

Delineating the impact of urbanization on the hydrochemistry of groundwater wells in Aba, South-east Nigeria

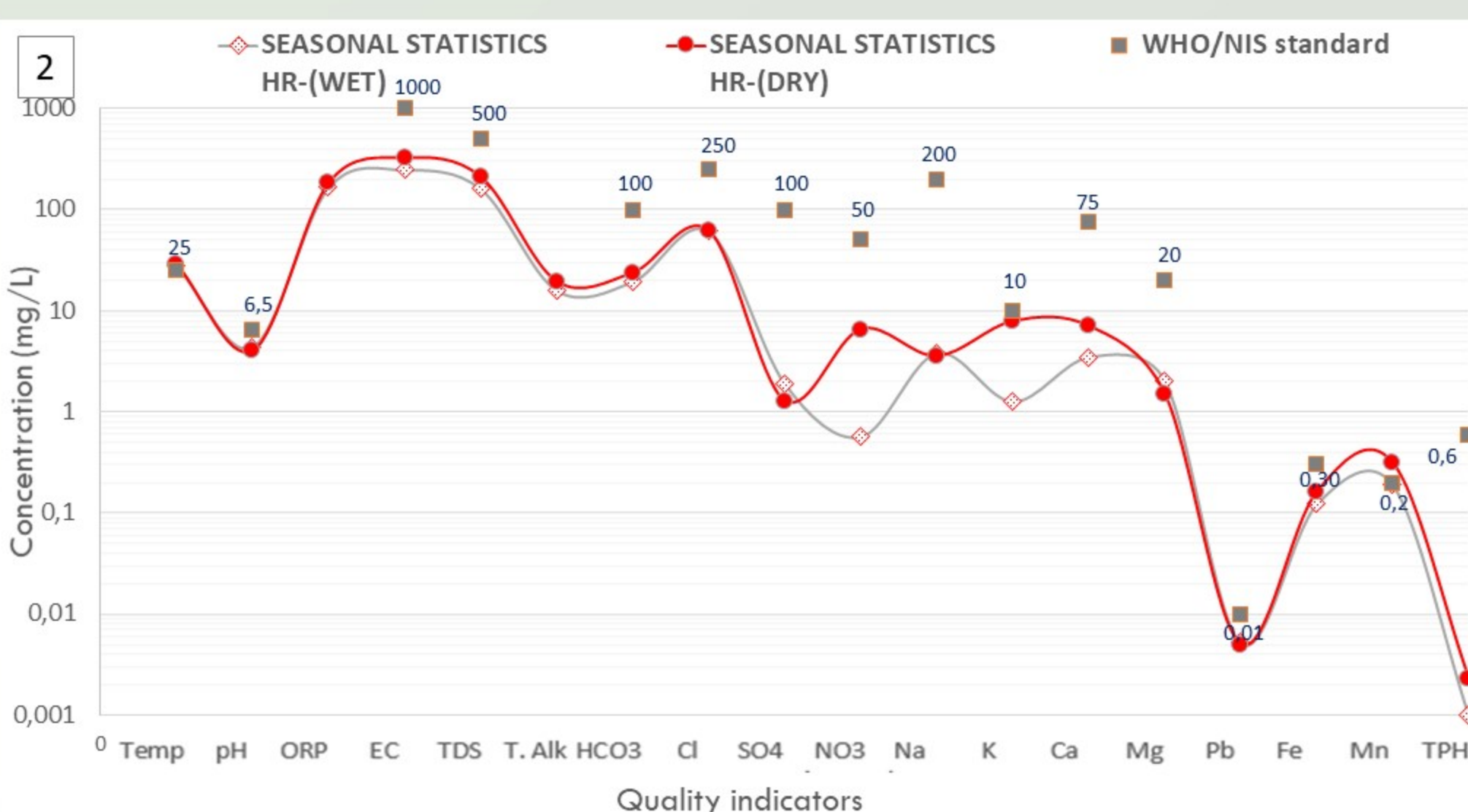
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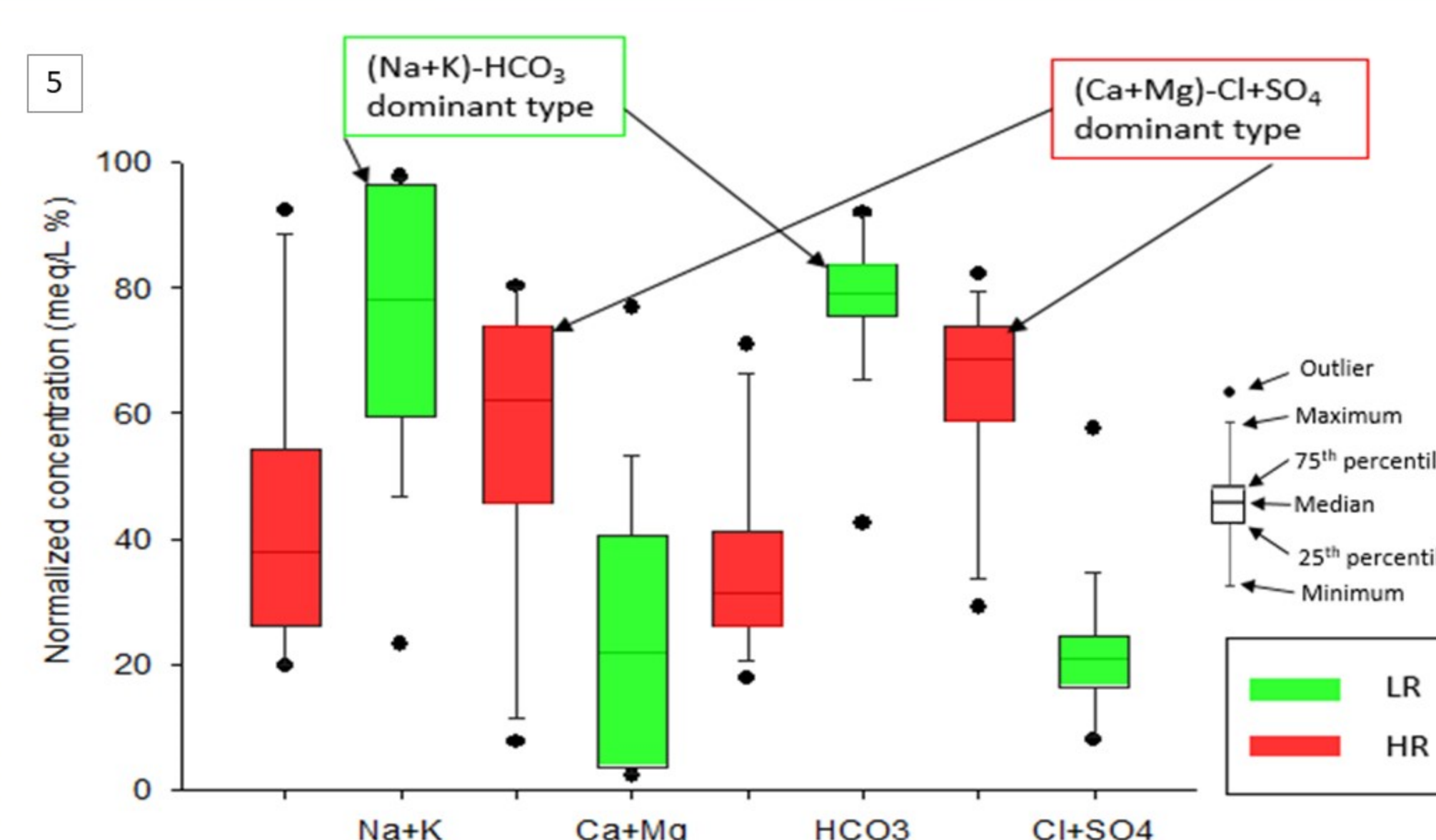
Introduction

