	GW+MS+PT[3] = 1, GW+MS=2, GW+PT=3, MS+PT =2, PT =4	4
Are there interruptions experienced in regular water supply forcing industries to switch to alternate sources of water supply?	Yes = 1, No =0	1
Do you think the shortage of water is on account of climate change?	Yes = 1, No =0	1

[3] GW refers to ground water supply, MS refers to municipal supply of water either through piped or through tankers, PT refers to private tankers

If yes, how do you rate water scarcity for industries	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Has the frequency of these interruptions increased in last 5-10 years	Yes = 1, No =0	1

Water management grouping

very low	Low	medium	High	very high
<2	**3to5**	6to8	9to11	>11

Table 7: Waste Water management

Climatic Susceptibility Assessment	**Response scoring**				**Maximum score**
Waste Water management					**4**
Does the IP have a Common Effluent Treatment Plant (CETP)	CETP present and able to treat all WW= Y =1	CETP present but unable to treat all WW =2	CETP/STP under construction = 3	No CETP and no plan =4	4

Waste Water management grouping

very low	Low	medium	High	very high
1	**2**	3	4	-

Table 8: Assessing Susceptibility of Energy System

Climatic Susceptibility Assessment	**Response scoring**	**Maximum score**
Energy System		**26**
Whether any climatic event has resulted in power outage in the past?	Yes = 1, No =0	1
Whether location of substation for grid connectivity for the IP and industries is vulnerable to climate hazard due to its location in low line area?	Yes = 1, No =0	1
What percentage of industries in the IP has back up/alternate power sources (assessing back up)?	<20% =5, 20% to 40% = 4, 40% to 60% = 3, 60% to 80% = 2, >80% =1	5

Have the IP and industries located inside its boundary experienced incidents of power outage on account of natural hazards like drought (leading to water shortage), floods, cyclone etc?	Yes = 1, No =0	1
How do you rate the occurrence of the same	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
What is the backup source of power supply in the IP (not inside the industries)?	Yes =0, No =1	1

Energy management grouping

very low	Low	Medium	High	very high
<3	3to5	6to8	9to11	>11

Table 9: Workforce and Industrial Community

Climatic Susceptibility Assessment	**Response scoring**	**Maximum score**
Workforce and industrial community		**19**
Do industries or IP have infrastructure or places which can function as emergency shelters?	Yes = 0, No =1	1
Does the transportation infrastructure in the vicinity of IP lead to commuting problems for employees in the event of any weather related event?	Yes = 1, No =0	1
Is there any kind of disaster management system in place at IP level?	Yes = 0, No =1	1
Is there any kind of disaster management system in place at Individual industries?	Yes = 0, No =1	1
If yes, how do you rate the adequacy of disaster management system in place?	Very high =1 , high =2 , medium =3, low =4 and very low =5, No response =0	5
Did the industry experience monitory loss on account of climatic event?	Yes =1, No =0	1
If yes, how do you rate the impact of the loss	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5

Were these losses covered under insurance?	Yes = 0, No =1	1
Have such events impacted companies insurability	Yes =1, No =0	1
Are there any early warning systems in place to alert industries/communities of upcoming climatic hazards	Yes = 0, No =1	1
Have extreme weather events impacted the surrounding population and surrounding areas?	Yes =1, No =0	1

Workforce and industrial community grouping

very low	Low	medium	High	very high
<4	4to7	8 to 11	12 to 15	>15

Table10: Production system

Climatic Susceptibility Assessment	Response scoring	Maximum score
Production		**8**
Are the manufacturing processes susceptible to temperature changes especially, high temperature events occurring during heat wave or drought or flood or heat islands?	Yes = 1, No =0	1
If yes, how do you rate the impact?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Are heat islands being experienced in IP?	Yes = 1, No =0	1
Have you experienced fire, rupture of pipelines etc associated with change in weather (heat waves, flood, and other natural disasters) (for facilities located within the IP)?	Yes =1, No =0	1

Production grouping

very low	Low	Medium	High	very high
<2	**2to3**	**4to5**	**6to7**	**>7**

Table 11: Open spaces and greenery

Climatic Susceptibility Assessment	Response scoring	Maximum score

Production		**8**
Is there any green patch along the periphery or near the boundary wall in IP?	Yes = 1, No =0	1
Whether the green cover be utilized for other purpose?	Yes = 1, No =0	1
Whether green cover is being maintained as per the requirement of EC or it has been done beyond it?	More than EC =1 / Equivalent =2 / Less than EC =3	3
Does the location of green cover provide a barrier between industries to facilitate cooling and reduction of heat islands or reducing the impact of flood?	Yes = 0, No =1	1

