CHAPTER – I

INTRODUCTION


**Meaning of Environment**

Environment is taken to mean all those which are physical and chemical, organic and non-organic components of the atmosphere, lithosphere and oceans. Environment is the aggregate of external conditions that influence the life of an individual or population, specifically the life of men; Environment ultimately determines the quality and survival of life. Organisms and environment are in constant change. Some changes are very rapid, others take thousands of years. The relationship between and among the physical environment (soil, water, air) and organism environment (plant and animal life) constitutes the study of ecology.

Some workers have used the term micro-environment for designating a functional environment i.e., specific environment of specific organisms.

Environmental chemistry is not a single disciplinary science but a multi-disciplinary science which encompasses many vastly different fields such as chemistry, physics, life sciences, agriculture, medical science, public health, sanitary engineering, etc.

**Types of Pollution:**

The usual practice to classify pollution is done according to the environment (air, water, soil) in which it occurs or according to the type of pollutant (lead, mercury, carbon dioxide, solid waste, noise, biocide, heat, etc.) by which pollution has been caused.
Sometimes, pollution is made to classify into two broad categories:

a) **Natural pollution**: It originates from natural processes.

b) **Artificial pollution**: It originates due to activities of man.

However, the following types of pollution have been noticed.

1. Air Pollution
2. Water pollution
3. Solid Waste Pollution
4. Land Pollution
5. Marine Pollution
6. Noise Pollution
7. Radiation Pollution
8. Thermal Pollution

According to “The Indian Environment (Protection) Act 1989”, *A pollutant has been defined as ‘any solid, liquid or gaseous substance present in such concentration as may be or tend to be injurious to environment.’*

**Environmental Segments:**

It is convenient to sub divide environmental chemistry into areas involving the chemistry of the atmosphere, hydrosphere, lithosphere and biosphere. All matter, from minerals in the outer layer of the earth’s crust to relatively stable ions in the upper reaches of the atmosphere may be classified in one of these categories.

1) **Atmosphere:**

The atmosphere refers to the protective blanket of gases which are surrounding the earth. It is able to sustain life on earth and saves
it from the hostile environment of outer space. It is able to absorb most of the cosmic rays from outer space and a major portion of the electromagnetic radiation from the sun. It is able to transmit only near ultraviolet, visible, near infrared radiation (300-2500nm) and radio waves (0.10-40μ) while filtering out tissue damaging ultraviolet radiation below about 300nm.

The atmosphere is subdivided into different regions of varying with altitudes. The simplest division is that of the lower atmosphere extending up to approximately 50 kilometers above the earth’s surface and the upper atmosphere, extending out into space.

The atmosphere plays a vital role in maintaining the heat balance of the earth by absorbing infrared radiation emitted by the sun and re-emitted from the earth.

The major components of the atmosphere include Nitrogen and Oxygen, while the minor components include Argon, Carbon Dioxide and some trace gases.

The atmosphere has been the source of oxygen (essential for life on earth) and Carbon Dioxide (essential for plant photosynthesis). It also supplies nitrogen which nitrogen-fixing bacterial and ammonia-manufacturing plants use to yield chemically bound nitrogen essential for life. Furthermore, it has been a vital carrier of water from oceans to land, as part of the hydrologic cycle.
2) **Hydrosphere:**

It refers to water in its various forms. It includes all types of water resources such as oceans, seas, rivers, lakes, streams, reservoirs, glaciers, polar ice caps and ground water (i.e., water below the earth’s surface).

About 97% of the earth’s water supply lies in the oceans, while the high salt content does not allow its use for human consumption. Nearly 2% of the water resources get locked in the polar ice caps and glaciers, while only 1% is found as fresh water (surface water-rivers, lakes, streams, and ground water) for human consumption and other uses.

The contamination of surface water takes place by pesticides and fertilizers in agricultural run-off water, human and animal wastes in sewage and industrial wastes. Water-borne diseases occurring due to sewage alone have killed millions of people in many developing countries.

