For proper understanding of the environmental status of the district, it is essential to understand the land use pattern. The details of land use in the Chittorgarh district have been given in Table 7.1 and graphical representation has been made in Figure 7.1. The basic land use/land cover classes are as under:

Table 7.1: Land use of Chittorgarh District (2010-11)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Particular</th>
<th>Area (in hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Geographical Area</td>
<td>750761</td>
</tr>
<tr>
<td>2.</td>
<td>Non Agricultural use</td>
<td>41420</td>
</tr>
<tr>
<td>3.</td>
<td>Barren and Uncultivable</td>
<td>72898</td>
</tr>
<tr>
<td>4.</td>
<td>Permanent pastures and grazing land</td>
<td>73929</td>
</tr>
<tr>
<td>5.</td>
<td>Miscellaneous trees and gardens</td>
<td>670</td>
</tr>
<tr>
<td>6.</td>
<td>Cultivable Wasteland</td>
<td>103276</td>
</tr>
<tr>
<td>7.</td>
<td>other fallow land</td>
<td>22319</td>
</tr>
<tr>
<td>8.</td>
<td>Current fallow land</td>
<td>18436</td>
</tr>
<tr>
<td>9.</td>
<td>Net sown area</td>
<td>297683</td>
</tr>
<tr>
<td>10.</td>
<td>Forest</td>
<td>120130</td>
</tr>
</tbody>
</table>

Source: District Statistical Department, Chittorgarh

1. **Forest coverage**
   Only 16 per cent of the total reporting area is under forest cover.

2. **Area under non-agriculture uses**
   This category belongs to the land put to non-agriculture uses such as residential, roads/paths, water bodies etc. The share of such land use is only about 6
per cent of the reporting areas. Across the district, this proportion varies from 3 per cent to 8 per cent.

3. **Barren and Un-cultivable Land**
   
   Broadly, this category of land is considered as Non-suitable for agriculture operation. At the district level, about 10 per cent of the total reporting is categorized as barren and un-cultural waste land. Across the sub humid southern plain, the proportion of the said category varies between about 10 to 20 per cent of reporting area.

4. **Permanent Pastures and other Grazing Lands**
   
   This is one of the most important categories of land use. The availability of permanent pasture and grazing land determines the status of livestock economy in the regions. It constituted about 10 per cent of the reporting area in Chittorgarh. In Irrigated North Western Plain, the grazing land is also found negligible. The Sub humid Southern Plain is endowed with pastures and grazing lands in one-tenth of the reporting area. Largely, it constituted about 4 to 7 per cent across the zones.

5. **Land under Misc Tree Crops and Groves**
   
   Area under fruit crop falls under this category of land use. In Chittorgarh and Rajasthan, the area under fruit crops is also negligible i.e. less than one per cent. In certain regions, area under fruit crop is absolutely missing. It can be inferred from the fact there is scope for horticulture development in the time ahead.

6. **Cultivable Waste Land**
   
   This is also one of the major categories of land use. On this land, agriculture operations are possible. It constituted a substantial proportion of the reporting area i.e. about 14 per cent. In Hyper-arid partial Irrigated Zone, land under cultivable waste in substantial proportion i.e. 40 per cent followed by sub humid southern and Irrigated North Western Plain zones with 15 and 12 per cent respectively. In rest of the zones it varies from 2 to 8 per cent.

7. **Fallow Land**
   
   There two types of fallow land as current fallow and long fallow. The land is treated as current fallow when the farmer suspended agriculture operation for one to
five years. After five suspension of agriculture operation it is treated as long fallow. At the state level estimates, there is no considerable variation in proportionate terms as in case of both types of fallows i.e. 3 and 3 per cent.

8. **Net Area Sown**

It most important category of land use pattern as considered as agriculture land. About 40 per cent of the total report area is under agriculture operation. Sub humid Southern Plain has the limited proportion of land i.e. more than one-fourth to more than one-third available of agriculture production.

Base line data collected from Agriculture Department, Chittorgarh and observed that area around the cement plants is majority distributed with following crops:

- Kharif Crops: - Bajra, Jowar, Soyabean, Moong, Cotton, Chilli etc.
- Rabi Crops: - Wheat, Sarson, Barely, Jeera, Garlic, Onion, etc.

