CHAPTER - VII
Chapter 7

Identification And Quantification Of Impacts

Introduction
Environmental impact may be defined as any alteration of environmental condition or creation of a new set of environmental conditions, adverse or beneficial caused or induced by the action or set of action or set of action under consideration. The industrial pollution has potential to cause irreversible reactions in the environment. Since the carrying capacity of the environment is not unlimited, ecosystems are more susceptible to adverse environmental impacts. The unplanned and haphazard location of industries might increase the risk to the environment. The impacts have been quantified based on existing control measures and the emission concentrations. The environment is a complex structure. The study of Environment impact Assessment is difficult and lengthy procedure besides being expensive. The accuracy of any prediction concerning the impact on the environment as a whole may not be precise. Hence relevant aspects of the environment are isolated as parameters and identification of the impact due to various activities on these parameters and identification of the impact due to various activities on these parameters have been done. The typical sets of parameters adopted for this study are listed below

1. Air Environment
2. Water Environment
3. Land Environment
4. Socio-economic Environment

The impact on each of the environment parameter can be identified by a careful examination of each of the activities listed under operational phase for establishing cause and effect relationship between the activity and the environmental parameter under study.

The industrial development activities in Bhubaneswar have impact on the environmental both directly and indirectly. The direct impact can be classified as primary impact whereas the indirect impact termed as secondary impact. The various impacts of the industrial activities on the different environmental parameters are discussed.
7.1 Impact On Topography
The major topographical changes in the region are primarily because of industrialization and mineral exploration. Though the ancillary activities will contribute to topographical changes, but they are on the smaller scale. There are more than 60 open cast industries existing in the region, which contribute to topographical changes by generation of open pits and solid waste dump yards. Industrial establishments like East Coast Railway Industry at Mancheswar, Fabrication industries In Mancheswar Industrial Estate, Plastic Industries and Crusher industries in Khurda etc. of Bhubaneswar- Jatani area generate huge amount of solid waste, which are dumped on the land on heaps thereby disturbing the topography. The slag- dumping yard has practically become a hillock. Most of the development causing deforestation has also affected the topography due to soil erosion.

7.2 Impact on Climate:
The impact on climate due to industrial activities are much more significant as the rapid growth of industrial and commercial activities affects the macroclimate of the area. Rapid deforestation, vegetation destruction and generation of heat by the industries in the atmosphere through their respective stack emissions causes thermal pollution and erection of huge structures for both industries and commercial purposes which directly affect the climate. The highest temperature recorded in the area is 46°C and annual rainfall varies 994 to 1973 mm. Comparison of annual average rainfall clearly indicates the overall activities in the area has affected the climate of the study area (Table 7.1)

Table 7.1 Comparison of annual average rainfall data (in mm) of study area for the year 2010 and 2009

<table>
<thead>
<tr>
<th>Blocks</th>
<th>Year 2010</th>
<th>Year 2009</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joda</td>
<td>1571</td>
<td>1167(-25.7%)</td>
</tr>
<tr>
<td>Satsang Vihar</td>
<td>1537</td>
<td>1371(-10.8%)</td>
</tr>
<tr>
<td>Bhubaneswar</td>
<td>1596</td>
<td>1787(+11.9%)</td>
</tr>
</tbody>
</table>

7.3 Impact on Air Quality
The ambient air quality is affected by continuous release of toxic gases and particulates to the air through stack emissions and other processes. Among the toxic gases and particulates that industries release, the suspended particulate matter, sulphur dioxide and oxides of nitrogen are major pollutants. Ambient air quality depends upon the wind direction, wind velocity and the relative
position of monitoring station with respect to the source of emission. There is also impact of mining on the air quality. The dust generated during the quarrying operations including blasting in the open cast industries and the movement of the mobile equipments such as dozers, shovels, etc. deteriorate the air quality in the surroundings. Existence of number of open cast industries and expansion of mining activities created dust and air pollution in the study area. Therefore, remedial measures should be taken for settling the dust and minimizing air pollution from mining activities.

The ambient air quality data around four major industries namely East Coast Railway Industry at Mancheswar, Fabrication Industries in Mancheswar Industrial Estate, Plastic Industries and Crusher Industries in Khurda are presented and their pollution status are discussed in Chapter VII. It has been observed that SPM level in most of the times exceeded the prescribed limit. In discriminated discharge of industrial emission and transportation of the materials have increased the presence of SPM in the ambient air. Depending upon wind conditions, the dust particles are carried to different places and account for high SPM values in the study area. The major activities for the source of air pollution are dumping, unloading, loading, transporting, crushing and dispatch operation.