3) **Lithosphere:**

It includes the outer parts of the solid earth. In general, the term refers to minerals incorporated in the earth’s crust and to the complex and variable mixture of minerals, organic matter, water and air making up soil. So far as environmental chemistry is concerned, the soil is probably the most significant part of the lithosphere.
4) **Biosphere:**

It refers to the realm of living organisms and their interactions with the environment, viz., atmosphere, hydrosphere and lithosphere. It includes living organisms and surroundings in which they can exist.

The biosphere as well as environment are influenced considerable by each other. Thus, the oxygen and carbon dioxide levels of the atmosphere are based entirely on the plant kingdom. Because of this fact, green plants alone have been more or less responsible for the accumulation of oxygen in the atmosphere, through photosynthesis and decay the original atmosphere having been devoid of oxygen.

The biological world, in general, has been intimately related to energy flows in the environment and water chemistry.

The biosphere is influenced tremendously by the chemistry of the environment and in turn exerts a powerful influence upon the chemistry of most of environment, especially the lithosphere and hydrosphere.

**Introduction to Atmosphere:**

The atmosphere refers to a protective blanket which is able to nurture life on the earth and protects it from the hostile environment of outer space. It constitutes the source of carbon dioxide for plant photosynthesis and of oxygen for respiration. It provides the nitrogen
which nitrogen-fixing bacteria and man’s ammonia manufacturing plants employ to produce chemically bound nitrogen essential for life. As a basic component of the hydrologic cycle the atmosphere transports water from the oceans to land, thereby acting as the condenser in vast solar-powered still. Unfortunately, the atmosphere also has been a dumping ground for many pollutant materials – ranging from sulfur dioxide to aerosol and Freon – a practice which causes damage to vegetation and material, shortens human life, and possibly alters the characteristics of the atmosphere itself.

The atmosphere forms an insulating blanket around the earth. Without it the temperature at the equator would rise to 180° during the day and droop as low as – 220°F at night. It burns up meteors that would bombard the surface of the earth from space. Without that atmosphere there would be no sound and no flight. There would be no conventional long-distance radio communication, for this is dependent on the electrons in the upper atmosphere. Without air there would be no lightning, no clouds, no rain, no snow, and no fire, the surface of the earth would be as bleak and sterile as the moon.

The atmosphere serves a vital protective function. It absorbs most of the cosmic rays from outer space and protects living things from their effects. It absorbs most of the electromagnetic radiation from the sun. The atmosphere has been essential in maintaining the heat balance of the earth. The atmosphere absorbs infrared radiation
emitted by the sun. It also absorbs energy reemitted from the earth in the form of infrared radiation. Therefore it serves an important heat stabilizing function and prevents the tremendous temperature extremes which occur on planets and moons lacking substantial atmospheres.

**Composition of the Atmosphere:**

The components of the atmosphere may be divided somewhat arbitrarily into major, minor and trace constituents. These components expressed for pollution-free dry air at ground level are given in Table 1.1