Groundwater is an important source of point domestic water supply in many developing urban areas. However, the interaction between the groundwater and urban activities raises concerns due to the possible negative impact they might have on the groundwater quality. In this study, we evaluated some physiochemical and geochemical indicators in delineated groundwater wells in a typical commercial area of Nigeria. This approach elucidates the influence of urbanization on the quality, and hydrochemistry of groundwater wells using some proposed hydrochemical methods

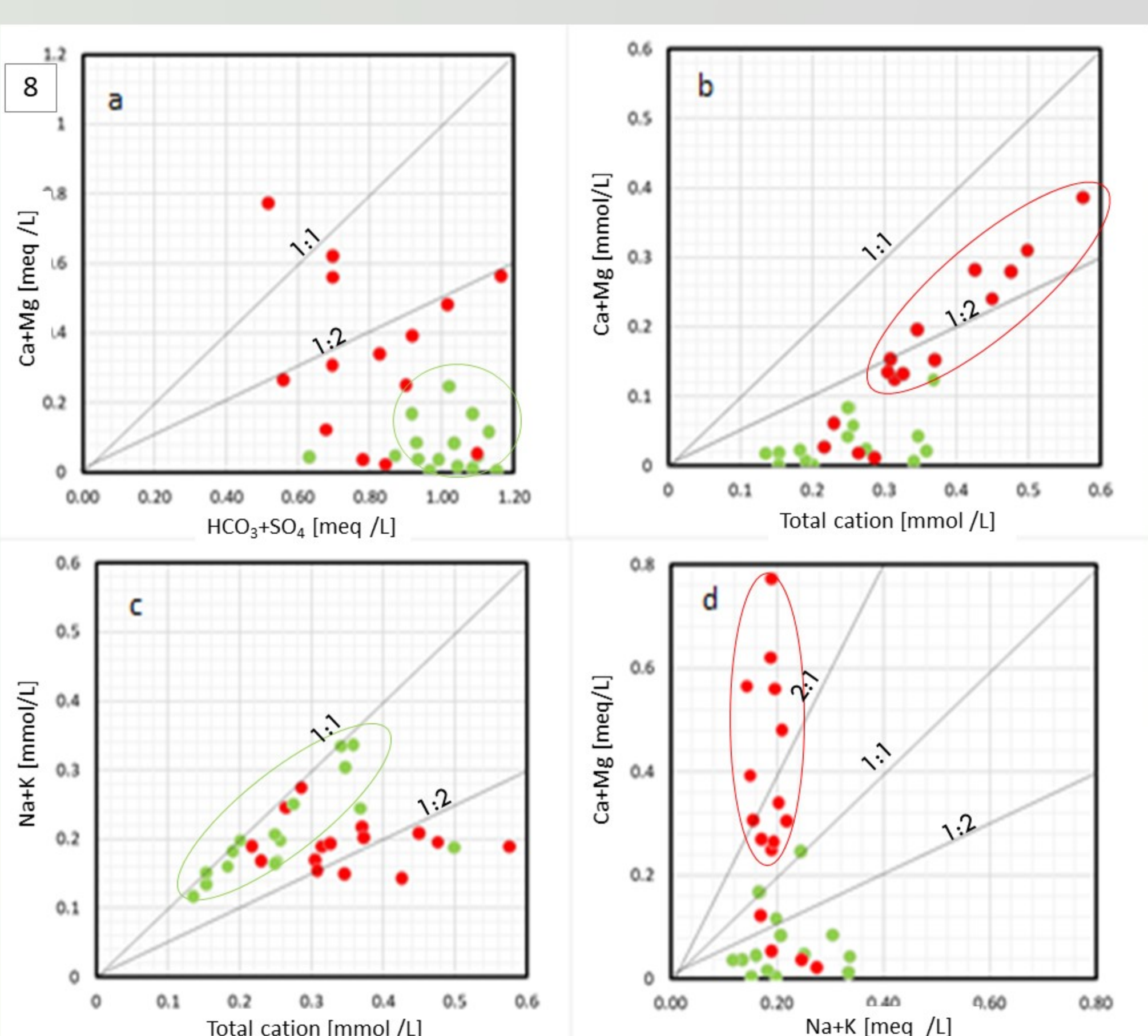
Results and discussion



The HR wells showed elevated concentrations, but generally within the WHO maximum acceptable concentrations for most indicators. However, the seasonal variation on the wells has little or no impact on the water quality