The general observations on the impact on air quality in present study area are:

Two atmosphere remains relatively clean during monsoon as most of the pollutants are washed out with rain. The pollutant concentrations at different locations do not follow any specific trend. It depends on the wind velocity and direction. However, the concentrations trend are generally increasing after monsoon and the air quality deteriorates more during peak winter.

7.4 impact on water resources:

The industrial activities affect the surface water resources both in qualitative and quantitative terms. These are three major surface water resources namely river Dhanua, Kushabhadra and Kuakhai flowing through the study area which gets affected by different industries and opencast industries. Most of the industries draw water for industrial as well as domestic use. East Coast Railway Industry draws water from river Kuakhai is 14,000 m$^3$/day for its plant and colonies. Fabrication Industries In Mancheswar Industrial Estate & Plastic Industries, Mancheswar Industrial Estate draws water from River Daya & Dhanua 21350 m$^3$/day and 8367 m$^3$/day respectively for its plant. Further 2600 m$^3$/day of industrial effluent of East Coast Railway Industry, 10680 m$^3$/day of Fabrication, 3972 m$^3$/day of industrial effluent of Plastic Industries, Mancheswar Industrial Estate and 7482 m$^3$/day of
Crusher Industries in Khurda are disposed into the river Kushabhadra, Kuakhai and Dhanua respectively. In addition to these, most of the villages draw water predominately either from surface water or dug wells.

**7.5 Impact on water quality:**

The factors influencing water quality in the region are predominantly industrial effluents, domestic effluents and leachets from solid wastes. The industries, which are water intensive and contributing to the effluent discharges of the area, are East Coast Railway Industry, Crusher industries in Khurda etc.

**7.5.1. Impact on water quality due to East Coast Railway Industry:**

The wastewater discharges from the industry finds its way to the river Kuakhai through a kuchha drain, which drains into the river Kuakhai, a tributary of river Brahmani. During monsoon not only huge quantities of water flows into river Kuakhai but also water becomes turbid due to presence of suspended solids from the onset of monsoon. This nallah only carries the wastewater of East Coast Railway Industry and the volume of effluent discharged to this nallah is 2800 m³/day and domestic sewage is at the rate of 500 m³/day. The raw water requirement is about 14000 m³/day, the raw water consumption for the following usage.

<table>
<thead>
<tr>
<th></th>
<th>Recirculating Water</th>
<th>Make up Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cooling water requirement for cooling tower</td>
<td>17.550 m³/day</td>
</tr>
<tr>
<td>2</td>
<td>Cooling water requirement for power plant</td>
<td>74.400 m³/day</td>
</tr>
<tr>
<td>3</td>
<td>Process water requirement for gas washer plant</td>
<td>6.750 m³/day</td>
</tr>
<tr>
<td>4</td>
<td>Process water requirement for gas washer plant</td>
<td>5.859 m³/day</td>
</tr>
<tr>
<td>5</td>
<td>For Dorr-thickener</td>
<td>2.400 m³/day</td>
</tr>
<tr>
<td>6</td>
<td>Cooling water requirement for PCM and Well</td>
<td>2.400 m³/day</td>
</tr>
<tr>
<td>7</td>
<td>The domestic consumption for factory and colony</td>
<td>NIL</td>
</tr>
</tbody>
</table>

The water quality results of East Coast Railway Industry effluent channel and Kuakhai river water indicate that some of the water characteristics are not within the standard specified for drinking.
High environmental risk is marked for the people living nearby river Kuakhai. pH, DO at station S7 during summer season, COD and hardness in all stations for all seasons, Cd at station S7 in summer season, Pb in all seasons except monsoon, Fe and Mn in all seasons were showing high concentration and more than the permissible limits. High COD and low DO at station S7 during summer which has adverse impact on water quality on people living nearby village. WQI values were maximum during monsoon and post monsoon seasons and are not suitable for drinking in some stations of river Kuakhai.