**Table 1.1**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Components</strong></td>
<td>Nitrogen</td>
<td>78.08</td>
</tr>
<tr>
<td></td>
<td>Oxygen</td>
<td>20.95</td>
</tr>
<tr>
<td><strong>Minor Components</strong></td>
<td>Argon</td>
<td>9.34 X 10^-1</td>
</tr>
<tr>
<td></td>
<td>Carbon dioxide</td>
<td>3.14 X 10^-2</td>
</tr>
<tr>
<td><strong>Trace Components</strong></td>
<td>Neon</td>
<td>1.818 X 10^-3</td>
</tr>
<tr>
<td></td>
<td>Helium</td>
<td>5.24 X 10^-4</td>
</tr>
<tr>
<td></td>
<td>Methane</td>
<td>2 X 10^-4</td>
</tr>
<tr>
<td></td>
<td>Krypton</td>
<td>1.14 X 10^-4</td>
</tr>
<tr>
<td></td>
<td>Hydrogen</td>
<td>2.5 X 10^-5</td>
</tr>
<tr>
<td></td>
<td>Xenon</td>
<td>5 X 10^-5</td>
</tr>
<tr>
<td></td>
<td>Sulfur dioxide</td>
<td>0 – 8.7 X 10^-1</td>
</tr>
<tr>
<td></td>
<td>Ozone</td>
<td>0 – 1 X 10^-4</td>
</tr>
<tr>
<td></td>
<td>Nitrogen dioxide</td>
<td>0 – 2 X 10^-6</td>
</tr>
<tr>
<td></td>
<td>Nitrous oxide</td>
<td>0 – 2 X 10^-6</td>
</tr>
<tr>
<td></td>
<td>Ammonia</td>
<td>0 – trace</td>
</tr>
<tr>
<td></td>
<td>Carbon monoxide</td>
<td>0 – trace</td>
</tr>
<tr>
<td></td>
<td>Iodine</td>
<td>0 – trace</td>
</tr>
</tbody>
</table>

(Components in pollution-free dry air at ground level expressed as per cent by volume.)
The characteristics of the atmosphere have been found to vary greatly, particularly with altitude. Other factors introducing variability include season, latitude, time and even solar activity. Temperatures in the atmosphere may vary from as low as 138°C to over 1700°C. Atmosphere pressure drops from 1.00 atmosphere at sea level to 3.0 \times 10^{-7} \text{ atmosphere} at 100km above sea level. Due to these variations, the chemistry of the atmosphere varies greatly with altitude. In addition to temperature differences, the mean free path of species in the atmosphere (mean distance traveled before collision with another particle) increases over many orders of magnitude with increasing altitude. A particle having a mean free path of approximately 1 \times 10^{-6} \text{ cm} at sea level is having a mean free path which is exceeds 2 \times 10^6 \text{ cm} at an altitude of 500km.

**Major Regions of the Atmosphere:**

It is possible to divide the atmosphere into a number of different regions depending upon the system of classification. The most general classification has been that of the lower atmosphere (up to approximately 50km) and the upper atmosphere.

The upper region of the atmosphere is having species appreciably different from those found in the lower region. As the lower regions are relatively homogenous in composition, one system of classification divides the atmosphere into regions called the *homo*
sphere (having little variation in composition) and the hetero sphere (having a high variation in composition).

The system most commonly used today (1975) is able to divide the atmosphere upon the basis of temperature change. In addition to the regions listed, a fifth region, the exosphere, is sometimes defined. Some of the species in the exosphere attain sufficient kinetic energy to break loose from the gravitational field of the earth and go into outer space.

The boundaries of the troposphere have been found to be influenced by a number of factors, including temperature and the nature of the underlying terrestrial surface. The troposphere has been characterized by falling temperature with increasing altitude, as the distance from the heat-radiating earth increases. In the absence of air pollution the composition of the troposphere has been somewhat homogenous. This homogeneity has been due to largely mixing by the constantly circulating air masses in the troposphere. The water content of the troposphere, however, is extremely variable due to cloud formation, precipitation, and evaporation of water from terrestrial water bodies.
Table 1.2

**Major Regions of the Atmosphere and Their Characteristics**

<table>
<thead>
<tr>
<th>Region</th>
<th>Temperature range (°C)*</th>
<th>Altitude range (km)*</th>
<th>Significant chemical species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Troposphere</td>
<td>15 to -56</td>
<td>0 to 11</td>
<td>N₂, O₂, CO₂, H₂O</td>
</tr>
<tr>
<td>Stratosphere</td>
<td>-56 to -2</td>
<td>11 to 50</td>
<td>O₃</td>
</tr>
<tr>
<td>Mesosphere</td>
<td>-2 to -92</td>
<td>50 to 85</td>
<td>O₂⁺, NO⁺</td>
</tr>
<tr>
<td>Thermosphere</td>
<td>-92 to 1200</td>
<td>85 to 500</td>
<td>O₂⁺, O⁺, NO⁺</td>
</tr>
</tbody>
</table>

*these figures are values ranging from the lowest part of the region to the highest part.