![Figure 7.1: Land use of Chittorgarh District](image)

Source: District Statistical Department, Chittorgarh
Figure 7.2: Land Use Land Cover of Chittorgarh Region

Source: Satellite image resorcesat-2 (L4FMX), Vintage 1st Feb. 2013
7.2 Soil Constituents

Soil is dynamic in nature and is composed of minerals, organic matter, water, air and living creatures including bacteria and earthworms. It has been ever changing since its formation due to five major physical factors; the parent material, time, the climate, the organisms present and the topography. Soil management is another important factor influencing soil character.

1. Mineral

Mineral is the largest portion of soil composition composing approximately 45% to 49% of the volume. Soil minerals are composed of two major types; Primary minerals are found in sand and silt. These are those constituents that resemble their parent material and are often round or irregular in shape. On the other hand, the second type of Secondary minerals results from the weathering of the primary minerals which releases important ions and forms more stable mineral forms such as silicate clay. Since clays have larger surface area which is also important for soil chemistry, they have better water-holding capacity. The negative and neutral charges around soil minerals affect the soil’s capacity to retain important nutrients, such as cations, contributing to soils’ Cation Exchange Capacity (CEC).

2. Water

Water is the second basic component of soil after mineral making up approximately 2% to 50% of the soil volume.

3. Organic matter:

Organic matter is found in soil at levels of approximately 1% to 5% and is derived from dead plants and animals and hence is the most productive for plant growth. Additionally, it has high water-holding capacity which has the ability to enhance the growth potential of soils having poor water-holding capacity, e.g. sand. However, prolonged decomposition of organic matter makes it unavailable for plant use, leading to creation of recalcitrant carbon stores in soils.
4. **Air**

Air is another important component of soil. Because air can occupy the same spaces as water, it can make up approximately 2% to 50% of the soil volume. If soil remains waterlogged (displacement of gas by excess water), it hinders root gas exchange leading to plant death, a common concern after floods.

5. **Microorganisms**

Microorganisms are the final basic element of soils, and

### 7.3 Measurement of Soil Pollutants

1. **pH**

Precisely, soil pH or hydrogen ion concentration in water is the logarithmic reciprocal of their weights measured in grams per liter of water. In other words, pH value of soil is the measure of Acidity or Alkalinity of water and is an important indicator of its quality. It is a simple yet very important parameter for estimation of soil quality, since it influences the availability of nutrients to crops and affects the microbial population in soils. Most nutrients are available in the pH range of 5.5 to 6.5.

A pH meter is used to measure pH with the help of a glass electrode which generates a potential varying linearly with the pH of solution. The standard procedure for estimating pH is as follows:

- Calibrating the pH meter using buffer solutions.
- Weighing 10.0 gms of soil sample in a 50 or 100 ml beaker and diluting upto 20 ml with distilled water.
- The soil sample is then allowed to absorb the distilled water first without stirring, later thoroughly stirring it for 10 second with the help of a glass rod. The suspension is stirred for 30 minutes.
- The concentration of pH as seen on the calibrated pH meter is recorded.

2. **Electrical Conductivity**

The Electrical Conductivity (EC) is a measure of the ionic transport in a solution between the anode and cathode. It is a measurement of the dissolved salts in any solution and follows the Ohm’s law.
The EC of soil is done by measuring the EC of a soil solution extract from a saturated soil paste. Identifying the soil/water ratio is very important as the EC depends on the number of ions in the solution, as the ratio of the soil solution in saturated soil paste is around two-three times higher than that at field capacity. For determining EC of soil solution, a sample volume of 400-500 g of soil is required, therefore a different and simpler method is normally practiced in which 1:2 soil/water suspension is used. The method is as follows:

1. Take 40 g soil into a 250 ml Erlenmeyer flask and add 80 ml of distilled water, stopper the flask and shake on reciprocating shaker for one hour. Filter the solution using Whatman No.1 filter paper. This filtrate is ready for measurement of conductivity.

2. Wash the conductivity electrode with distilled water and rinse with standard KCl solution.

3. Pour some KCl solution into a 25 ml beaker and dip the electrode in the solution. Adjust the conductivity meter to read 1.412 mS/cm, corrected to 25°C.

4. Wash the electrode and dip it in the soil extract.

5. Record the digital display adjusted to 25°C. This concentration in mS/cm of EC is a measure of the soluble salt content in the extract, and an indication of salinity status of this soil.

The conductivity can also be expressed as mmhos/cm.