7.5.2 Impact On Water Quality due to Fabrication Industries In Mancheswar Industrial Estate:

The main source of water supply is from River Daya. The water is required for the following purposes:

1. Industrial cooling and process 12320 m$^3$/day.
2. Domestic and miscellaneous use 240 m$^3$/day.

The industrial effluents of Fabrication Industries in Mancheswar Industrial Estate contributed a significant amount of effluent into the river Daya near village Rasulgarh. As a result the effluent in the downstream stations of the confluence contaminates Kuakhai river water. The impact of pollutants to River Daya by this industry are discussed below. The pH, TSS, alkalinity and hardness are within the levels specified for drinking water purpose as well as irrigation purpose. However, DO, TDS and TSS in most of the seasons at stations S7 are unsafe for drinking. The dissolved metals like Zn, Pb, Hg, Cd, Cr, Mn and Fe are less than the maximum permissible limit for drinking water purpose but higher than World river average. Broadly it can be summarized that the concentration of dissolved metals are not exceeding acceptable limit, however most of them are greater than the World river average.

7.5.3 Impact on water quality due to plastic industries, Mancheswar Industrial Estate

The factors influencing the water quality of river Dhanua are predominately industrial effluents of a sponge iron industry. It can be observed that the sponge iron industrial effluent in the study area ultimately find their way into river Dhanua. Discharge of industrial effluents (treated, inadequately treated or untreated) into river Dhanua has completely destroyed the pristine quality of the confluence point (station S7). River Dhanua is influenced by the effluent channel of Plastic
Industries, Mancheswar Industrial Estate. As a result, there is a sharp deterioration of river Dhanua downstream stations from the confluence point. The pH, alkalinity and total hardness of the present study are within the permissible limit. DO at station S7 and S8 in summer and S7 in post monsoon and winter are below the permissible limit indicating high organic pollution. During monsoon season the river water carrying higher values of TSS are not suitable for drinking. The TDS concentration at station S7 and S8 were beyond permissible limits in all the seasons. In most of the times electrical conductivity recorded above the EEC (European Economic Community) standard at station S7 and S8. The present study revealed that dissolved Zn, Cd, Pb, Hg and Fe are within the safe limit for drinking purpose. However, most of the above metals are much higher than World river average. The concentrations of Mn in some stations are higher than the drinking water standard prescribed by BIS, 1983.

7.5.4 Impact On Water Quality Due To Crusher Industries in Khurda.

The demand of water use by this industry is met by abstraction of ground water. This causes the depletion of ground water resources. This industry discharges industrial effluent directly to river Dhanua causing the river water unfit for further use in the downstream. Most of the water samples of river Dhanua are not suitable for drinking with respect to TDS concentration. TDS and alkalinity concentration are much higher than the Indian and World river average in most of the stations. DO concentration of confluence point of river Dhanua effluent channel and some downstream stations are below the permissible limit and not suitable for drinking purpose. The Ph, TSS, alkalinity and hardness of the river Dhanua are within the permissible limit for drinking and irrigation purpose. Dissolved metals like Zn, Hg, Cr and Pb concentration are quite less than the permissible limit for drinking water purpose as per WHO, 1984 and BIS, 1983. However in some stations of river Dhanua during summer season, Cd concentration was exceeding the maximum permissible limit. The Fe and Mn concentration in river Dhanua were quite higher than the permissible limits and showed high environmental risk for consumption of water by living organisms. As per WQI, the station S6 is characterized by very poor quality during monsoon only due to high suspended solid coming from the catchment area. Disease such as jaundice is prevalent in the area of effluent discharge of Crusher industries in Khurda. The ground water quality is also affected by discharge of liquid and solid waste onto land. The leaching of chemicals from waste dumps percolate into the soil and liquid waste discharged to land causes ground water contamination.
7.5.6 Impact On Ground Water Quality

The impacts of various industrial and mining activities can be understood from the characteristics of ground water from tube wells in the immediate vicinity, which are represented in Table 7.2. 10 different sampling stations were selected for assessing ground water quality of the study area. A number of physico-chemical parameters and presence of trace metals were analyzed in the ground water samples (Dash et al., 1992 and Patel et al., 1993). From the results of ground water analysis, it was found that trace metals viz. Zn and Mn in all the stations are within the permissible limit. The concentration of Fe in most of the samples exceed permissible limit but within the excessive limit. The concentration of all other analyzed parameters was found within the permissible limits.

