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Cover Page Footnote

It gives me great pleasure to thank Dr. Chava Srinivas, Professor and Head, Department of Civil Engineering, for his support and assistance during the Development of the project. We also take this the opportunity to acknowledge the contribution of all faculty members of the department for their assistance and cooperation during the development of our project. We also thank all the Non Teaching Staff of the Department who helped us in the course of the project.

Study on Coastal Area Pollution by Anthropogenic Activities Along The Krishna – Eastern Delta

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Abstract: Krishna Delta is located towards 90 km southeast of Vijayawada and 50 km to the south of Machilipatnam. Krishna Eastern delta area receives large quantities of pollution due to Seawater intrusion which directly affects coastal groundwater. Another main cause of pollution is due to excessive use of pesticides, discharging of chemicals and other anthropogenic pollutants from nearby households, aqua cultures. The quality of water is getting deteriorated due to unscientific waste disposal and unethical manmade activities. The waste disposal around the water bodies may damage the groundwater aquifers and physio-chemical properties of water. By testing the Surface waters, underground waters and comparing their properties with Drinking standards of water, we can know the extent of pollution caused in the coastal areas and suggest possible remedial measures.

Key Words: Krishna-Eastern Delta, Anthropogenic activities, physio-chemical properties, groundwater aquifers

1. INTRODUCTION

Water is important for all the known forms of Life, About 71 % of the Earth's surface is water-covered, and the oceans hold about 96.5 percent of all Earth's water. Water also exists in the air as water vapor, in rivers and lakes, in icecaps and glaciers, in the ground as soil moisture and in aquifers. Water is essential for drinking purposes, Agriculture and Industrial works. Coastal districts in Andhra Pradesh are Srikakulam, Vizianagaram, Visakhapatnam, East Godavari, West Godavari, Krishna, Guntur, Prakasham and Nellore. This study is about Krishna Eastern Delta, In coastal aquifers, the interface between groundwater and

sea water is naturally in equilibrium. However from an increase in population, to fulfill the water demands for domestic, agricultural as well industrial usages there is excessive withdrawal of groundwater, which is causing affect to hydrodynamic equilibrium between seawater and groundwater causing upward movement of seawater. Therefore, the salinity and contamination levels of these surface water bodies affects the quality of groundwater. The inland movement of seawater into the coastal aquifer is Seawater intrusion, which has been the major cause of deterioration of coastal

groundwater resources. Utilization of insecticides and pesticides in agricultural farms may indirectly be a cause for the pollution, because they might percolate to deep ground levels and make fresh water polluted.

2. ABOUT STUDY AREA

Krishna Delta is surrounded on the East by Bay of Bengal, west by Guntur and North by Eluru and South by Bay of Bengal. Krishna Delta has a total coastal length of 88 km. Krishna Eastern delta falls to the left bank of Krishna River, The levees, formed along the main river channel between Vijayawada and Avanigadda, support fresh ground water aquifers in the area. The study area includes Eastern part of Krishna District which is left side of Krishna River. The Krishna Delta is situated between $\sim 15^{\circ} 42'$ to $16^{\circ} 30'N$ and $80^{\circ} 30'$ to $81^{\circ} 15'E$ with its head at Vijayawada. About 75% of the basin is under a semi-arid climate, receiving monsoonal rainfall. The rainfall of the delta is 910mm with precipitation mainly in June through October. The surface water temperature varies 27.5° - $40^{\circ}C$. with minimum value in winter and maximum value in summer. The locations for sampling were taken based on area of spreading of intrusion as shown in figure-1

