ABSTRACT

Jaipur also known as Pink City is a popular tourist place. It lies between north latitudes 26°46'30":27°02' and longitudes 75°35':75°55' covering a geographical area of 646 sq. kms. in the east central part of Rajasthan.

The area experiences rainy season during the months of June and September with an average of 65.63mm. During summers highest temperature goes upto 45°C and during winters lowest temperature is 5°C. During major part of the year the air is generally dry. The relative humidity is generally over 60%. Climate here is semiarid with high evapo-transpiration rate.

It comprises almost flat plain land with clusters of sand dunes in the south-western part and a long rocky ridge. There is no major river or canal in the area. It is mainly drained by a Nalla known as Amanishah Nalla which joins Mendha River in the south at Sanganer block outside the urban limits. There are two surface water bodies Jalmahal and Tal Katora which are small water reservoirs only.

Jaipur is an industrial area hence most of its part is covered by commercial buildings which have reduced the land area for agriculture. Soils are alluvium sand, silt, clay with some kankar. Total infiltration rate in soils is 17-18 cm/hour.
The area suffering from depletion of water levels and quality deterioration needs the water resources to be managed properly. Although recharge to groundwater is being done in the area by ponds and tanks and water harvesting schemes but there is still need of some other recharge schemes.

Calcium content in water samples (141.08 ppm at Jal Mahal) was found to be higher than drinking water standards which may have adverse effects on human health. These high values may be due to return irrigation flow and use of calcium containing rocks. Magnesium (0-286.47ppm) and sodium (17.39-600ppm) content was found within permissible limits. Higher values of potassium (0-40.76ppm) may be due to excessive use of fertilizers, weathering of potash silicate minerals, rainwater and returned irrigation flow. Sulfate content in ground water (14.41mg/l- 499.38mg/l)is also higher which may be due to sulfate minerals in sedimentary rocks and oxidation of sulfate from various soil amendments. Nitrate content in water samples of the area (642 &658 ppm) is extremely high which may cause chemical manifestations of diseases called methemoglobinemia in infants, cyanosis and damage of liver. The main sources of nitrate are leakage and seepage from sewerage system and soak pits, lacking solid waste disposal management, unlined drains, cattle excreta and excessive use of nitrate fertilizers.
Surface of the area is mostly covered by sedimentary rocks comprising of sand, silt, kankar and quartzite of recent to sub-recent age. Rocks below them are meta-sediments consisting schist and gneisses with some migmatites of Bhilwara Super Group of Archean age.

The sedimentary rocks are of Delhi Super Group and are characterized by predominant joints. The greater part of the area is covered by alluvium and wind blown sand, which form the most important aquifers. The ground water availability in the area is controlled by hydro geological situations characterized by occurrence of alluvial formations and quartzitic hard rocks.

The average yield of the wells in area varies from 40,000 liters/day in quartzitic aquifers to 96,500 liters/day in alluvial aquifers with average discharge of tube wells from 8.3 m³/day in quartzitic aquifers to 12.0 m³/day in alluvial aquifers. The value of coefficient of transmissivity ranges from 22.0 m²/day to 179 m²/day. There is over-exploitation of groundwater of the magnitude of 51.44 mcm/year in the area which may lead to drying up of aquifers within two decades.

The stage of groundwater development is 239% and the area experiences decline in water level at the tune of 0.50 meter to 1.19 meter per year. The elevation of water level varies from 430 mamsl to 3.30 mamsl. Net annual recharge by rainfall is 36.97 mcm/year and net annual ground water draft is 88.03 mcm/year which results in (-) 51.44 mcm annual ground water balance.
Fluoride contents in water samples (1.8-2.65 ppm) of the area was also found exceeding the limits which may be due to fluoride salts used in small and large scale industries, phosphate fertilizers and industrial wastes. Excessive intake of fluoride gives rise to mottled enamel of the teeth, skeletal fluorosis and sometimes osteosarosis.

SAR values plotted on U.S. salinity diagram show that water of the area lies in C₃S₄, C₄S₂, C₃S₁ and C₃S₂ classes of water and are of moderate quality. Piper trilinear diagram of the water samples suggests that water of the area is of sodium and magnesium type.

Among trace elements iron content was found (12.95 ppm) to be higher than permissible limits which may be attributed to anthropogenic sources. Copper content (0-0.17 ppm) was lower than desirable limits. Copper is an essential metal in human metabolism and hence low contents of copper is a great matter of concern. Chromium (0 mg/l to a maximum 0.082 mg/l), cobalt (0 ppm to 0.069 ppm), manganese (0-0.97 ppm), nickel (0 to 0.018 ppm) and zinc (0-1.1 ppm) are fairly distributed. Long-term exposure to cadmium in water is associated with kidney diseases as it was found to exceed the limits in some samples (0.005-0.008 ppm). Other long-term effects are lung damage and fragile bones. Mercury concentrations in water samples (0.44 ppm & 0.37 ppm) were also found to be high which may be due to seepage of industrial effluents. Intake of mercury can permanently damage brain, kidneys and developing foetus.
Lead can affect almost every organ and system in human body. Lead contents in water samples (0.004-0.2 ppm) were also found to be high.

Based on the study of all parameters in the area following management options and controlling measures have been suggested.

Sock pit system of sanitation must be abandoned as leakage from sock pits is a common phenomenon and is a major source of pollution.

A proper sewerage system for disposal of waste in the area should be planned.

Unlined drains carrying sewerage/effluents should be lined urgently.

Nitrate fertilizers like urea may furnish significant quantum of nitrate constituents. Use of these fertilizers for gardening, etc. should be discouraged.

Farm animals produce considerable amount of nitrogenous organic waste that tends to concentrate at place where large number of animals are confined. It is suggested that these dairy farms should be shifted to some other places.

Plantation not only balances microenvironment system but also is likely to reduce pollution levels. Therefore plantation and vegetation should be encouraged.

Artificial recharge schemes can be utilized for recharging groundwater as the water levels are declining rapidly in the area.
All the ground water abstraction structures including hand pumps with high nitrate and fluoride concentration should be marked so as to avoid their utility for drinking purposes.

Urban water suppliers should introduce dual water supply bringing fresh water supply schemes to the affected areas from other areas for drinking purposes.

High nitrate and fluoride waters of the affected areas can be supplied separately for other domestic purposes like washing, cleaning, bathing etc.

Alternative sources of fresh drinking water must be evaluated where water is free from pollution.

Alternative matter of chemical dye used in dyeing industries can be replaced by such dyeing matter, which should not contain fluoride.

Awareness among the public and other NGO’s about the adverse effects of chemical contaminant should be encouraged.

The public should be made aware of the importance of hygiene, the dangers of pollution, and benefits of environmental preservation.

Available technologies for the treatment of water should be evaluated and cost effective and eco-friendly technologies be adopted.