would establish a nuclear plant to use the phosphate ore deposit that it has. However, the energy that would be produce it would be use to desalinate the sea water of Aqaba gulf [2, 3, 10]. The idea is still under studying since there is still environmental conservation about the nuclear usages risks.

4) Rain water harvesting projects: these types of project covered mostly east of Jordan. Although it was used since long time but it still the quantity of water that is collected is limited. North and Middle West of Jordan receive the highest amount of rainfall up 500 mm/yr therefore this region would be the optimized region for water harvesting. However, currently most of the water harvesting are in the east of Jordan where is the minimum amount of rainfall [14] which we think that the government of Jordan has to rethink about that.

According to the previous water resources projects Jordan could be divided into 4 water resources zones that are presented in Figure 7. However, this map is preliminary and has to be improved according to the dynamic results of the sustainable water resources management in Jordan [14-16].

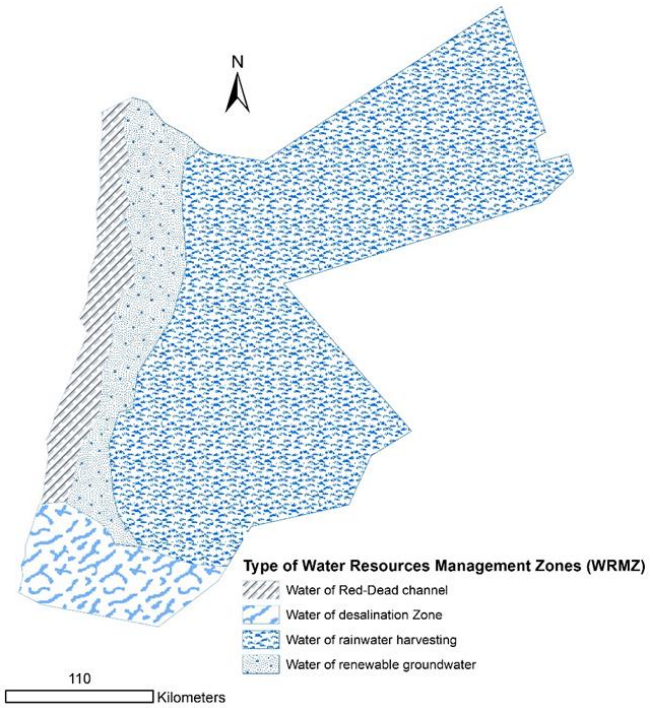

Figure 7. A suggested water resources plan for Jordan

5. CONCLUSIONS

Jordan carried out integrated sustainable projects for water resource management in order to face the water demands of increased native population and migrated refugees. The water demand in Jordan is increased because of the rapid urban development too especially in city of Amman, Zarqa and Irbid. However, Jordan still need to extend other water projects that would help to have sustainable water resources management such as: water harvesting, cloud seeding, Dams construction and River restoration. However, GIS is an optimized tool for spatial analysis in order to generate water management zones.

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REFERENCES

[1] AL-Eisawi, D. (1996). Vegetation of Jordan. UNESCO, Cairo Office, pp. 29-43.

[2] Department of Statistics. (2016). Statistical Yearbook. Jordan, 200 p.

[3] Salameh, E., Bannayan, H. (1993). Water Resources of Jordan-Present Status and Future Potentials. Friedrich Ebert Stiftung, Amman.

[4] Odeh, T., Boulad, N., Abed, O., Abu Yahya, A., Khries, N., Abu-Jaber, N. (2017). The influence of Geology on landscape typology in Jordan: Theoretical understanding and planning implications. https://doi.org/10.3390/land6030051

[5] Winter, T.C. (2001). The concept of hydrologic landscapes. Journal of the American Water Resources Association, 37(2): 335-349. https://doi.org/10.1111/j.1752-1688.2001.tb00973.x

[6] Food and Agriculture Organization of the United Nations (FAO). (2011). The State of the World's Land and Water Resources for Food and Agriculture. Earthscan 711 Third Avenue, NY 10017, New York.

[7] Alley, W.M., Reilly, T.E., Franke, O.L. (1999). Sustainability of Ground-Water Resources. U.S. Geological Survey Circular 1186, p. 79.

[8] Jaiswal, RK., Mukherjee, S., Krishnamurthy, J., Saxena, R. (2003). Role of remote sensing and GIS techniques for generation of groundwater prospect zones towards rural development—an approach. Int. J. Remote Sens., 24(5): 993-1008. https://doi.org/10.1080/01431160210144543

[9] Berndtsson, R., Larson, M. (1987). Spatial variability of infiltration in a semi-arid environment. J. Hy-drol., 90: 117-133. https://doi.org/10.1016/0022-1694(87)90175-2

[10] Changnon, S.A., Huff, F.A., Hsu, C.F. (1988). Relations between precipitation and shallow ground-water in Illinois. Journal of Climate, 1: 1239-1250. https://doi.org/10.1175/1520-0442(1988)

[11] De Vries, J.J., Simmers, I. (2002). Groundwater recharge: An overview of processes and challenges. Hydrogeology Journal, 10: 5-17. https://doi.org/10.1007/s10040-001-0171-7

[12] Ministry of Water Resources and Irrigation in Jordan 2019. Open Online Data File.

[13] Margane, A. (2015). Updating the Groundwater Contour Map of the A7/B2 Aquifer in North Jordan. Technical Report BGR.

[14] Ministry of Agriculture, Jordan. (1994). National Soil Map and Land Use Project – The Soils of Jordan, Level 2: Semi-detailed Studies, vol. 2. Main Report, Ministry of Agriculture, Jordan.

[15] Odeh, T., Rödiger, T., Geyer, S., Schirmer, M. (2014). Hydrological modelling of a heterogeneous catchment using an integrated approach of remote sensing, a geographic information system and hydrologic response units: The case study of Wadi Zerka Ma'in catchment area, north east of the Dead Sea. Environ Earth Sci. https://doi.org/10.1007/s12665-014-3627-5

[16] Scheffran, J., Brauch, H.G. (2014). Conflicts and security risks of climate change in the Mediterranean region, in The Mediterranean Sea, edited, pp. 625-640, Springer. https://doi.org/10.1007/978-94-007-6704-1_39