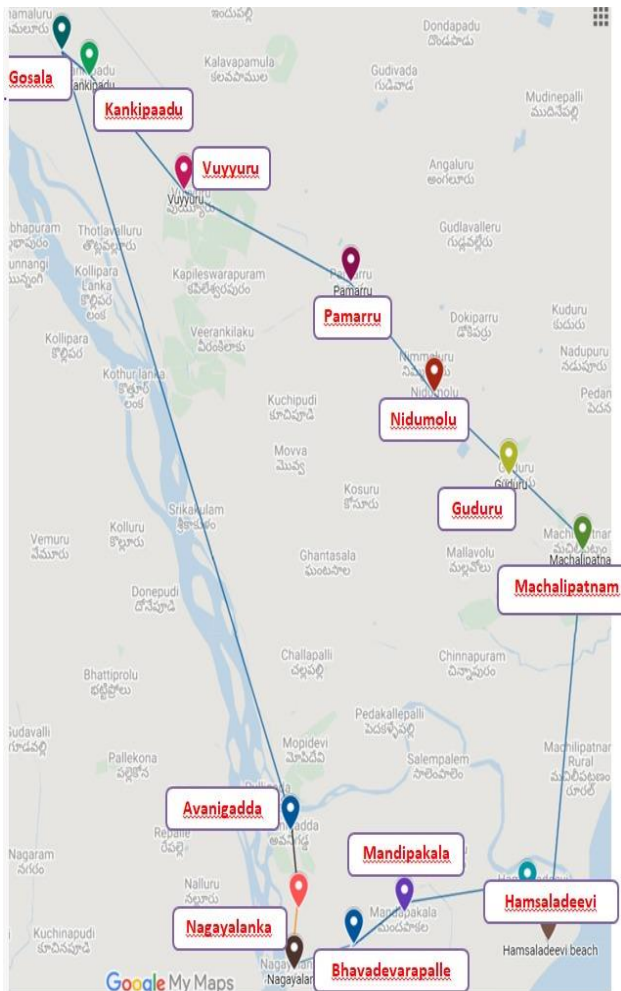


Figure-1 Study Area

SAMPLNG LOCATIONS ALONG KRISHNA EASTERN DELTA

Table-1 Locations of the Study area

1.	Hamsaladeevi village
2.	Hamsaladeevi (Near coast)
3.	Machilipatnam
4.	Mandapakala
5.	Guduru
6.	Bhavadevarapalle
7.	Nidumolu
8.	Avanigadda
9.	Nagayalanka
10.	Pamarru
11.	Vuyyuru
12.	Kankipaadu

3. LITERATURE STUDIES

[1] Kantamaneni et al., 2019.-Sea-level rise plays a significant role in deteriorating groundwater quality and agricultural land degradation. Higher sea levels will push the water table up, The salt water spread to 40 feet for every 1 foot of freshwater depression . Seawater intrusion is caused by decrease in groundwater levels or by rises in seawater levels. When you pump out fresh water rapidly, you lower the height of the freshwater in the aquifer. When fresh groundwater level drops, the intrusion can reach the pumped well, then we may get salt water out of the pump which is neither suitable for drinking nor irrigation purposes. [2] . Mahmuduzzaman et al., 2014. Other human activities such as large- scale groundwater usage for agriculture, land reclamation, unplanned shrimp culture, aqua cultures , inland saltpans, insufficient or poorly maintained infrastructure, and inadequate water management systems can encourage salinization of the coastal aquifer , Materials from the land's surface can move through the soil and end up in the groundwater. Industrial discharges, urban activities, agriculture, groundwater pumping and disposal of waste all can affect groundwater quality.

[3] Vijay et al., 2011 Groundwater quality was evaluated with drinking water standards as prescribed by Bureau of Indian Standards and Environmental Protection Agency to assess the suitability. The study revealed that groundwater quality was deteriorated due to the discharge of effluent from septic tanks, soak pits, pit latrines, discharges of domestic wastewater in leaky drains, and leachate from solid waste dumpsite. Based on observed groundwater quality, various mitigation measures were suggested to protect the water fields and further groundwater contamination in the city.

[4] Abdel-Satar et al. 2017 Water Quality Assessment of sewage discharge wastes may carry many types of compounds such as heavy metals, antimicrobial agents, inorganic, organic, biodegradable, hydrophilic, hydrophobic, non-volatile, volatile, non-toxic, and toxic compounds .

[5] Singh et al., 2017 The geochemistry of groundwater due to the impact of landfills and rainwater flow from the agricultural fields is vulnerable to non-geogenic inputs . Geochemical ratios can be used to understand the chemical processes that take place between the water and soils/rocks, as well as the water and anthropogenic activities that alter the chemical composition of groundwater.

[6] Mateo-Sagasta et al. 2017; Water pollution from agriculture The unsafe use of untreated wastewater, or polluted waters, when the conventional water resources are scarce, can cause the accumulation of pathogenic microorganisms, antibiotic resistant bacteria, antibiotic resistance genes, and toxicants in crops and livestock products.