Open spaces and Greenery grouping

very low	Low	Medium	High	very high
<2	**2to3**	**4to5**	**6to7**	**>7**

Table 12: Climate Hazard Exposure Assessment and Ranking

Susceptibility Parameters	IP XX	IP XX1	IPXX2	IPXX3
Building infrastructure	**Medium**	**Low**	**Very low**	**Very high**
Internal Roads	**Very low**	**Very high**	**Low**	**Medium**
Storm water management	**High**	**Medium**	**High**	**Low**
Water management	**Medium**	**Low**	**Very low**	**Very high**
Waste water management	**Very low**	**Very high**	**Low**	**Medium**
Energy	**Very High**	**Medium**	**High**	**Low**
Workforce and Industrial Community	**Medium**	**Low**	**Very low**	**Very high**
Production	**Very low**	**Very high**	**Low**	**Medium**
Open spaces and Greenery	**High**	**Medium**	**Very High**	**Low**
Parameters with High susceptibility				
Parameters with Medium Susceptibility				

Susceptibility ranking				

Resilience to climate change

Table 13: Financial Resilience

Climatic Susceptibility Assessment	**Response scoring**	**Maximum score**
Financial Resilience		**8**
Does the IP allocate funds for environment related activities?	Yes = 1, No =0	1
If yes, does it allocate funds for climate change related activities	Yes = 1, No =0	1
Does the IP have separate O & M budget?	Yes = 1, No =0	1
Whether there is an urgency to dedicate more OPEX for climate change adaptation measures in and around the industry boundary?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5

Financial resilience grouping

very low	Low	Medium	High	very high
<2	**2to3**	**4to5**	**6to7**	**8**

Table 14: Rules and regulations

Climatic Susceptibility Assessment	**Response scoring**	**Maximum score**
Rules and Regulations		**6**
Whether building code including standards for resilient design is being followed by IP and industries during IP layout and construction phase?	Yes = 1, No =0	1
How do you rate necessity of enforcement for building code in the industrial park areas?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5

Rules and Regulation grouping				
very low	Low	Medium	High	very high
1	**2**	**3**	**4**	**>4**

Table 15: Supply structure

Climatic Susceptibility Assessment	**Response scoring**	**Maximum score**
Supply structure		**6**
Has the IP though off or is planning to develop alternate sources/options of water supply in the context of increasing frequency of climatic events?	Yes = 1, No =0	1
How do you assess the necessity of alternate sources/options of water supply in the context of increasing frequency of climatic events?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
How do you rate the current status of resilience/capability of the IP/its industries infrastructure to cope with the problems of climate change?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5

Supply structure grouping				
very low	Low	Medium	High	very high
<3	**3to4**	**5to6**	**7to8**	**>8**

Table 16: Governance and Management

Climatic Susceptibility Assessment	**Response scoring**	**Maximum score**
Governance and Management		**7**
Does the IP have a mechanism in place to identify report, monitor and initiate action plan in case of climatic events/disasters etc.?	Yes = 1, No =0	1
If yes, rate the level of satisfaction level of the system	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5

Does IP management take up activities on occupational, health and safety?	Yes = 1, No =0	1

Governance and Management grouping

very low	Low	Medium	High	very high
0 to1	**2to3**	**4to5**	**5to6**	**7**

Table 17: Human Resource, Awareness and Knowledge

Climatic Susceptibility Assessment	**Response scoring**	**Maximum score**
Human Resource, Awareness and Knowledge		**9**
Are any climate change mitigation or adaptation projects already under implementation? (Like installation of renewable energy source, storm water drainage system etc.)	Yes = 1, No =0	1
Does the IP have human resource to undertake such activities	Yes = 1, No =0	1
Do you see a need to enhance the skill level of resources or add resources to implement these activities?	Yes = 0, No =1	1
How do you rate current awareness and knowledge level of personnel of IPs and industries on climatic events and preparedness for the same?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5
Would the stakeholders be willing to undertake these activities	Yes = 1, No =0	1

Human resource, awareness and knowledge

very low	Low	Medium	High	very high
0 to1	**2to3**	**4to5**	**5to6**	**7**

Table 18: Production

Climatic Susceptibility Assessment	**Response scoring**	**Maximum score**
Production		**5**

Whether there is willingness or desire or necessity among the industries to make their product portfolio more climate resilient?	Very high =5 , high =4 , medium =3, low =2 and very low =1, No response =0	5

Production grouping

very low	Low	Medium	High	very high
1	**2**	**3**	**4**	**5**

Table 19: Climate Resilience Ranking

Resilience assessment parameters	IP XX	IP XX1	IPXX2	IPXX3
Financial	Medium	Low	Very low	Very high
Rules and Regulations	Very low	Very high	Low	Medium
Supply structure	High	Medium	High	Low
Governance and Management	Very low	Very high	Low	Medium
Human resource ,awareness and knowledge	High	Medium	High	Low
Production	Very low	Very low	Very low	Medium
Parameters with **very low – low** resilience				
Parameters with **Medium** resilience				
Resilience based ranking				

Vulnerability Assessment

Vulnerability is a function of climatic impact and resilience.