7.5.7 Impact On Flora And Fauna

Flora and Fauna are important components and indicators of the ecosystem. Any impact on these get reflected on all other components of the ecosystem. The industrialization and mining coupled with urbanization will have their direct and indirect impacts on the ecology and environment, there by affecting flora and fauna of the area. The opening of new industries followed by the expansion of the existing industries and mining areas encroaching upon virgin lands and agricultural fields affect flora and fauna of the area.

**Impact on Flora**: Industrialization has adverse impacts on the flora of this area such as loss of vegetative cover. Constructions of East Coast Railway Industry at Mancheswar, Fabrication Industries in Mancheswar Industrial Estate, Plastic Industries and Crusher Industries in Khurda have adverse effects on land use and ecology due to pollution. The indirect effect of industrialization is felt by influx of population who migrated to these areas for their employment and livelihood. To accommodate and support them and their domestic needs including firewood, the vegetative areas have been encroached upon resulting in unscrupulous felling of trees, which only results in environmental degradation.

**TABLE 7.2 Ground Water Quality of the Study Area**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Stations</th>
<th>Type</th>
<th>Zn mg/l</th>
<th>Mn mg/l</th>
<th>Fe mg/l</th>
<th>pH</th>
<th>DO mg/l</th>
<th>COD mg/l</th>
<th>TSS mg/l</th>
<th>TDS mg/l</th>
<th>TH mg/l</th>
<th>Alkalinity mg/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Aiginia</td>
<td>Tube Well</td>
<td>0.392</td>
<td>0.036</td>
<td>0.358</td>
<td>7.3</td>
<td>5.9</td>
<td>27</td>
<td>29</td>
<td>108</td>
<td>78</td>
<td>64</td>
</tr>
<tr>
<td>2</td>
<td>Baramunda</td>
<td>Tube Well</td>
<td>0.214</td>
<td>0.041</td>
<td>0.439</td>
<td>7.1</td>
<td>6.3</td>
<td>24</td>
<td>36</td>
<td>142</td>
<td>93</td>
<td>89</td>
</tr>
</tbody>
</table>
The increasing number of cattle population in the Bhubaneswar-Jatani area also has their adverse effects on the flora. The increasing rearing of sheep and goats, which have been encouraged by Government Schemes have accelerated the destruction of forests. The dust and gaseous emissions from industries and iron fines from industries associated with transportation of dust in the atmosphere have their adverse effects on flora. Settlement of particulate matter on leaves of plants will affect photosynthesis. This will affect the growth of plants and results in decay of plants, which ultimately result in denudation of vegetative cover.

A study conducted to assess environmental impact of industrial pollution on plants and cattle, which indicated that there is stress on biodiversity of plants. The number of plant species thriving in areas close to industries is less than the number of species occurring in areas away from industrial influence. The construction of roads and infrastructure due to industrial activity as well as vehicular traffic has adversely affected the flora of the area.

**Impact on Fauna:** Destruction of habitat due to industrial activities is related to the destruction of fauna. The various activities in the study area have destroyed the natural vegetation; as a result most of the fauna were forced to migrate. The noise levels in the area due to constant functioning of industries have adverse impact on fauna. There are three rivers namely Kushabhadra, Kuakhai and
Dhanua along with many reservoirs, tanks and ponds in the area used to contain rich aquatic life like fish. With the advent of industrialization the aquatic life has severely affected due to discharge of industrial pollutants into the water bodies. The worst affected water body is Dhanua river which carries effluents from Crusher industries in Khurda. Due to the discharge of polluted and toxic materials to air and water, insects and aquatic animals are greatly affected. This in turn affects the birds and reptiles that are dependant on insects.

7.8 Impact on Soil and Agriculture

The impact on the soil characteristics in the study area is imminent because of the water pollution and air pollution. The base line soil characteristics of the study area have been discussed in the Table 7.4a and 7.4b. Soil characteristics were studied by sampling at five locations within the study area.

The sampling locations are $S_1$, $S_2$, $S_3$, $S_4$ and $S_5$, which were decided, based on the following criteria.

1. To determine the impact on soil characteristics due to emission from industrial activities.
2. To determine the impact due to wastewater.
3. To determine base line soil characteristics of the study area.

In the entire study area, mainly four types of soils were encountered.

