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Recent Shoreline Changes and Coastal Morphology of Gautami and Nilarevu River Mouths of Godavari River, East Coast of India & Ground Water Quality of Kakinada CIT

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Summary

The study of satellite images of 2001, 1999, 1997 and topo-sheet of 1975 indicate a widened channel of Nilarevu at its mouth and an erosional shoreline on the northern bank. The spit on the southern side has grown and added another curved spit to its distal end. The beach ridges are aligned with the curved spit. The accreted river mouth bar off Gautami till 1975, rapidly got eroded simultaneously nourishing the spit at the mouth of river Nilarevu. The change in the shoreline configuration during 1975 to 2001 is conspicuous.

A comparison of 1975 toposheet with 1997 satellite image showed a net erosion of 6.89 sq.km., with 1999 showed a net erosion of 13.7 sq.km. Image of 2001 comparison shows that an accretion of 10.28 sq.km and an erosion of 20.99 sq.km with a net erosion of 10.7 sq.km. The image of 1997 and 1999 comparison showed a net accretion of 1.1 sq.km. where as the image comparison of 1997 and 2001 showed an accretion of 6.9 sq.km., 1999 and 2001 images showed an accretion of 5.3 sq.km . A total of 10.7 sq. km of land has been eroded which the last in 25 years.

Similarly morphological features are also measured and given below: All the features estimated with reference to 1975 topo-sheet with the 2001 image.

Mangroves: Area of 18.65 sq.km of mangroves has been modified into different uses as result of natural / anthropogenic reasons.

Flood plain: An area of13.59 sq.km has been lost due to natural / anthropogenic reasons.

Tidal flats: An area of 13.75 sq.km has been lost probably due to river mouth processes / sea level changes.

Human encroachment: An area of 27.1 sq.km has been modified into aquaculture / salt pan cultivation (Fig.13).

The ground water quality of Kakinada city is presented in part II and is of alkaline and is classified as brackish type. Total hardness (TH) is indicating that waters belong to very hard category (>300 mg/l). The water is characterized by $Na^+ > Ca^{2+} > Mg^{2+} > K^+ : HCO_3^- > Cl^- > SO_4^- > NO_3^- > F^-$ *facies. Dominance of cations and anions shows that the ground water is of* $Na^+ : HCO_3^-$ *type. The relation among the chemical parameters suggests the controls by geogenic (evapotranspiration) process, water-soil, sea water incursion and water – geological formation interactions depending upon topographic conditions, residence time of water with the aquifer material and intensive and long-term infiltration of affluent discharge and seawage waste of the city that cause such variations in the local and regional hydrogeochemical processes. The Piper Trilinear diagram (1944) clearly suggested that the ground waters are initially a fresh type, subsequently modified to a mixed type and finally moved towards brackish nature. As per Stiff pattern diagrams (1951) waters of a similar quality define a distinctive shape but the waters are similar. The TDS,*

which is higher than the desirable limit (> 500 mg/l) prescribed for drinking purpose may decrease palatability and induce an unfavorable physiological reaction in the consumers.

Total hardness represents the concentration of Ca^{2+} or Mg^{2+}salts or both. This classification suggests that 81 % of may lead to the incidence of urolithiasis (WHO, 1984), anencephaly, perinatal mortality, some types of cancer and cardio-vascular disorders. Higher concentration of TH (>300 mg/l) develops scales on water heaters, boilers and cooking utensils and also increases soap consumption for washing.

38 % of the ground water samples in the area, Na^{+} is more than the prescribed limit which is risky to the patients suffering from the hypertension or heart diseases except the remaining 62 % sampled (safe area) area people. In the present area, 52 % samples have HCO_3^{-} in excess of the safe limit. The ground water has more than the tolerable limit of 250 mg/l of concentration of Cl^{-} and within the maximum permissible limits. Higher concentration of Cl^{-} in waters imparts a salty taste and for those who are not accustomed creates laxative effect.

A comparison of groundwater quality with drinking water standards shows that 28.57 % have SO_4^{-} higher than the prescribed limit of 150 mg/l, 28.57 % have higher calcium and 47.62% have higher magnesium than the prescribed limit. As SO_4^{-} with Na^{+} and Mg^{2+} exerts a cathartic action on human beings, and higher concentration of SO_4^{-} causes respiratory problems. Far excess quantity of nitrate concentrations (>45 mg/lt) are alarming and Methemoglobinemia may takes place if these waters are consumed.

Fluorine has considerable physiological significance on human life for maintaining the normal growth of bone structures. However, when less than 0.6 mg/l of F^{-} causes dental caries and when more than 1.2 mg/l, causes bone fluorosis. In the Kakinada groundwater, 95.24 % (20 samples out of 21 samples) of the samples contains less than 0.6 mg/l of F^{-} and 4.76 % (one out of 21 samples) contains more than 1.2 mg/l.

The data plotted on the US Salinity diagram (Richard, 1954), the zones suggests that the degree of risk is high in using the water for gardening / irrigation which is associated with high to very high (C3 to C4) and low (S1) to very high (S4) sodium hazard duly supported by Wilcox (195) plots. The higher concentration of TDS (> 1000 mg/l) in 38 % of the samples in the area of study may develop corrosion. Deleterious effect on metallic pipes and structures can occur in 29 % of the samples because of the effect of corrosion due to the concentration of Cl^{-} exceeding 500 mg/l where as the HCO_3^{-} may produce scale formation as it exceeds 400 mg/l in 24 % of the samples. SO_4^{-} may generate an incrustation if exceeds 100 mg/l possible in 43 % of the samples. Therefore, both these chemical reactions (incrustation and corrosion) can create adverse effects on processing, steaming and cooling units, if such waters are applied to the industrial sectors.