Table 20: Climatic Vulnerability Ranking of IPs based on the risk assessment tool

Order Based on exposure	Susceptibility Score			Impact ranking	Resilience Score			Vulnerability Ranking
IP XX1	XX	X	X	XX	XXX	XX	X	XX
IP XX2	X	X	X	X	X	XXX	X	
IP XX3	XXX	X	XX	XXX	XX	XX	XX	XXX

Annexure III

Synopsis of the setting-up process for new Industrial Parks in Telangana
By Telangana Industrial Infrastructure Corporation (TSIIC) limited

Allotment of Land to TSIIC by Govt.

- TSIIC identify the barren / degraded, non-fertile land or waste lands (Which might be patta land or revenue land) and submits the document / reports to government for setting up of Industrial Clusters in different parts of the state to meet the Industrial land requirements.
- Govt. allots land to TSIIC based on the report which details the extent of land required, proposed investment, employment potential, infrastructure needs and the likely impact on environment.
- On the basis of the report land alienation proposals are submitted to the concerned district collectors.
- The concerned collectors shall initiate land alienation proceedings as per the requisition made by TSIIC.
- **If any Land Acquisition required, it involves the process liaison with district revenue authorities, attending the legal cases if any etc.,**
- The collector shall recommend the proposal to Land Management Authority (*LMA*), which appraises the same and makes appropriate recommendations to the Government.
- Allotments to individual Industries within the industrial parks shall be done by TSIIC only, following its internal process.

The core functions of TSIIC are:

- **Identification of sites for industrial areas and development of layouts keeping in view basic amenities including R**oad connectivity, Airport, Railway Station, Power Distribution, water facilities and major commercial centres etc.,
- **Allotment of developed plots based on guidelines**
- **To perform a role as facilitator for industrial Investment in the state**
- **Planning and Development of project identification and implementation**
- **Promotion of infrastructure project under Public Private Partnership mode (PPP)**
  Nodal Agency for all industrial projects including IT parks, Biotech parks, Apparel Parks and Special Economic zones in the state.

Role of TSIIC- Engineering Wing at Head Office:

- **Preparation of IP / SEZ layout and process for approval from concerned approval bodies i.e, DTCP, GHMC, HMDA through VC&MD.**
- **Preparation of Master plan by engaging consultants as per the norm of TSIIC to know the existing geological , geomorphological conditions including slope,** social infrastructure, availability of basic industry amenities like power, water etc. including Environmental settings like flora-fauna, water, forest, etc.

- **Development of cost estimations and communicate the same to internal Finance wing through VC&MD / Proper Channel for further finance allocations**

Role of Finance wing of TSIIC

For fixation of land cost and to determine the level of infrastructure to be provided in an industrial park a committee constituted by MD, TSIIC, called Price Fixation & Infrastructure Committee.

The role and responsibilities of the committee are as follows:

1. To recommend the cost of land/premises to be allotted in an industrial park
2. To discuss and recommend the level of infrastructure facilities to be provided for in an industrial park
3. To review and recommend land cost in all the industrial parks periodically and upon the requirement.
4. In cases where implementation of any project is delayed due to non-provision of any infrastructure facility by TSIIC, the committee may recommend extension of time for implementation to such allottee after examining his request about non-provision / delay in execution of development works for extending time for implementation of project with or without penalty and such recommendations are to be considered by MD for approval or otherwise.
5. In addition, PF&IC may review the land cost in any industrial park from time to time, depending on market conditions, enhanced land compensation claims made/received, additional infrastructure costs to be incurred or such events.
6. The Committee is a recommendatory body and MD, TSIIC may approve or modify the recommendations of the committee with reasons to be recorded.
7. The land costs, as approved by the MD, from time to time, for all the industrial parks are to be placed before the Board for information and shall be updated on the websites of TSIIC & Commissioner of Industries.

Role of TSIIC- Project & Asset Management wings of Head Office:

The Sub-committee formed with members from TSIIC, Pollution Control Board(PCB) ,*State Financial Corporation (*SFC), Commissioner of Industries, Andhra Pradesh Industrial and Technical Consultancy Organisation Ltd.(APITCO), technical consultants to scrutinize the DPR & related documents and recommend the extent of land for allotment. Considering these recommendations, the State Level Allotment Committee (SLAC) formed with the same members will approve/defer/reject the application.

Whenever a new Industrial Park is developed by Corporation, Head Office of TSIIC shall cause publication of the same, in one newspaper in English and other in Telugu which has wide circulation intimating the launch of the New Industrial Park and inviting entrepreneurs to file applications for allotment.