1. Red and Yellow Soil
2. Laterite Soil
3. Reddish Brown Loomy Soil
4. Red Sandy Soil

Among those, the laterite soils and red sandy soils mostly occupy the hill ranges composed of iron ore while the reddish brown loomy soils are generally confined to the small enclosed valleys. The thickness of the reddish brown soil is comparatively high and varies from 0.5 to 2.5m. The soils are moderately plastic, have a granular to crumby texture. The upper part of the profile contains some amount of humus. From the soil sample analysis in the study area, it was obtained that most of the soil samples are sandy clay in texture having moderate bulk density and pore space. The water holding capacity is very low and is slightly acidic in reaction with a pH range from 6.3 to 6.8. All soil samples are low in salt content and cation exchange capacity. Organic carbon present with red sandy soil is low compared to soil samples from agricultural lands. Nitrogen and phosphorus
contents are rather low, but potassium is well within the prescribed limits. The industrial drains carrying wastewater from various sections of the plant are discharged indiscriminately, which are causing top soil contamination. The pond or lagoon constructed is inadequate to settle all the effluents of industries. So the overflow wastewater will render top soil contaminated with heavy metals like Zinc, Lead, Iron, Mangenese and Chromium. Increase in concentrations of heavy metals was observed due to industrial activity in the area. The deposition of dust and particulate matter in the surrounding area of industries affects the percolation of rainwater to the strata of the soil. This affects the soil micro-organisms. Exchange of gases between atmosphere and soil gets affected. Thus it leads to a negative impact on soil characteristics. Types, location and analysis results of soil samples are presented in Table 7.3, 7.4a and 7.4b.

*Table 7.3:* Soil Sample Locations and Types.

<table>
<thead>
<tr>
<th>Sample no.</th>
<th>Type</th>
<th>Location</th>
<th>Distance from Industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>A</td>
<td>U/S Kuakhai river near PHD Pump house</td>
<td>(2) 0.5 Km From East Coast Railway Industry</td>
</tr>
<tr>
<td>S2</td>
<td>A</td>
<td>Baramunda Area</td>
<td>(5) 2km From East Coast Railway Industry</td>
</tr>
<tr>
<td>S3</td>
<td>A</td>
<td>U/S Kuakhai River</td>
<td>(1)0.5 Km From Fabrication Industries In Mancheswar Industrial Estate</td>
</tr>
<tr>
<td>S4</td>
<td>A</td>
<td>Vani Vihar</td>
<td>(4) 1 Km From Fabrication Industries In Mancheswar Industrial Estate</td>
</tr>
<tr>
<td>S5</td>
<td>A</td>
<td>Mancheswar Industrial Estate</td>
<td>(3) 0.5 Km From Plastic Industries, Mancheswar Industrial Estate</td>
</tr>
</tbody>
</table>

A= Reddish Brown Soil

*Table 7.4a:* Soil Sample Analysis Results

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>pH</th>
<th>Total Soluble Salt</th>
<th>Sand (%)</th>
<th>Salt (%)</th>
<th>Clay (%)</th>
<th>Texture</th>
<th>Bulk Density gm/cm³</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>5.5</td>
<td>0.030</td>
<td>46.2</td>
<td>12.1</td>
<td>41.7</td>
<td>Clay</td>
<td>1.37</td>
</tr>
<tr>
<td>S2</td>
<td>5.8</td>
<td>0.075</td>
<td>50.10</td>
<td>20</td>
<td>23.90</td>
<td>Sand Clay</td>
<td>1.49</td>
</tr>
<tr>
<td>S3</td>
<td>5.7</td>
<td>0.020</td>
<td>40.2</td>
<td>11.7</td>
<td>46.4</td>
<td>Clay</td>
<td>1.30</td>
</tr>
<tr>
<td>S4</td>
<td>5.5</td>
<td>0.038</td>
<td>54.10</td>
<td>13.1</td>
<td>16.9</td>
<td>Sand Clay</td>
<td>1.46</td>
</tr>
<tr>
<td>S5</td>
<td>5.3</td>
<td>0.023</td>
<td>45.9</td>
<td>7.2</td>
<td>46.9</td>
<td>Sand Clay</td>
<td>1.28</td>
</tr>
</tbody>
</table>
### Table 7.4b: (Continued) Soil Sample Analysis Results