7.4 Land Degradation and Waste Disposal

Successive mining leads to significant degradation of the land. Removal of overburden is generally done by blasting and excavating. The ratio of overburden excavated to the quantity of mineral removed can be termed as the stripping ratio. For example, a stripping ratio of 5:1 means that 5 tonnes of waste rock is being removed to extract one tonne of ore. Stripping ratio depends upon the area under mining and thereby varying from mine to mine. The productivity of mine would be more if the stripping ratio is less. As per Indian Bureau of Mines, average stripping ratio for limestone mines in India is 1:1.05.
Waste generated due to overburden removal being useless for the industry, is normally stored in huge piles and dumping yard within the mine lease area. It can also be said that, larger the scale of the mine, greater is the quantum of waste generated since larger mines generate more quantity of waste in comparison to smaller mines. In addition, opencast mines produce 8 to 10 times as much waste as compared to the underground mines are therefore more polluting.

Removal of overburden leads to waste generation in huge quantity consisting mainly of soil, debris and other material and very significant loss of biodiversity and the rich top soil. Impact of mining on soil also gets reflected in land-use pattern of the respective area. In areas where soil is eroded, the surrounding water resources get damaged, soil gets toxicated, the flora and fauna is affected, air and water gets polluted and more such factors lead to cumulative effects on environment. This cycle is often termed as Land Degradation Cycle.

In cement manufacturing, solid waste include clinker production waste (composed of spoil rocks), removed from the raw materials during the raw meal preparation. Generally, the cement plants are huge in size; therefore they involve great house-keeping practices which result into generation of waste in great amount. Insulated bricks used for inner lining usually in kilns and pre-heaters are changed time-to-time leading to solid waste generation. Some waste is generated from plant maintenance (e.g., used oil and scrap metal). Other waste materials may include alkali or chloride / fluoride containing dust buildup from the kiln. Filtrate from the filter presses used in the semi-wet process is fairly alkaline and contains suspended solids.

### 7.5 Present Status

Soil samples were collected from Village-Karthana, Nimbahera, Tilakhera, Mangrol, Phalasiya, Joravar Ji Kakhera, Mungava Ka Khera and Chanderia to know soil quality in the area. The physio-chemical analysis of all the samples is shown in Table 7.2. Total eight samples were taken and analyzed as per standard methods. The pH and conductivity of soil samples are plotted in Figure 7.3.
Table 7.2: Status of Soil pollutants at Different Locations (Near Cement Plants) in Chittorgarh District

<table>
<thead>
<tr>
<th>S. No</th>
<th>Parameter</th>
<th>Sampling Location</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Karthana Village</td>
</tr>
<tr>
<td>1</td>
<td>pH (at 25°C)</td>
<td>7.64</td>
</tr>
<tr>
<td>2</td>
<td>Conductivity µMho/cm</td>
<td>220</td>
</tr>
</tbody>
</table>

Figure 7.3: Concentration of pH and Conductivity of soil (Near Cement Plants) in Chittorgarh District

7.5.1 pH

Precisely, soil pH or hydrogen ion concentration in water is the logarithmic reciprocal of their weights measured in grams per liter of water. In other words, pH value of soil is the measure of Acidity or Alkalinity of water and is an important indicator of its quality. It is a simple yet very important parameter for estimation of...
soil quality, since it influences the availability of nutrients to crops and affects the microbial population in soils. Most nutrients are available in the pH range of 5.5 to 6.5.

As per the analysis results, the concentration of pH has varied in soil samples from maximum 8.20 at Joravar Ji Ka Khera to minimum 7.62 at Mangrol (Figure 6.1). The permissible range for pH as per BIS for portable water is 6.5 to 8.5. Higher concentration of pH leads to scaling of water heating apparatus and reduction of the germicidal potential of Chloride. The concentration of pH below 6.5 mostly leads to release of toxic metals, such as Zn, Pb, Cd, Cu, etc. due to corrosion in pipes.

7.5.2 Conductivity

A measure of capacity of any substance or solution to conduct electric current is defined as Conductivity. It is a reciprocal of resistance any substance or solution.

As per the analysis results, the concentration of Conductivity varied in surface water from a maximum level of 393 µMho/cm at Joravar Ji Ka khera to a minimum level of 216 µMho/cm at Mungava Ka Khera (Figure 6.1). All the surface as well as ground water samples exceeded the permissible limit (300 µMho/cm) may be due to the presence Ionic constituents such as Bicarbonates, Chlorides, Sodium, Potassium, Magnesium and Sulphate (Peavey et al. 1986) in the water bodies which are under study. This reflects the contribution of pollutants by domestic sources.