Land allotment Procedure:

Based on the recommendations of the Sub-Committee, the State Level Allotment Committee/ District Allotment Committee will take decision for allotment on the basis of the following criteria such as Financial viability of the project, Green category industries, Justification for land, Investment to be made and Employment to be created etc.

Role of Environmental Management & Planning (EMP) wing at Head Office:

- Obtain Environmental Clearance (EC) for the new / existing IPs / SEZs of TSIIC from concerned regulatory authorities like Central Environmental Appraisal Committee (CEAC) at central level, State Level Environmental Appraisal Committee (SEAC) at state level with reference to EIA Notification 2006 and amendments thereof by engaging environmental consultancies through floating Request for Proposals (RFP).
- Apply / process for CFE (Consent for Establishment) on receiving EC to provide infrastructure in IP

  Also Preparation of RFPs for CETPs, Solid / Hazardous waste management at IP level located in various zones and also other activities like; Execution of Industrial Environmental Improvement Drive (IEID) every year (from June 5th to July 5th) , Execution of collaborated projects like; 5-Point programme, CCA, THH etc., RAAHGIRI Day (every Sunday), CARFREE Thursday and Kfw etc.,

Role of Zonal Managers:

- Zonal Manager is the field level representative of the Corporation who is responsible to implement programmes and policies of the Corporation, as per delegations given to him.
- He is responsible to identify new entrepreneurs and improve occupancy position and is responsible for arranging district level promotional campaign to attract entrepreneurs/ business development.
- He is responsible for execution of civil works, as per schedule and ensure quality of works.
- He is responsible for correcting non-conformance and servicing.
- He is responsible for financial management and Accounts at Zonal Offices.
- He has been delegated with requisite authority to create quality produce (infrastructure); implement policies of the Corporation and improve marketing potential for the products.
- He is designated as Public Information Officer to receive applications under RTI ACT,2005

Appendix I

Stakeholder response and scoring table for Rapid Climate Risk Analysis

Section 1	General Information					
1.1	Name of IP and Zone :	IP Pashamylaram & Patancheru	IP Rampur & IP Madikonda	IP Cherlapally & Shamshabad	Software Units Layouts, Madhapur	Jeedimetla
1.2	Mandal	Patancheru	Patancheru	Ghatkesar	Serilingampally	Quthbullapur
1.3	Number of industries:			990		1100
1.4	District	Medak	Warangal	Ranga Reddy	Ranga Reddy	Ranga Reddy
1.5	Area	1645 acres	188 acres	1100 acres	64.103 Acres	
1.6	Vacant space			Nil		
1.7	Working population at IP	50,000	1,200	35000-40,000		30,000
1.8	Residential colony(Y/N)		No			
	If Y, no. of families residing:					

1.9	**Industries in each category:**	**pharma, Engineering, Bulk drugs, chemical industries, foundry, automobiles**		**Textiles, Rice mills, Granites, Paraboiled rice mills, seeds**		**Engineering, plastic, pharma, chemical, fabrication, chemical industries rubber, borewell, fabrication, polymer industries**		**IT industry**			
Section 2	**Hazard Exposure Assessment**										
2.1	Heat waves	**13**		**10**		**11**		**14**		**14**	
2.1.1	Whether there are instances of heat waves in the region	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1
	If yes how do you rate the instances of heat wave?	High	4	Medium	3	Low	2	high	4	medium	3
	Whether the duration of experienced heat waves has increased during the past years?	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1
	If yes, how do you rate the increase in duration of heat wave?	High	4	low	2	High	4	high	4	high	4

2.1.2	Whether the frequency of heat waves has increased during the past years?	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1
	How do you rate the increase in frequency of heat wave?	Low	2	Low	2	Low	2	medium	3	high	4
2.2	**Drought**	**18**		**14**		**10**		**20**		**20**	
2.2.1	Whether there are instances of drought in the region during the past years	Yes	1	Yes	1	Yes	1	Yes	1	Yes	1
	If yes, how do you rate the intensity of drought?	High	4	low	2	Low	2	medium	3	high	4
	Whether the duration of drought has increased during the past years?	High	4	medium	3	Yes	1	Yes	1	Yes	1
	If yes, how do you rate the increase in frequency of drought?						0	low	2	high	4
2.2.2	Whether the frequency of drought has increased during the past years?	Yes	1	Yes	1		0	Yes	1	Yes	1