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Pore Space (%)</th>
<th>Water Holding (%)</th>
<th>(CEC) meq/100g</th>
<th>Exchange Cations Me/gms</th>
<th>OC (%)</th>
<th>N ppm</th>
<th>P ppm</th>
<th>K ppm</th>
<th>S ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ca&lt;sup&gt;2+&lt;/sup&gt;</td>
<td>Mg&lt;sup&gt;2+&lt;/sup&gt;</td>
<td>Na&lt;sup&gt;+&lt;/sup&gt;</td>
<td>K&lt;sup&gt;+&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S&lt;sub&gt;1&lt;/sub&gt;</td>
<td>46.1</td>
<td>36.37</td>
<td>13.2</td>
<td>3.9</td>
<td>2.9</td>
<td>0.21</td>
<td>0.61</td>
<td>0.85</td>
<td>120.1</td>
</tr>
<tr>
<td>S&lt;sub&gt;2&lt;/sub&gt;</td>
<td>36.0</td>
<td>36.0</td>
<td>18.5</td>
<td>5.92</td>
<td>2.5</td>
<td>0.36</td>
<td>0.92</td>
<td>0.35</td>
<td>125.7</td>
</tr>
<tr>
<td>S&lt;sub&gt;3&lt;/sub&gt;</td>
<td>40.5</td>
<td>36.92</td>
<td>14.2</td>
<td>3.7</td>
<td>2.7</td>
<td>0.95</td>
<td>0.25</td>
<td>0.34</td>
<td>115.8</td>
</tr>
<tr>
<td>S&lt;sub&gt;4&lt;/sub&gt;</td>
<td>37.0</td>
<td>37.0</td>
<td>12.8</td>
<td>3.9</td>
<td>2.8</td>
<td>0.18</td>
<td>0.59</td>
<td>0.25</td>
<td>118.9</td>
</tr>
<tr>
<td>S&lt;sub&gt;5&lt;/sub&gt;</td>
<td>48.9</td>
<td>32.15</td>
<td>9.7</td>
<td>2.4</td>
<td>1.7</td>
<td>0.53</td>
<td>0.97</td>
<td>0.16</td>
<td>82.0</td>
</tr>
</tbody>
</table>

CEC = Cation Exchange Capacity, OC = Organic Carbon

The study area being hilly in nature, such types of crops like wheat, maize, ragi, green gram, black
gram, horse gram, til, mustard, potato and paddy are cultivated in the area. Utilization of
contaminated water from river Kuakhai, Kushshhadra and Dhanua for agricultural purposes
subsequently increase the concentration of pollutants in the soil. But rapid growth of
industrialization in the study area has adverse impact on the agriculture as most of the agricultural
land has been converted for industrial and residential use.

#### 7.9 Impact on Socio Economic Aspects

The study area comprises of six police stations of Bhubaneswar district namely, Jatani, Baramunda,
Aiginia etc are dominated by schedule tribe (S.T) population. The area belongs to high labour force
participation i.e. 62% where female work force constitute 58%, because of agriculture does not
provide the main source of occupation. Available agriculture land is very scanty due to the presence
of extensive reserve forest area and long run mountain ranges. There are large-scale mining and
industrial activities all around the study area.

The remarkable manifestation of the culture by the inhabitants can be glimpsed through their dances
namely Mani dance, Dhruba dance and Gadi dance. Majority people of the study area live below
poverty level and the level of the poverty is linked with high level of illiteracy i.e. 59% to total
population where as percentage of female illiteracy to total illiteracy is 67%. The impact on various
aspects due to mining and industrial activities in the study area is described as follows:
Impact on Human Settlements:

The human settlement has intensified in the surrounding area because of variety of industrial activities. The increase in settlements has adverse impacts on environment as it causes degradation.

Impact on Economic Aspects:

The employment potential of the mining and industrial establishments will improve economic conditions of the families of employees directly and it will provide indirect employment for those who will be engaged in contracts, business and service-oriented activities. The improved economic levels of people will improve the sociological conditions of the area.

Due to the indiscriminate discharge of industrial waste to river Dhanua mainly by Crusher industries in Khurda, has adverse impact on economic conditions of the people depending upon farming and fishing in the area. River Dhanua carries contaminated water which is unfit for drinking and bathing for the people living in the immediate downstream of villages. When water was drawn for irrigation purposes in the area, the farmers had reported more of pest attacks and hence consequent loss of productivity. Further contaminated river water had destroyed the fishes and other aquatic life in the river.