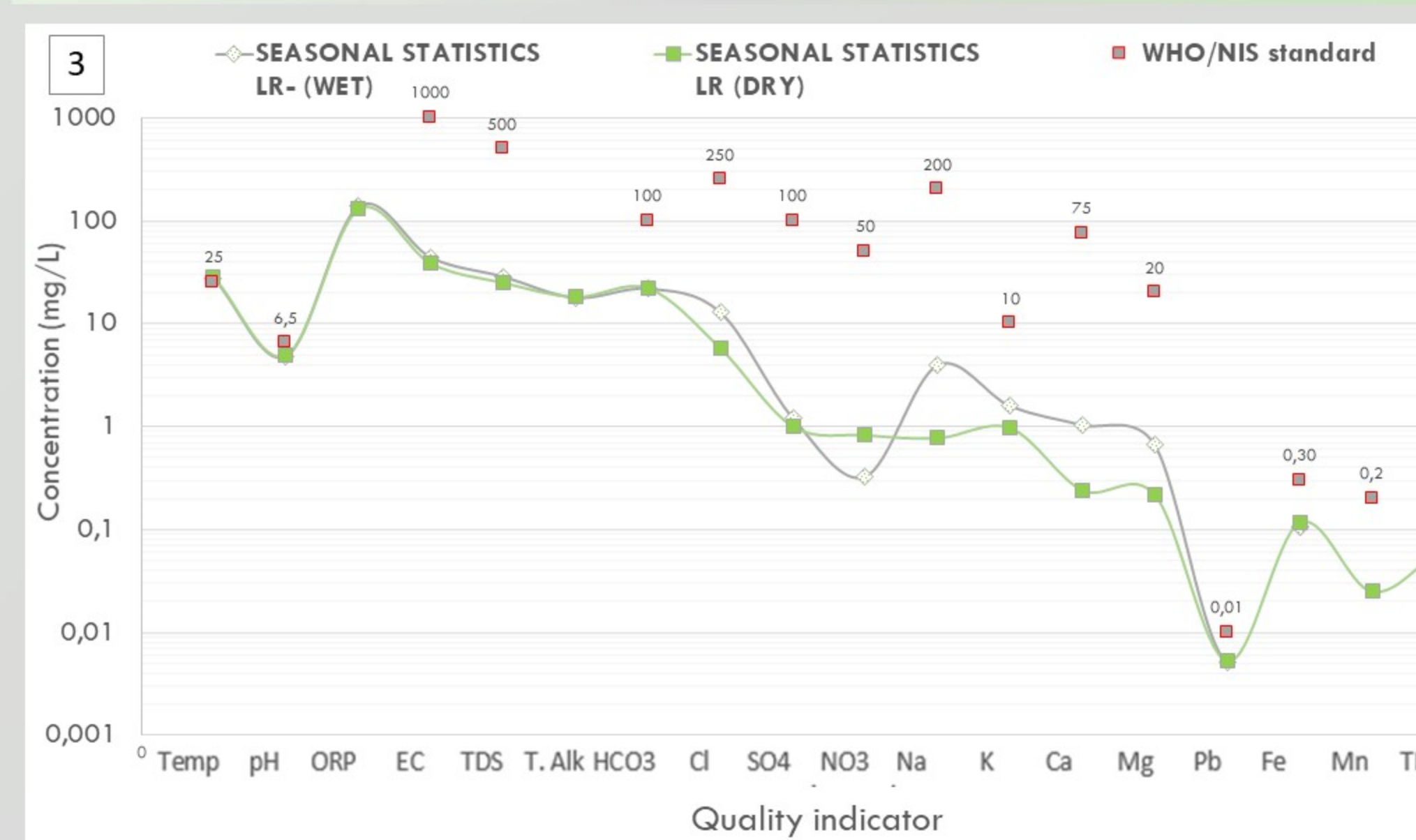
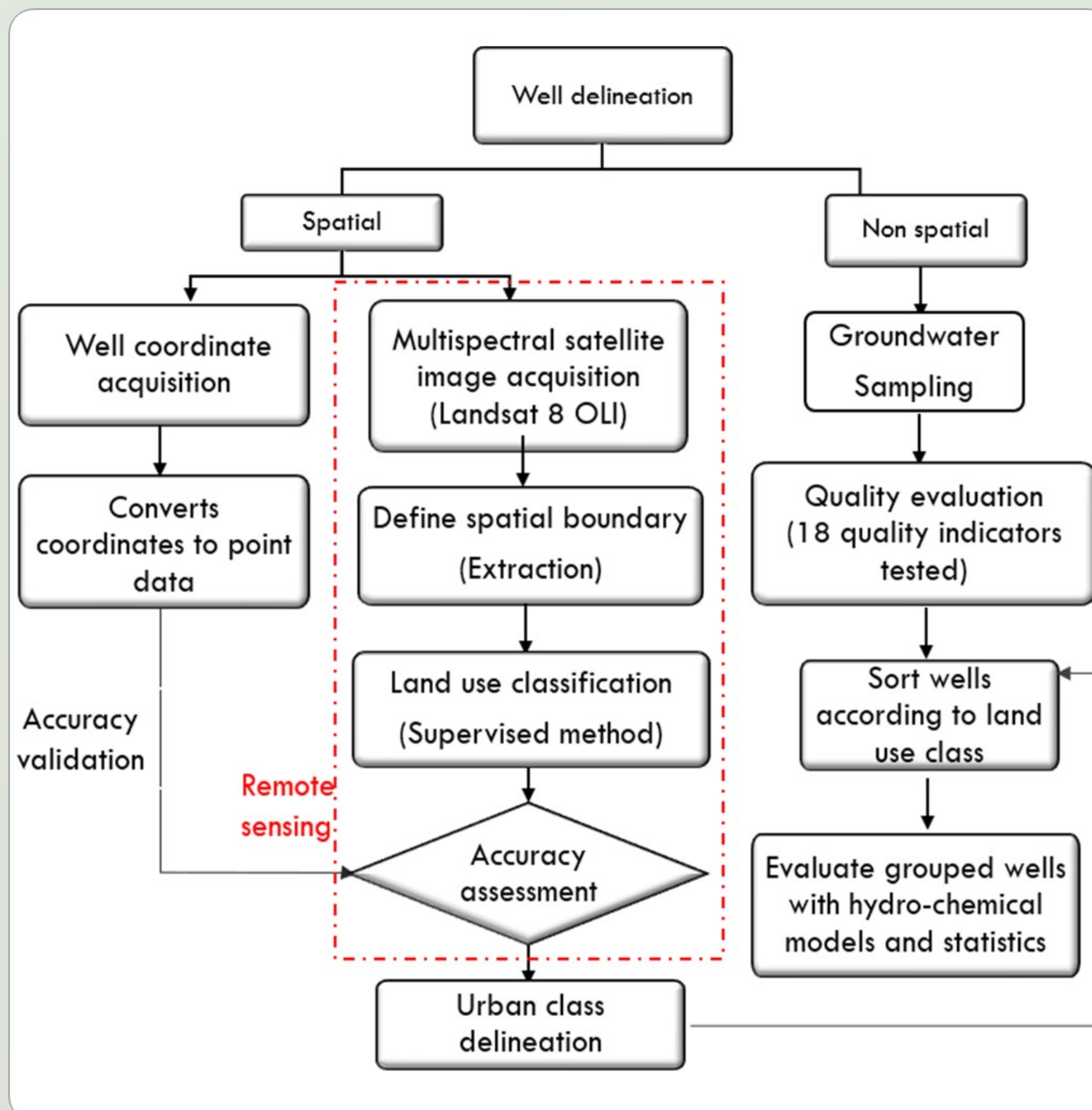


The boxplot shows the statistics of an array of the normalized equivalent weight percent concentrations of the predominant ions in the LR and HR wells. The highest median scores for the cations and ions suggest the predominant water-type in each well-group