	If yes, how do you rate the increase in frequency of drought?	high	4	medium	3		0	high	4	medi um	3
2.2.3	If yes, how do you rate the strength/intensity of these events?			Low	2	High	4	high	4	medi um	3
	Have you experienced increase in duration of these events in the past years? If yes, how do you rate it?	high	4	Low	2	Low	2	high	4	medi um	3
2.3	**Heavy rainfall including flood, landslide and other events**	**1**		**0**		**3**		**8**		**5**	
2.3.1	Whether there are instances of flood, landslide and other events during the past years in and around the IP?	No	0	No	0	Yes	1	Yes	1	Yes	1
	If yes what type of event was observed?					Water logging		water logging		small flood	
2.3.2	If yes, how do you rate the strength/intensity of these events?	very low	1			Low	2	medium	3	Low	2

	Have you experienced increase in duration of these events in the past years? If yes, how do you rate it?					No	0	No(because rains are less)	0	Low	2
2.3.3	Whether there are increase instances/frequency of flood and rainfall related events?	No	0					Yes	1	No	0
	If yes, how do you rate the increase in frequency?							Medium	3	No	0
2.3.4	please identify hot spots associated with rainfall(low line area which is being frequently getting flodded or landslide or other event is happening) If yes, indicate the area where water logging are usually experience? (provide a map indicating excat location)	NA		No		Roads & Industries	N A	Roads and open space		roads	
Section 3	**Climatic Susceptibility Assessment**										
3.1	**Building infrastructure**	**6**		**4**		**9**		**5**		**9**	

3.1.1	What is the average age of industries located within the IP?	20 to 30 years		<10 years and some from 10 to 20 years		phase I > 30 years, phase 2 (84-85)		10 to 20 years		20 to 30 years	
3.1.2	a. Is an assessment of the stability of IPs building infrastructure available? (This could be in the form of any building stability assessment reports with individual industries)	Yes		No				Yes		No	
	b. If yes, what is the frequency of such assessments							one time stability test			
	c. If yes, how many industries have undertaken such an assessment							100%			
	d. Is such a report available for the common infrastructure for the IP as well?								1	No	

3.1.3	a. Have there been any incidents of infrastructure damage on account of flood and other natural events?	No	0	No	0	Yes, gas comp anies	1	flash flood		No	0
	b. If yes, which part of the building was affected							roof			
	c. If yes, describe the loss							not sub unit			
	c.Reason for damage:					flash flood		flash flood			
	d. How do you rate these damages					Low	2	very low	1	very low	1
3.1.4	Is seepage or leekage a problem in the infrastructure at the IP?	Yes	1	No	0	Yes	1	No	0	Yes, r	1
3.1.5	What percentage of industries have lightening conductors installed on their buildings	60-80%		80%-100%		0-20%		80%-100%		0-20%	
3.1.6	What percentage of industries have fire fighting system in place and operational?	40-60%	3	40%-60%	3	20-40%	4	80%-100%	1	40%-60%	3

	Does the IP as a whole have any fire fighting system?	No	1	No	1	Yes	0	Yes	0	Yes	0
3.2	**Infrastructure for storage of various items**										
3.2.1	a. Are there any underground storage systems for storing chemicals, inflammables, hazardous substances, water or hazardous waste?	Yes	1	No	0	No	0	Yes	1	No	0
	b. If yes, list the type of items being stored and type of industry										
	chemicals	Yes								few industries	
	inflammables	Yes		Tyre oil							
	Hazardous substances	Yes						ewaste			
	Water	Yes		Rice mill effluent				underground 100%			
	Waste	Yes		Granite bottom waste				underground 100%			
	please elaborate										

3.2.2	Have there been any past incidents where storage facilities in the industries or IP got affected, if yes, describe the impact	No	0	No	0	No	0	No	0	No	1
3.2.3	How do you rate storage system in existing industries prone to natural disaster specially events like heat wave?	medium	3			very low	1	very low	1	Medium	3
3.3	Road infrastrucutre (Spatial location)	7		8		10		4		6	
3.3.1	Are all roads inside the IP and industries inside the IP paved?	Yes	0	Yes	0	Yes	0	Yes	0	Yes	0
	What kind of pavment is used?	Cement		mostly bituminous and some concrete		mostly bituminous and some concrete		Tarmac		Bituminous pavement and cement concrete	

3.3.2	What is the mechanism of O & M for the roads within the IP	Need basic mainten ance	2	others	3	others, no action	3	Pre-defined regular maintenanc e , every two years re-carpeting of roads	1	Needs basic maintenanc e	2
3.3.3	Do the roads in the IP have a proper drainage system?	No	1	No	1	No (140 lakhs for storm water	1	Yes	0	Yes	0
	How do you rate the drainage system In the IP?	low	4	low	4	very low	5	high	2	medium	3
3.3.4	Which roads within the IP experience water logging (Locate in map or layout)?	No	0	No water logging	0	Phase 2		Yes	1	Ram hospital, sagar hospital, some roads (15%) of total roads	1
3.3.5	Whether any instances of uprooting of roads, increase in cracks in road or melting of roads surface due to increase climate temperature?	No	0		0	No, sometimes due to waterloggin g	1	No	0	No	0