Impact on Social Status:

As per 2009 census there are about 10.7% Schedule Tribe (ST) and 9.2% Schedule Caste (SC) population thus representing 19.9% population under weaker sections. Due to industrial activities and subsequent employment, the outlook of the tribal population has undergone a complete change. The increased employment a level in the weaker sections people has improved their economic levels which is in turn has resulted in better social status. Due to large number of industrial and academic activities in the study area, a sharp rise in population from nearby districts and states namely Bihar, Jharkhand and West Bengal have been observed. More people means more consumption of natural resources like water, land, firewood, etc., which have adverse impacts on the environment.

Impact on Literacy and Educational Facilities:

As per 2009 census, the percentage of total literacy in the study area is 52%. High literacy rate has been achieved due to migration of educated people for taking up jobs. Some industries have opened
new educational institutions in their localities for which the rate of literacy among the weaker sections has been improved. There are two government colleges; six aided and private colleges presently are running which improved the rate of literacy in the study area. Higher literacy means better social status and thereby improved life style.

**Impact on Population Growth:**

The density of population has increased due to commencement of new iron based industries and industries in the study area. The population growth in the study area has inflicted adverse impacts on environment. Increased population growth has exerted some stress on the environment in the region.

As per 2009 census, the total population in the study area is 6,09,252, which is 23% more than 1991 census. Out of the total population, the percentage of the female population is 49% i.e. 2,906,811. The proposed Steel Industry in the study area will provide further employment opportunities and increase the population growth.

**Impact on Civic Amenities:**

The transport system in the area has greatly been affected. The State Highway in the area has been damaged and unsafe. National Highway 215 has been greatly affected as a very large number of trucks nearly 15,000 per day carrying mineral ores from Jatani to Rasulgarh. The rural people in the study area lacked even basic amenities like water supply, proper health services and education facilities. Further the study area is devoid of any recreational facilities. Therefore, the construction of new roads and reconstruction of many existing roads is required immediately to facilitate the transportation system and completion of Cuttack to Mancheswar railway line which is under construction is required very soon to boost the economy of this area.

**Impact on Human Health:**

The discharge of wastewater and polluted air by industries and industries has adverse effect on human health. Air pollution has severe impact on health and can have two types of effects.

1. **Immediate Effects:**

   The symptoms are usually referable to respiratory system; even a small increase in air pollution has been shown definite increase in mortality and morbidity.
2. Delayed Effects:
The people in the study area have complained of chronic bronchitis, acute bronchitis with emphysema, asthma and long cancer due to the prolonged exposure of air pollution.

Impact on Health Care Facilities:
Rural health care facilities in the study area are very poor. People of rural and remote areas have to depend on local treatment systems. But the essential medical facilities have been concentrated in the semi urban and urban areas. District Headquarter Hospital at Bhubaneswar has essential medical facilities like facilities of ambulance, well-equipped operation theatre, separate wards for male and female in different departments etc. There are however, one sub-divisional hospital, one community health centre, two primary health centers, 6 nos. of dispensary, one ESI hospital and one central hospital exist in the study area. The population covered by each health centre is 32,497.

7.10 Impact On Land Use:
There is a substantial change in the land use pattern in the study area due to rapid increase in the mining and industrial activities. A large area, which was under agriculture and vegetal cover, has been diverted for establishment of industries, residential colonies, transportation corridors and solid waste dumps. Due to rapid urbanization in the study area, the agricultural land has also been converted for residential purposes. Details of land use of the study area are shown in Table 5.5. There are four types of land use i.e. (i) Irrigated Land, (ii) Rain Fed Land, (iii) Forest Land, (iv) Marshy Land and the area in hectare are shown below.

Table 7.5 Land use of the Study Area

<table>
<thead>
<tr>
<th>Sl.No. Block</th>
<th>Name of Block</th>
<th>Agriculture</th>
<th>Forest Land</th>
<th>Marshy Land</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Irrigated Land</td>
<td>Rainfed Land</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Jatani</td>
<td>1739</td>
<td>14281</td>
<td>11259</td>
</tr>
<tr>
<td>2</td>
<td>Khurda</td>
<td>2629</td>
<td>23730</td>
<td>8113</td>
</tr>
<tr>
<td>3</td>
<td>Bhubaneswar</td>
<td>8173</td>
<td>25668</td>
<td>3652</td>
</tr>
</tbody>
</table>