4. PROBLEM

Water is crucial thing for drinking purpose, agricultural and industrial works which leads the whole system of life. Primary source of drinking water is ground water table although these days levels of ground water table has been reducing which gives rise to sea water levels, ascribed by human activities. When sea water levels raises salinity enters ground water. The main reasons behind the coastal area pollution are

- Fluctuation of salinity in ground water and sea water levels.
- Sea water intrusion into ground water table.
- Human activities polluting drinking water.

5. RESULTS

After tests were conducted they are compared to standard values of drinking water from BIS Standards 10500-2012.

➤ Chlorides Test

Locations	BIS Standards 10500-2012	
	Observed values (ppm)	Standard values (ppm)
Hamsaladeevi village	437.98	250 - 1000
Hamsaladeevi (Near coast)	520.57	
Machilipatnam	400.44	
Mandapakala	96.35	
Guduru	380	
Bhavadevarapalle	252.77	
Nidumolu	369	
Avanigadda	287.81	
Nagayalanka	770.84	
Pamarru	160	
Vuyyuru	148.16	
Kankipadu	126	

➤ pH Test

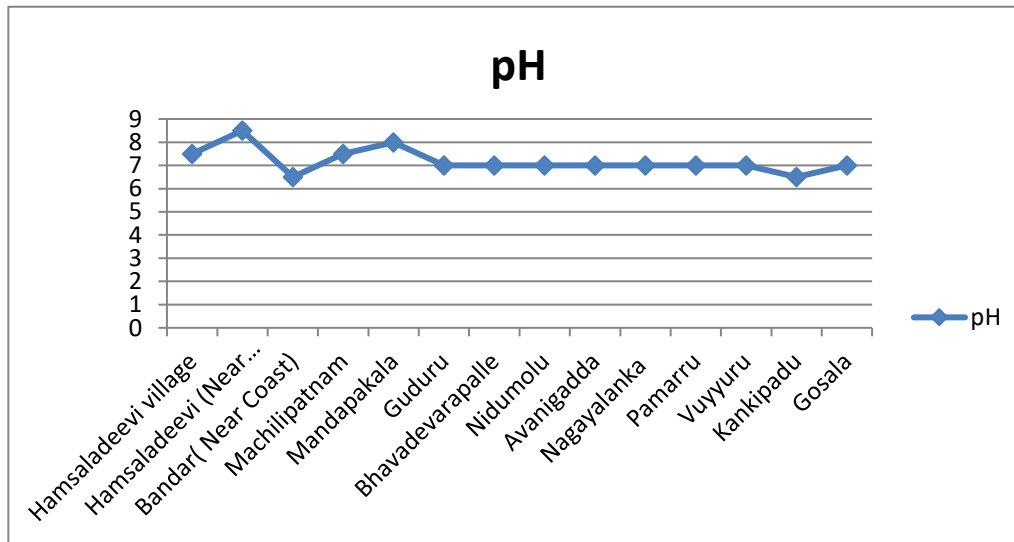
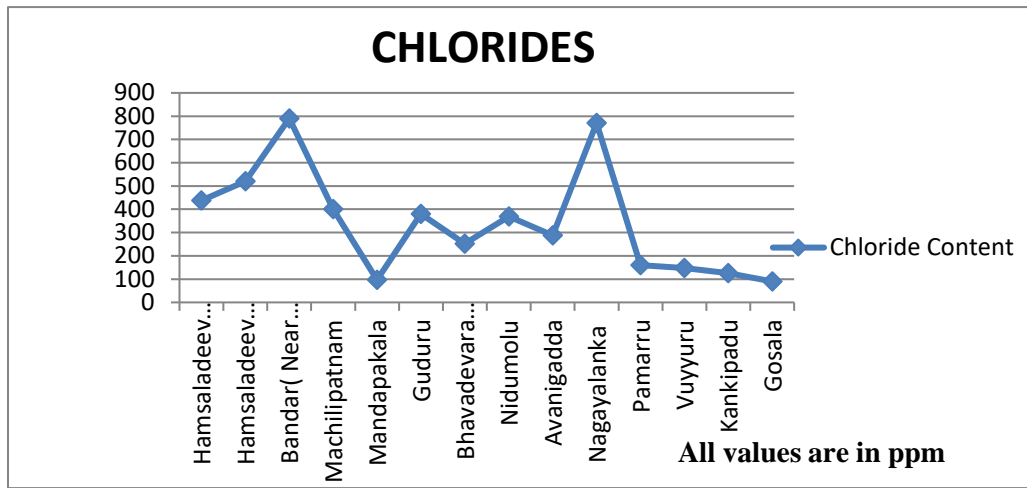
Locations	BIS Standards 10500-2012	
	Observed values	Standard values
Hamsaladeevi village	7.5	6.5 – 8.5
Hamsaladeevi (Near coast)	8.5	
Machilipatnam	7.5	
Mandapakala	8	
Guduru	7	
Bhavadevarapalle	7	
Nidumolu	7	
Avanigadda	7	
Nagayalanka	7	
Pamarru	7	
Vuyyuru	7	
Kankipadu	6.5	