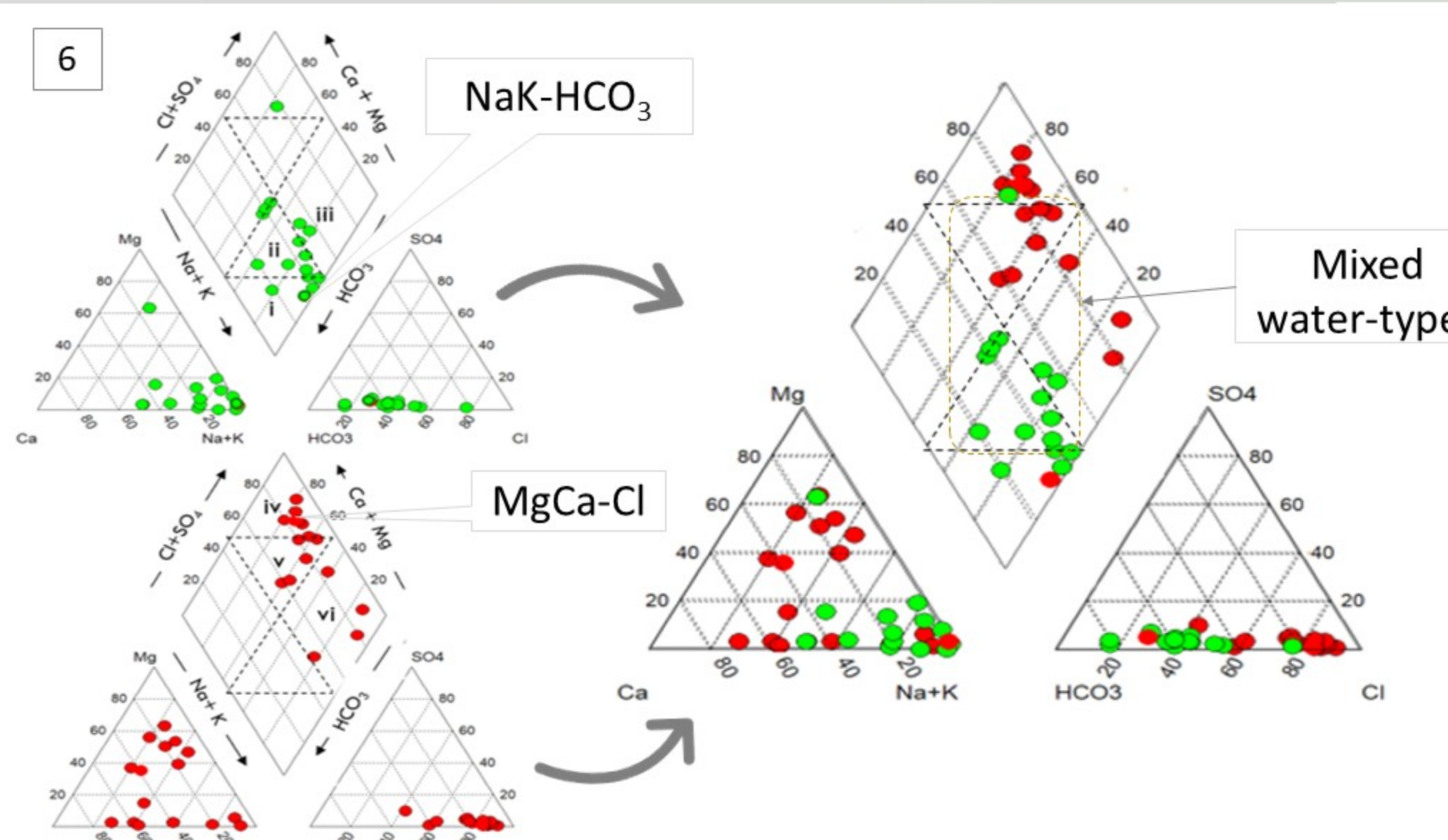


The bivariate cross-plots reveals that silicate weathering furnishes the background the major ions in the LR wells, but the change in the groundwater chemistry of the HR wells is influenced by reverse base ion exchange between the water and the surrounding