The most discussed of the long term effects has been the changing concentration of carbon dioxide. Records of carbon dioxide concentrations over the last century have revealed that there has been occurring a gradual increase from about 290 ppm before 1890 to the present value. The world’s climate is dependent on the global heat balance. It has been assumed that particulate concentrations have been increasing because of man’s activities and that this increase would have an effect of the climate particles.
GROUND WATER INFORMATION, GUNTUR DISTRICT,
ANDHRA PRADESH

DISTRICT AT A GLANCE

I GENERAL:

1. Location : North Latitudes 15°44' and 16°47'
   East Longitudes 79°10' and 80°55'
2. Geographical Area : 11,328.23 sq.km.
3. District Head Quarters : Guntur
4. Municipalities : 10
   Mandals : 57
   Villages : 729
   Towns : 11

II Population: (2001 Census)

1. District Population : 44,65,144
2. Urban Population : 12,85,760
4. Literate : 24,55,965
5. Density of Population : 394 persons/sq.km
6. Decadal Growth Rate : 8.72%
   (1991-2001)

III Population: (2011 Census)

1. District Population : 4,889,230
2. Decadal Growth Rate : 9.5%
3. Density of Population : 429 persons/sq.km
4. Literate : 3,006,999
IV CLIMATOLOGY:

1. **Average Annual Rainfall**: 889.1 mm
2. **Contribution from S.W Monsoon**: 525 mm (59%)
3. **Contribution from N.E. Monsoon**: 228 mm (26%)
4. **Mean Daily Maximum Temperature (Summer)**: 48.5 °C
5. **Mean Daily Minimum Temperature (Winter)**: 16.8 °C
6. **Relative Humidity**: Highest 80%
   : Lowest 30%
7. **Evapotranspiration**: 145mm – 350 mm
8. **Wind Speed**: 4.5 to 16.3 km/hr.

The Guntur district has been gifted with the vast surface and ground water resources. About 3.56 lakh ha area is irrigated by canals and it has a ground water recourses of 3.63 lakh ha. However the failure of rainfall over successive years since 2001 has resulted in depletion in ground water resources as well as canal water supply for irrigation. This has greatly effected the agricultural production. The supply of spurious seeds, insecticides and fertilizers has further contributed to the failure of the crops. It is reported that around 60 farmer belonging to 29 mandals have committed suicides because of great loses they have incurred in farming over the consecutive years. It is reported that majority of the effected farmers are those who were engaged in cash crops like chili, cotton and tobacco forming.
The Guntur district with a geographical area of 11,328 sq. kms falling between Latitudes 15°44' & 16°47' North. and Longitudes 79°10' & 80°55' East (Fig.-1) and having a population of 4889230 (2011 census) (2441128 males and 2448102 females) is one of the Central coastal districts of Andhra Pradesh. It comprises 57 mandals under administrative control of 3 divisions namely Narasaraopet, Guntur and Tenali. The district has 729 villages and 1036 hamlets. The annual normal rainfall received by the district is 889.1 mm. Southwest and northeast monsoon contributes 59% and 26% respectively. Mainly Krisha and Gundlakamma rivers with its important tributaries drain the district. Its important tributaries include Gundlavagu near Durgi, the Golivagu near Rentachintala, the Dandi vagu near Gurajala, the Naguleru near Korempudi, the Gadidela vagu near Piduguralla, the Edduvagu near Kovuru and both the Vite Vagu and Mada vagu near Amaravati (Vaikuntapuram).
The district has 2 major and 1 medium irrigation projects. The Nagarjunasagar Right Bank Canal Command (NSRCCA), Krishna Western Delta (KWD) Canal System and Guntur Channels Scheme.