3.4	Storm water management	17		9		19		9		18	
3.4.1	a. Do the IP or its industries have storm water management system or storm water drains?	No	1	No	1	No	1	Yes	0	Yes	0
	b. What percentage of area have storm water management system?			0%	0	0-20%	5	60%-80%	2	40-60%	3
	c. Is the storm water being used by the industries?	No	1	No	1			Yes	0	No	1
3.4.2	Where does the water from the storm water drains find its outlet?	Open areas within the IP, well strucutured pond or lake within the IP, into open space outside the IP		Road Open areas		Municipal sewers, roads and open areas		rain water harvesting pit constructed & excess is let into Durgam cheruvu lake		open areas within the IP and Municipal sewers, ntural drains, nllahs, into open spaces outside the IP	

3.4.3	Does the IP and its industries have the rainwater harvesting system in place?	Yes	0	No	1	Yes	0	Yes	0	Yes	0
	What percentage of area has rain water harvesting system in place?	<20%	5	<20%	4	20-40%,	4	60-80%	2	20-40%	4
3.4.4	How often the drainage systems is being cleaned in the IP?	When clogged	2	No drainage system is there		Others	3		1	When clogged	2
	How do you rate adequency of cleaning of drainage system?	low	4	High	2	High	2		2	low	4
3.4.5	Do industries practice waste water segregation, reuse, and recycle option? If yes, rate the efficacy of the same	low	4	No	0	Low	4		2	low	4
3.5	Water Management	7		6		7		8		7	

3.5.1	What are the sources of water for industries and IP?	private tanker,Ground water, Municipal supply	1	Private tankers and Ground water	3	Municipal tankers, ground water, IALA supplies	2		2	private tanker, municipal tanker, Ground water is polluted	2
3.5.2	Are there interruptions experienced in regular water supply forcing industries to switch to alternate sources of water supply?	Yes	1	Yes	1	Yes	1	Yes	1	Yes (once in two days)	1
	Do you think the shortage of water is on account of climate change?	Yes	1		0	Yes	1	Yes	1	Yes	1
	If yes, how do you rate water scarcity for industries	medium	3	Low	2	Low	2	medium	3	low	2
3.5.3	Has the frequency of these interruptions increased in last 5-10 years	Yes	1		0	Yes	1	Yes	1	Yes	1
3.6	Waste Water Management	2		4		3		3		2	

3.6.1	Does the IP have a Common Effluent Treatment Plant (CETP)	No	1	No	1	No	1	No	1	Yes	0
	If yes, where is it located?							under execution			
	If yes, do all industries sent effluent to CETP?		0					Under execution		Yes	
3.6.2	If answer to 3.1.4.1 is yes, please describe the O&M of CETP		0					NA		JETL independent	
3.6.3	Has the CETP ever been impacted by climatic events							NA		No	
	How do you rate impact of climatic events on operation of CETP?							NA		very low	
	If there are any impacts, what type of of impact was there?							onsite STP & discharge in sewerage line without treatment, 60 to 70%		Machinery failure	

3.6.4	How is wastewater handled in case of temporary beakdown of CETP?	Stored at site	0					No		sent to alternate facility	
3.6.5	If no CETP is present, how do the industries treat its effluent?	Onsite ETP, Discharge in sewerage after treatment	0					discharge in sewer		On site ETP, off site ETP, discharge in sewerage after treatment	
3.6.6	How do you rate impact of climatic events on operation of ETP?	medium	3			No	0			Low	
	If there are any impacts, what type of impact was there?									Others	
3.6.7	In such an event, what do industries do with the effluent?	store at site, discharge in sewer								sent it to alternate facility or sotre at sight and dischare in sewer	
3.7	Energy	10		2		5		4		10	

3.7.1	What percentage of industries has onsite power generation facilities?	<20%		<20%		<20%		<20%		< 20%	
3.7.2	Whether any climatic event has resulted in power outage in the past?	Yes	1	no	0	Yes	1	Yes	1	Yes	1
	If yes, this is associated with	failure of transmission line, damage of transformer				Some times, very rare		damage at the power generation unit and damage at the transformer			
3.7.3	Whether location of substation for grid connectivity for the IP and industries is vulnerable to climate hazard due to its location in low line area?	No	0		0	No	0	No	0	No	0
3.7.4	What percentage of industries in the IP has back up/alternate power sources (assessing back up)?	20-40%	4		0	>80%	1	>80%	1	20-40%	4