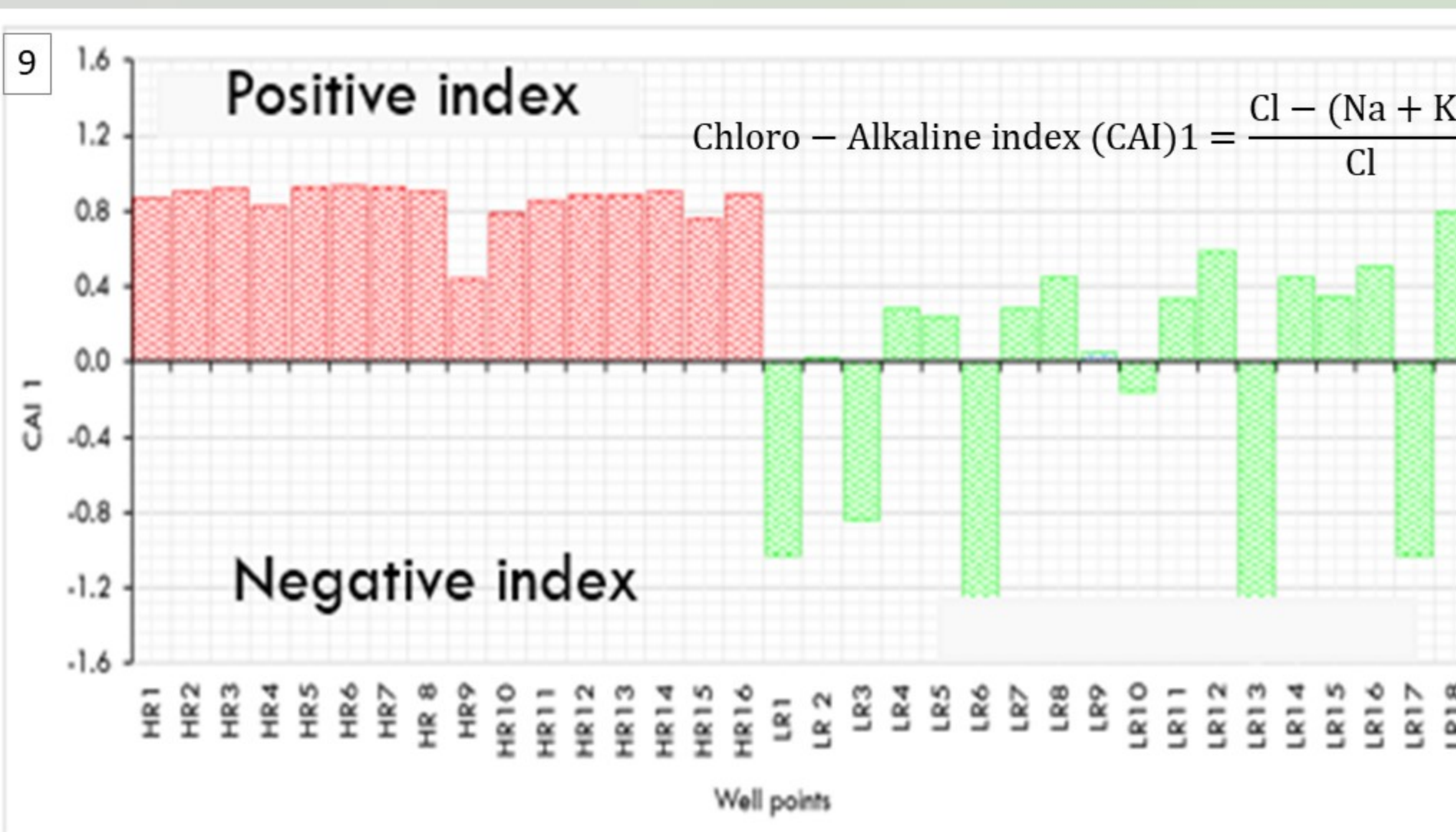
Methodological framework



Seasonal variation in the LR wells shows no significant impact on the mineralization of the groundwater wells