The NSRCCA has been designed of discharging capacity of 22,000 Cusec through its two main canals with each one having a capacity of 11,000 Cusec. This project has a vast network of irrigation system spread over 5 districts. The length of the Right Main Canal is 201.6 km with an ayacut of 4.505 lakh ha. The length of the Left Main Canal is 177.6 km with an ayacut of 3.869 lakh ha. The total length of the Branch canals and Distributories is around 24,000 km. In Guntur district total irrigation potential created is around 2,74,000 ha.

The Krishna Western Delta canal system (KWDS) covers 24 mandals. It has a main canal length of 355.44 Km in total and 1,135 Km of branch canals. The head discharge at Sitanagaram Head sluice is 8000 C/S. The total registered Ayacut in Guntur district is 4,99,231 acres (2,02,038.78 ha).

The Guntur channel scheme is a Medium Irrigation Project for supply of water for Irrigation of the high level lands adjoining Krishna delta. The requirement of water for this project is drawn through Undavali vagu, which receives water from Krishna River, through an out fall sluice, on the upstream of Prakasam barrage. The head
regulator is designed to pass the full discharge of 600 cusecs. The length of Guntur channel is 47.00 km with total ayacut of 27000 acres (10927 ha).

The total area irrigated by all sources in the district is 4,30,806 ha which works out to be 23.33% of the total area of the district. Out of this about 3,56,328 ha (82.71%) is irrigated through canal network and 1.94% through lift irrigation. 14% area is irrigated through Tube wells and filter points and the rest 1.35% area is irrigated through Tanks and other sources. The major crops grown are paddy, coconut, groundnut, sugarcane, pulses, chilies, tobacco, cotton and fruit crops like Banana, Orange, Mango and other fruit varieties. About 40% of the district is underlain by hard rocks. About 35% area is occupied by alluvium and the rest 25% by soft rocks.

The geological mapping of the district was first carried out by William King and Bruce foot of Geological Survey of India (GSI). Subsequently detailed geological mapping was done by various officers of the Geological Survey of India during different field seasons. However CGWB has been carrying out different scientific studies in the district soon after its formation. Under Hydrogeological studies CGWB has covered the entire district under systematic hydrogeological investigations/studies by the year 1990 in addition to other surveys. After this, reappraisal surveys are being conducted
in the district regularly. Recently it has also conducted detailed micro level studies in the coastal mandals to map out the saline and fresh water interface.

Under its Ground Water Exploratory program CGWB has drilled several exploratory bore wells in the deltaic, coastal and other alluvial areas with a depth ranging between 200 to 600 m. Right now under its regular program CGWB is carrying out Ground Water exploration in hard rock areas of the district.

CGWB also monitors ground water regime through battery of wells located throughout the district four times every year to ascertain the changes occurring in the ground water regime due to failure of rainfall, development of ground water, water logging areas and over exploitation etc. Each year water samples are collected from these wells for chemical analysis to ascertain the changes in ground water chemical quality. There are right now 39 National Hydrograph Network Stations in the district.

In addition to the above CGWB has conducted Water Supply Investigations, Geophysical surveys, Remote Sensing Studies, Ground Water Pollution studies and Urban Hydrogeology etc. in the district.
GROUND WATER SCENARIO

Hydrogeology:

The Guntur district is underlain by various rock types of different age groups ranging from Archaean to Recent. The Archaean basement complex comprising the granite-gneisses, Schists, Khondalites, Charnockites and basic dykes of dolerites form the predominant rock types. It occupies around 1/3rd part of the district mainly in the central part of the district. These are the predominant water bearing formations in the district. These formations lack primary porosity. They developed secondary porosity through fracturing and subsequent weathering over 14 ages and become water bearing, although very much limited. The movement of ground water is controlled by the degree of interconnections of the secondary pores and voids. The depth of weathered mantle ranges from about 8 to 15m bgl and below this zone fractured rocks are known to occur down to 40.0 m bgl. The depth to water level ranges from less than a meter to 12 m bgl. Dug wells generally yield 10 to 80 or even up to 200 m³/day, depending on the location of the well. Bore wells drilled in these formations are 30 to 40m deep and generally yield 1.5 to 5 lps and sometimes even more depending upon the fractured zone encountered in the bore well. The dug wells sustain four to six hours of pumping and capable of irrigating about 0.8 to 3.0 hectares. A perennial spring, with a discharge of about 200 lpm is
located along a fault, near Bugga Melleswara temple of Papayapalem in the Bellamkonda Mandal, and it is reported that this spring is being used to irrigate 10 hectares. The fringe of the Archaeans in the central part of the district is represented by the northeastern part of the Cuddapah basin, namely Nallamalai group of Upper Cuddapahs. In a sequential order, the younger Kurnools occurring in the Cuddapahs and those in the western parts of the district are thrust over by the Cuddapahs and these in turn by the Archaean granite-gneisses. The Upper Gondwana group of sandstones and shales out crop are seen at places between Guntur and Tenali. The youngest rock types of the district appear to be of Mio-Pliocene age followed by the Alluvial deposits of recent to sub-recent age. In the Cuddapah and Karnool group of rock slaty phyllites, quartzites and lime stones the ground water occurs in the joints, bedding planes and the weathered portions. However, the quartzite do not form good aquifers in the area because of their compactness and occurrence at high relief. The ground water is developed in slaty phyllites by dug, dug-cum bore wells and few bore wells. The general depth of wells varies from 3 to 25 m bgl, with moderate to very poor yields ranging between 10 to 70 m$^3$/day. The depth to water levels range from 0.4 to over 7.0 m bgl, but in phyllites and slates it varies from 4 to 15 m bgl. The general yield of wells ranges from 20 to
80 m$^3$/day, with exceptions in the highly fractured locations.

The rocks of Upper Gondwanas occur as isolated out crops in the eastern part of the district, viz., around Mutkur, Sangam, Jagarlamudi and Kolkalur areas. The Gondwana formations are of fluviatile or lacustrine origin and also contain intercalated marine sediments, suggesting the marine transgression. The upper Gondwanas in the district are divided into three divisions, viz., the basal Budavada sandstones, which are buff coloured and of marine origin; the middle thin bedded, buff coloured and fossiliferous (plant) Vemavaram shales and the upper brown to red coloured and unfossiliferous Pavaluru sandstones. The ground water occurs under water table and confined conditions. The shales over-lying the sandstone act as the confining medium. The ground water is tapped by means of dug wells, dug-cum-bore wells and bore wells. The depth to water ranges from 2.20 to 10.60 m bgl and the depth of dug wells varies between 5.50 and 18.50 m bgl. The tube wells in the area range in depth from 40.0 to 75.0 m bgl, with yield ranges from 28 to 1300 lpm for drawdowns of 8.0 to 15.0m. The quality of ground water in these formations at places is found to be brackish other wise in general it is good for potable purposes.
The alluvial formations which are of recent to sub-recent in age were formed from the weathering of the older rocks and also as fluvial/Marine alluvial materials and residual soils. The fluvial alluvial deposits in the district are mainly restricted to the Krishna river and its stream courses. Extensive tracts of alluvium can be observed in the east and southeastern parts of the district and comprises of intercalation of clay, silt, sand, gravel, pebbles and Kankar of variable thicknesses. The thickness of alluvium varies from a few metres to over 100m. These are of deltaic origin and marked at places by shallow to about 30m thick sandy to gravelliferous palaeo/buried channels. The beach sands are combined to the areas along the sea coast with the occurrence of beach ridges and back swamps. Laterite, lateritic shingle and gravel occur in many parts of the district as superficial deposits. The thickness of the alluvium along the stream courses vary from 2 to over 10.0m bgl. Ground water is being developed in the flood plain areas of Krishna river course mostly through filter-point wells and shallow bore wells with yields ranging from 3 to over 15 lps as observed around Rayapudi and Borepalem areas of Amaravati and Thullur mandals. The depth to water level in the alluvium of fluviatile origin ranges from almost ground level to 5m bgl. The wells located in the river terraces and alluvial ridges register deep water level conditions of 7.0 to over 12.0 m bgl with poor to moderate discharges. The extensive deltaic alluvium occurring along
the eastern and southeastern parts of the district comprises alluvium of over 100 m in thickness but due to their sandy clay nature are poorly permeable and the ground water movement is rather sluggish. As a result the ground water is highly mineralized and at places it is found to be brackish. The ground water utilization for irrigation in these areas is observed to be negligible due to poor quality. The palaeo-channels, buried channels and flood plains occurring in this region, especially, in the mandals of Dugirala, Tenali, Ponnur and Repalle, are found to be potential aquifers with good quality water. The palaeo/buried channels at places are thin to about 30m thick and consist of sandy, gravelliferous formations and yield fresh water. The extent of these formations vary from a few meters to as much as 2.5 km in width and hundreds of meters to several kilometers in length. Filter-point wells and shallow tube wells are the common ground water abstraction structures in these areas. Ground water is brackish to saline at shallow depths especially in the areas bordering the coast. Only the beach ridges at shallow depths yield fresh water. In the deltaic and coastal alluvial areas, the depth to water level ranges from less than 1m to 5 m bgl. The depth of open wells ranges from 2m to 12 m bgl and the depth of shallow tube wells and filter point wells range from 10m to 27m, with yields of 25 to over 75 cu.m/hr. Hydrogeomorphology and Hydrogeology of the district are depicted in Fig. 2 & 3 respectively.
Fig 2
**Ground Water Regime Studies:**