➤ Alkalinity Test

Locations	BIS Standards 10500-2012	
	Observed values (ppm)	Standard values (ppm)
Hamsaladeevi village	247	200
Hamsaladeevi (Near coast)	74	
Machilipatnam	190	
Mandapakala	162	
Guduru	195	
Bhavadevarapalle	157	
Nidumolu	196	
Avanigadda	395	
Nagayalanka	87	
Pamarru	198	
Vuyyuru	200	
Kankipadu	220	

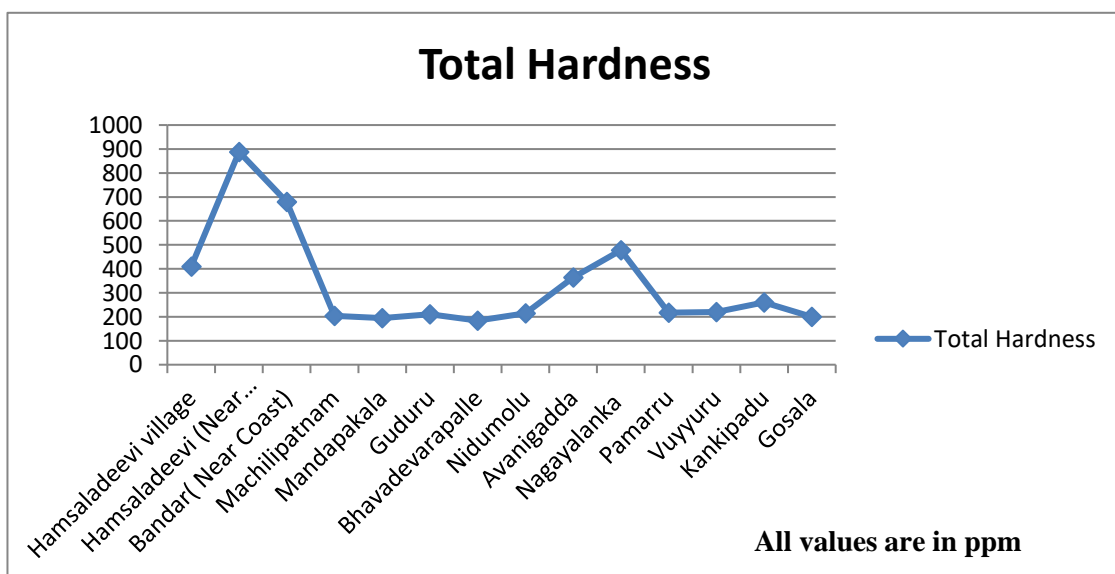
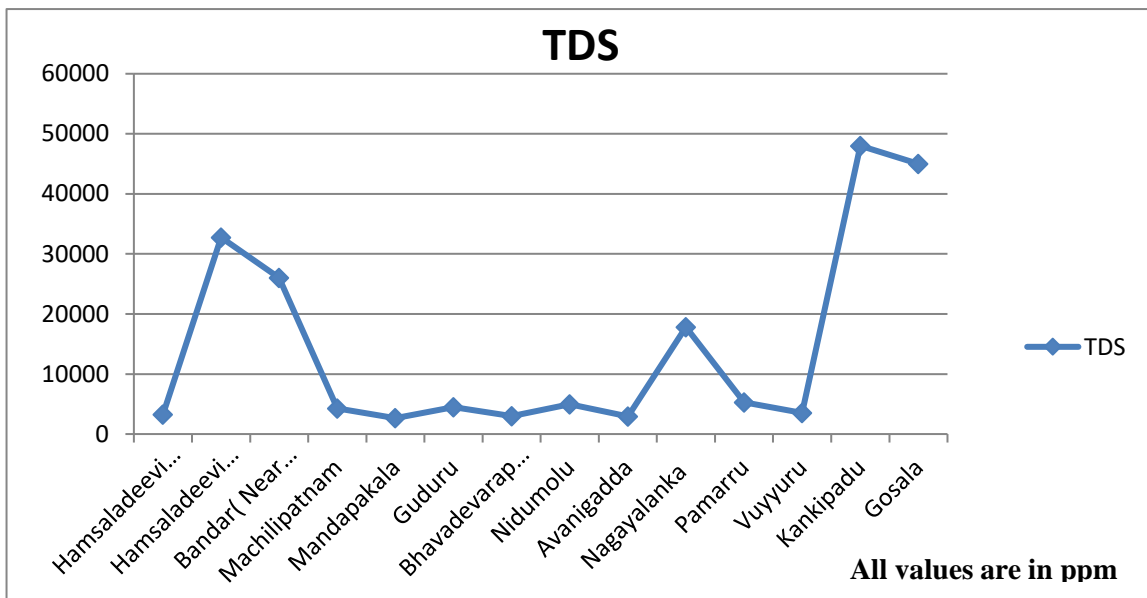
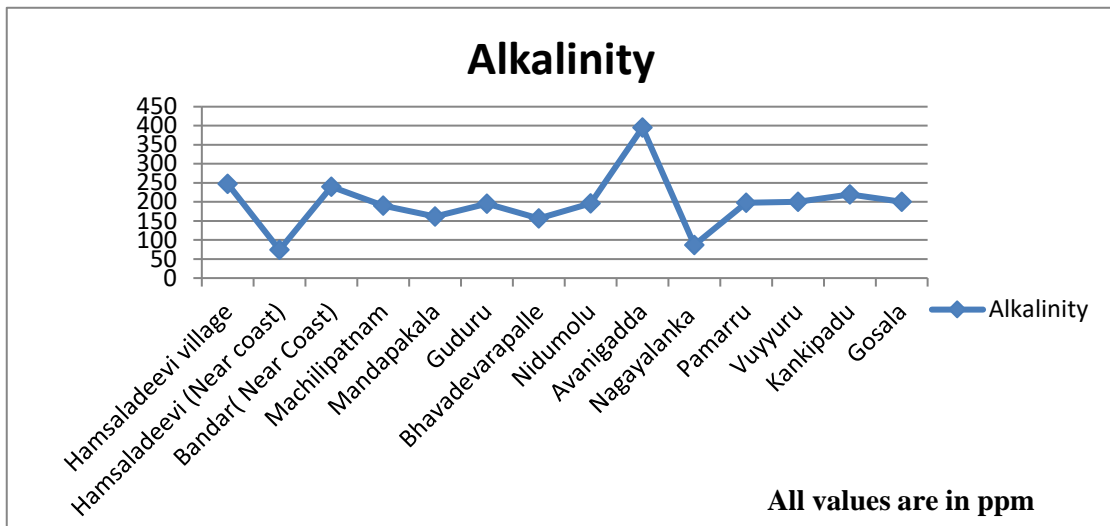
➤ Total Dissolved Solids