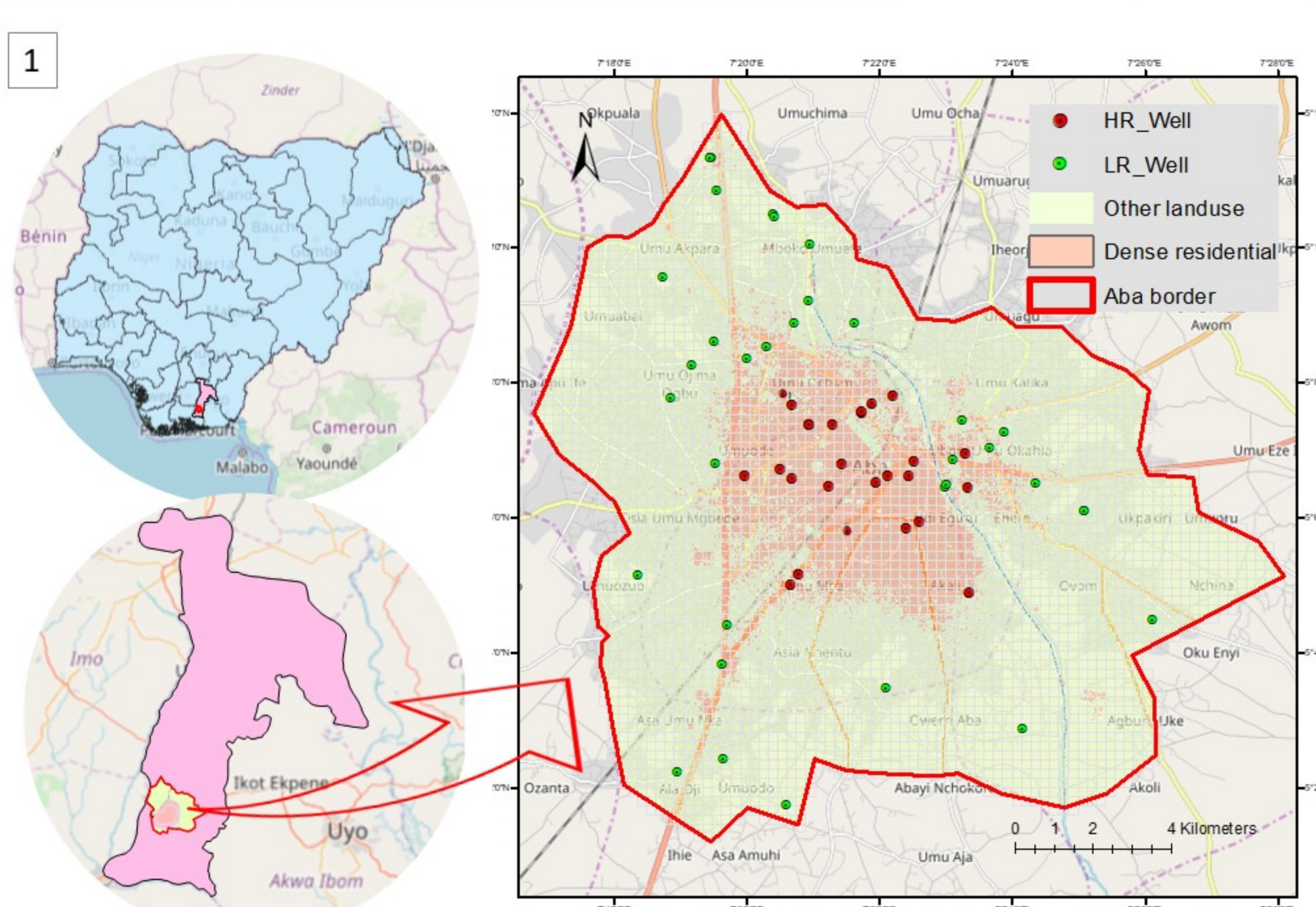


Piper diagram shows there is no dominant water type in most of the wells groundwater facies. However, the dominant water-types in the LR and HR wells reservoirs are (NaK-HCO₃) and (MgCa-Cl) respectively. The contrasting water-type in the HR wells is as a result of influence of substances from rapid