3.7.5	Have the IP and industries located inside its boundary experienced incidents of power outage on account of natural hazards like drought (leading to water shortage), floods, cyclone etc?	Yes	1	No	0	No	0	Yes	1	Yes	1
	If yes, describe specific event?										
	How do you rate the occurance of the same	Medium	3	Very low	1	Low	2	very low	1	Medium	3
3.7.6	What is the age of the power generation infrastructure in the IP?	No power generation in IP						about 5 years solar		NA	
3.7.7	What is the back up source of power supply in the IP (not inside the industries) ?	No back up	1	No	1	No	1	Diesel Generators	0	No	1
3.8	Workforce	5		2		4		9		10	

3.8.1	Do industries or IP have infrastructure or places which can function as emergency shelters? (for example: In summer when heat waves are at extreme does the IP have shelters and availability of other fluids which can keep the worker hydrated in case of emergency)	No, but we have a ten bed hospital with ambulance facility with Doctor within the industries	1	No	1	No	1		1	No	1
3.8.2	Where do most of the shop floor workers reside?	near by villages				Nearby		No		in nearby colonies - 5 to 15km	
3.8.3	What is the common mode of transportation for employees	public transport and private vehicles		Public transport		buses, two wheelers & cycles		NA		public transport, cycle	
3.8.4	Does the transportation infrastructure in the vicinity of IP lead to commuting problems for employees in the event of any weather related event?	No	0	No	0	Yes, but negligible	0	private vehicles and public	1	No	0
3.9	Industrial Community										

3.9.1	Is there any kind of disaster management system in place at IP level?	No	1	No	1	No	1	Yes	0	No (only fire fighting station)	1
3.9.2	Is there any kind of disaster management system in place at Individual industries?	Yes, we have fire systems in few industries	0	No		No	1	Yes, for fire	0	Yes (only some chemical & Eng & big industries having)	1
	If yes, describe the general system:										
	If yes, how do you rate the adequency of disaster management system in place.	low	2							low	2
3.9.3	Did the industry experience monitory loss on account of climatic event?	No	0	No	0	No	0	Yes, due to use of DG	1	Yes	1
	If yes, how do you rate the impact of the loss							medium	3	low	2
	Were these losses covered under insurance?							No	1	No	1

3.9.4	Have such events impacted companies insurability	No	0			No	0	NA	0	NA	0
3.9.5	Are there any early warning systems in place to alert industries/communities of upcoming climatic hazards	No	1			No	1	No	1	No	1
3.9.6	Have extreme weather events impacted the surrounding population and surrounding areas?	No	0			No	0	Yes	1	No	0
3.9.7	How does the industrial community within the IP collaborate in case of flash floods, heat wave or other such climatic events	NA						High, IALA is responsible		No	0
	If yes, how do you rate the adequency of disaster management system in place?							high	0		0
3.10	Production	4		3		3		0		1	

3.10.1	Do the industries insulate critical processes from harm due to heat wave?	Yes				Yes, Engineering industries under heat wave they were increased		NA		Yes	
3.10.2	Are the manufacturing processes susceptible to temperature changes especially, high temperature events occuring during heat wave or drought or flood or heat islands?	Yes	1	No	0	Yes	1	NA	0	Yes.	1
	If yes, how do you rate the impact?	medium	3	medium	3	Low	2		0		0
3.10.3	Are heat islands being experienced in IP?	No	0	No	0	No	0	No	0	No	0
	If yes, how many measures been taken or are underway to prevent them?	No						Building color change and others , project to upgrade buildings - Energy efficiency			

3.10.4	Have you experienced fire, rupture of pipelines etc associated with change in weather (heat waves, flood, other natural disasters) (for facilities located within the IP)? If yes, describe the incidents?	No	0			No	0	No	0	No	0
3.11	Open space/Greenery	2		3		3		2		3	
3.11.1	Is there any green patch along the periphery or near the boundary wall in IP?	Yes	0	Yes	0	Yes	0	Yes	0	Yes	0
	What is the percentage of green cover in IP (excluding open spaces)	5%		10-20%		10-20%		20%		about 10% to 15%	
3.11.2	Whether the green cover be utilized for other purpose ?	No	0	Yes	1	No	0	Yes, Since the use is only for recreational purpose it does not spoil the greenry	0	No	0

3.11.3	Whether green cover is being maintained as per the requirement of EC or it has been done beyond it?	As per the EC the total green cover requirements 10 %	2	Yes	2	Yes	2	Yes	2	No	3
	a. As per the EC the total green cover requirements										
	b. Total green cover in the IP										
	The targeted green cover in the IP					Yes, 5-10%					
3.11.4	Does the location of green cover provide a barrier between industries to facilitate cooling and reduction of heat islands or reducing the impact of flood?	Yes	0	Yes	0	No	1	NA	0	Yes	0
	How do you rate the impact of greenery on mitigating the climate hazard?	medium	3	Medium	3	Low	2		0	Medium	3
4	Resilience to climate change										
4.1	Financial assessment	3		4		3		6		4	