Locations	BIS Standards 10500-2012	
	Observed values (ppm)	Standard values (ppm)
Hamsaladeevi village	3280	500 - 2000
Hamsaladeevi (Near coast)	32720	
Machilipatnam	4280	
Mandapakala	650	
Guduru	4500	
Bhavadevarapalle	2970	
Nidumolu	4956	
Avanigadda	2920	
Nagayalanka	17830	
Pamarru	5300	
Vuyyuru	3500	
Kankipadu	48000	



Total Hardness

Locations	BIS Standards 10500-2012	
	Observed values (ppm)	Standard values (ppm)
Hamsaladeevi village	410	200 - 600
Hamsaladeevi (Near coast)	888	
Machilipatnam	204	
Mandapakala	194	
Guduru	210	
Bhavadevarapalle	184	
Nidumolu	214	
Avanigadda	364	
Nagayalanka	478	
Pamarru	217	
Vuyyuru	220	
Kankipadu	260	



6. CONCLUSION

Ground water near the coast are contaminated by sea water intrusion whereas ground water away from the coastal region are polluted due to chemicals used to treat the water, pesticides, fertilizers from agricultural run-off. In general areas surrounded by coast will have

more chlorides due to nearness of sea water. From this study we concluded that Mandapakala which is near coast area has fewer chlorides due to presence of floating fresh water pockets which is a rare scenario that occurs due to water flow that comes from long distance in confined layer.

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