construction activities and septic effluents in this area

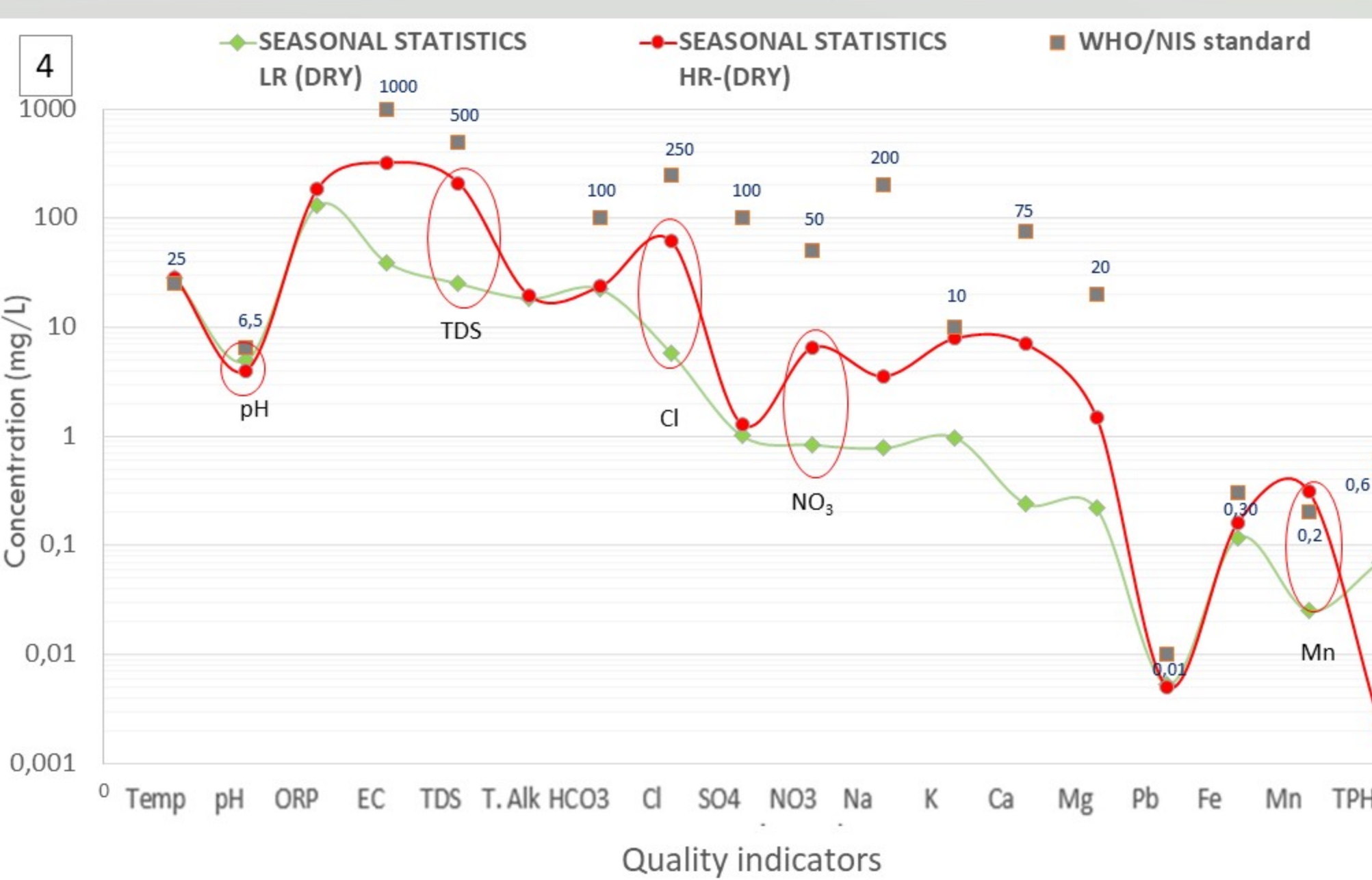


The positive index of base exchange in HR wells suggests that are reverse ion exchange controls the chemistry of the HR area. The positive and negative indices in the LR areas implies mixing effect of groundwater reservoirs from the HR to the LR area