4.1.1	a. Does the IP allocate funds for environment related activities?	No	0	No	1	No	0	Yes, 15% for EMP - Environment Management Planning	1	Yes	1
	b.If yes,does it allocate funds for climate change related activities	No	0		1	No	0	Yes	1	No	0
4.1.2	a. Does the IP have separate O & M budget?	No	0	No	1	Yes	1	Yes	1	Yes	1
	b. If yes, do they meet all the O& M requirements					Yes	1	Yes			
4.1.3	What is percentage of IPs total budget that is being used for							Remining is shared with GHMC and others			
	a. Environmental activities	5%				5-10%		15%		20%	
	b.Infrastructure	90%				90-95%		30%		40%	
	c.capacity development	No predefined budget						less than 5%		2%	

4.1.4	Whether there is an urgency to dedicate more OPEX for climate change adaptation measures in and around the industry boundary?	medium	3	very low	1	very low	1	medium	3	low	2
4.2	Spatial Resource										
4.2.1	Does the IP have open space for the development of infrastructure for climate change readiness for addressing climatic events ?	Yes, For letting out excess water, as shelters center during flood, Drainage systems, water tanks		climate resilient grid infrastructure		Yes for some of the activities, little psace for plantation		Yes		for letting out excess water, Shelter during heat waves & water tanks	
	Shelter during heat waves					No shelters		Yes			
4.3	Rules and Regulations	3		3		3		5		3	
4.3.1	Whether building code including standards for resilient design is being followed by IP and industries during IP layout and construction phase?	No	0	Yes	1	No	0	Yes	1	No	0

4.3.2	How do you rate necessity of enforcement for building code in the industrial park areas?	medium	3	Low	2	Medium	3	high	4	medium	3
4.4	supply structure (particularly water and energy/power)	8		6		7		9		6	
4.4.1	Has the IP though off or is planning to develop alternate sources/options of water supply in the context of increasing frequency of climatic events?	Yes	1	Yes	1	Yes	1	Yes	1	No	0
	How do you assess the necessity of alternate sources/options of water supply in the context of increasing frequency of climatic events?	high	4	medium	3	Low	2	high	4	High	4
4.4.2	How do you rate the current status of resilience/capability of the IP/its industries infrastructure to cope with the problems of climate change?	medium	3	low	2	Low	4	high, Not in the name of CC but activities is related to CC	4	Low	2

4.5	Governance and Management	1		0		1		4		1	
4.5.1	Does the IP have a mechanism in place to identify report, monitor and initiate action plan in case of climatic events/disasters etc.?	No	0	No	0	No	0	Yes	1	No	0
	If yes, rate the level of satisfaction level of the system		0					medium	3		0
	If no, does it intend to develop one?					Yes, if suggested				No	
4.5.2	Does IP mangement take up activities on occupational, health and safety?	Yes	1	No	0	Yes	1	No	0	Yes	1
	If yes, describe							Because industry takes care		may be	
4.6	Resource	4		3		4		5		5	

4.6.1	a. Is any climate change mitigation or adaptation projects already under implementation? (Like installation of renewable energy source, storm water drainage system etc.)	No	0	No	0	Yes, storm water drainage system	1	Yes	1	Yes	1
	b. If yes describe									Industrial municipality (IALA) regularly undertakes afforestration programmes	
	c.Who is implementing?					IALA at IP level		Individual industry and at IP level		IALA at TP level	
4.6.2	Does the IP have human resource to undertake such activities	No	0	No	0	No	0	No, all feasibility studies	0	Yes	1

	Do you see a need to enhance the skill level of resources or add resources to implement these activities?	No	1	Yes	0	Yes	0	Yes	0	Yes	0
4.7	Awareness and Knowledge										
4.7.1	How do you rate current awareness and knowledge level of personnel of Ips and industries on climatic events and preparedness for the same	low	2	low	2	Low	2	medium	3	Low	2
	stakeholders who require awareness and knowledge on the topic of climate change and its possible impact/preparedness for IP and industry?	IALA members,industry,contractors		Zonal members and IALA members		Zonal members and IALA members, Industry and contractors		zonal employees, IALA members industry		Zonal employees, IALA members, Industry and Contractors	
	If any other, please specify									employees	
4.7.2	Would the stakeholders be willing to undertake these activities	Yes	1		1	Yes	1	Yes	1	Yes	1

4.8	Production	4		3		2		2		3	
4.8.1	Whether there are willingness or desire or necessity among the industries to make their product portfolio more climate resilient?	High	4	medium	3	Low	2	low	2	Medium	3

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