In order to monitor the ground water regime in space and time, the Central Ground Water Board (CGWB) has been conducting Ground Water Regime Studies by the establishing and monitoring National Hydrograph Network Stations (NHNS) in the entire district. The Board so far had established 39 such hydrograph stations in various hydrogeological environments of the district which are being monitored four times in a year ie., in the months of January, May, August and November. These studies throw light on the pace of ground water development vis-a-vis recharge in different areas and the variation in the quality of ground water with time. The comparative study of the historical water levels highlight the areas extent of water logging, ground water behaviour and stage of development, over exploitation if any and fluctuations of water levels and quality changes with time and in space, effects of surface water on ground water, rainfall (Pre-and post-monsoon) recharge, chemical and other anthropogenic activities on the ground water regime. While analyzing the ground water regime in the district the data of 220 observation wells monitored by Andhra Pradesh State Ground water Department is also utilized. The State department collects water levels every month and water samples twice in a year to monitor the quality variations. The study of hydrographs of National Hydrograph Network Stations indicate the changes in the ground water scenario of each station from time to time. The data of all the
observation wells when correlated with rainfall as well as with the release and stoppage periods of canal water, there appears to be a clear relationship. There is a perceptible rise in the water levels from June/July onwards till December every year. Then the water levels fall from December onwards till May. Just after the onset of monsoon (say June) to March of the following year there is due to release of canal water in different irrigation commands in the district and between middle of March to May/June, the canal water is stopped. This is reflected in the hydrographs with a steep rise and decline. The fall in the levels of hydrographs of the district may be attributed to the cessation of canal waters, apart from the lessening effects of rainfall. Depending upon the graphical information it can be attributed to the application of canal water in the area where these wells are located however the wells located near Guntur such as Prattipadu, Chebrolu and Guntur itself indicate that the ground water is no longer being extensively used. On analysis of the chemical data of water samples of these wells it is inferred that the ground water changing with seasons.
References:


2) S.S.Dara, Text Book of Environmental Chemistry and pollution Control (1997).


