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The Development of Water Quality Monitoring System(WQMS) to Preserve Clean Groundwater in Rural Area

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ABSTRACT

Groundwater has been used as a source of drinking water in the rural provinces where has no public water supply and sewage system. It becomes one of the major nation's clean water resources when the surface water has confronted with contamination. Groundwater is not the infinite resources of the clean water. It is one of mid-term in the hydrological cycle which is originated from evaporation in the ocean and moving through the rainfall and surface runoff or rainfall infiltration into the subsurface aquifer, and finally it will return to the ocean. Therefore if we do not abstract less than permissible amounts of groundwater and do not preserve its quality from contamination sources, our future generation will meet the severe water deficit.

The Ministry of Agriculture in Korea has developed a new groundwater managing system recently to preserve groundwater properly in quantity and quality. The new system has change the data managing system from previous spreadsheet to new GIS mapping system.

This study was proposed by the Ministry of Agriculture in Korea to upgrade new groundwater managing system. The various analyzing tools were developed through this study for water quantity and quality data like groundwater recharge model, delineating groundwater contaminated and conservative areas, active monitoring system and sea water intrusion model etc. Optimum abstraction rate would be estimated by proper groundwater monitoring and analyzing system based on regional aquifer system analysis under the environmentally sustainable restriction. Those analyzing tools developed by this study would be added to the new groundwater managing system and

make it possible to improve its function. The officer in the regional government even who is not a groundwater expert can be easily delineate groundwater conservative area and also easily find the proper location for newly proposed well and the proper site for new contamination such as landfill.

Following four sub-objectives were established and have developed to fulfill the main aim ; Analyzing tool for the present groundwater contamination in rural area, Expert decision tools for delineating groundwater preservation area and finding proper location for the new well site, Optimum water supply management considering both surface-groundwater body and controlling water quality in the rural area, Developing groundwater quality monitoring system in rural area.

Using GIS tools, spatial data such as well locations, contaminated site, groundwater flow directions, aquifer characteristics, distribution of the soil and geology and so on are drawn by vector data (point, line, polygon) and their attributes such as groundwater level, water quality, conductivity of aquifer are described by raster data(grid and database) on the same base map. The newly developed groundwater quality analyzing system is more powerful than data base system which calculates and analyzes spatial and raster data and gives useful output to delineating preservation area and contaminated area. In this study, we use ARC GIS(ver. 8.12) and develop the 'Water Quality Monitoring System to Preserve Clean Groundwater In Rural Area'(WQMS). The WQMS requires widely distributed data and continuous monitoring data accumulation to get more confidential output such as groundwater recharge rate, recharging area, aquifer conductivity, specific yield, permeability of vadose zone, soil properties, mechanism of nitrate moving, manure adsorption, seawater intrusion in shore, etc.

The surface area can be identified into 4 groups by WQMS, 'clean area', 'surveillance area', 'usable area', and 'polluted area'. Since the groundwater managing system developed by this study was based on internet, it is possible that everyone who is interested in the groundwater can be reached freely to the output data file. The output file shows groundwater contaminated area and conservative area. The more detail reports and data are offered in the Online. The amount of future groundwater development and the proper location for new contamination sites and so on. Every tools have developed by this study would be add and apply for new groundwater managing program implemented by the Ministry of Agriculture in Korea.

Key words: WQMS, expert decision, optimum water supply management, GIS, groundwater conservative area