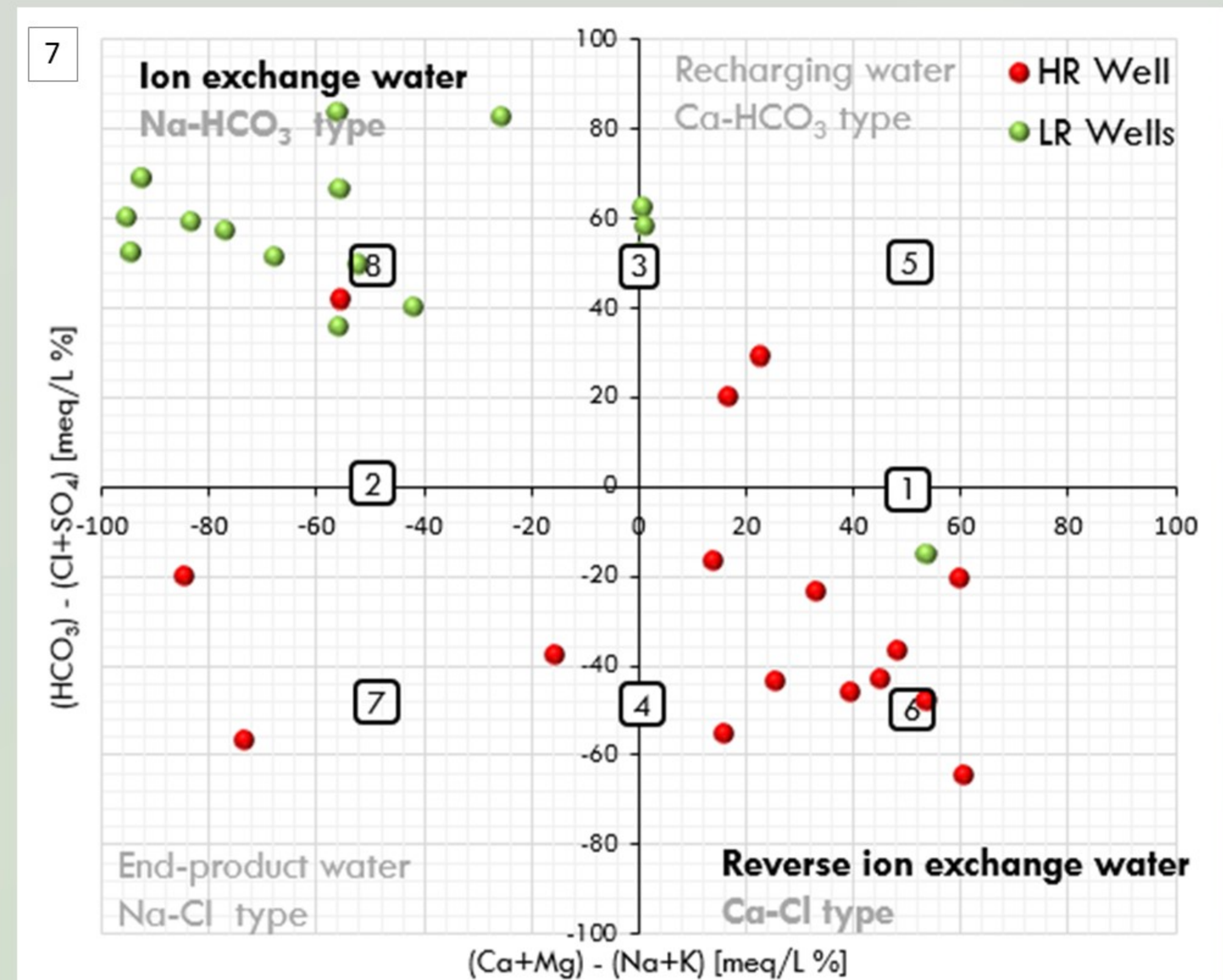
Study area



Delineated land-use map of Aba, Nigeria in 2017 showing wells in the densely residential area (HR) and wells in other land-use (LR) areas



Comparison for the spatial variation in the quality of the groundwater between the wells at the LR and HR areas. The results showed there is a rapid change for urban indicators such as pH, TDS, Cl, NO₃ and Mn



Chadha's plot reveals similar results as the Piper plot and further suggests some dominant geochemical process in each quadrant

Summary

The groundwater assessment of the wells showed that the wells are of good chemical quality, with excellent mineralization relative to the WHO's standard limits for drinking water quality. Seasonal variation has no significant impact on the wells, but the chemistry of the well-groups (LR and HR wells) showed different groundwater water-types in the area. These results are supported by the different hydrochemical evaluation methods, which revealed the influence of the urbanization on the geochemistry of the HR area. Understanding the implications of this change will require further investigation to find out the reason for such change

Acknowledgement

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