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Analytical Solution -- 3.2.2. Discussion of the Analytical Solutions -- SUMMARY AND CONCLUSIONS -- APPENDIX A -- APPENDIX B -- ACKNOWLEDGEMENTS -- REFERENCES -- INDEX.

Sommario/riassunto

Most large urban centres lie in coastal regions, which are home to about 25% of the world's population. The current coastal urban population of 200 million is projected to almost double in the next 20 to 30 years. This expanding human presence has dramatically changed the coastal natural environment. To meet the growing demand for more housing and other land uses, land has been reclaimed from the sea in coastal areas in many countries, including China, Britain, Korea, Japan, Malaysia, Saudi Arabia, Italy, the Netherlands, and the United States. Coastal areas are often the ultimate discharge zones of regional ground water flow systems. The direct impact of land reclamation on coastal engineering, environment and marine ecology is well recognised and widely studied. However, it has not been well recognised that reclamation may change the regional groundwater regime, including groundwater level, interface between seawater and fresh groundwater, and submarine groundwater discharge to the coast. This book first reviews the state of the art of the recent studies on the impact of coastal land reclamation on ground water level and the seawater interface. Steady-state analytical solutions based on Dupuit and Ghyben-Herzberg assumptions have been derived to describe the modification of water level and movement of the interface between fresh groundwater and saltwater in coastal hillside or island situations. These solutions show that land reclamation increases water level in the original aquifer and pushes the saltwater interface to move towards the sea. In the island situation, the water divide moves towards the reclaimed side, and ground water discharge to the sea on both sides of the island increases. After reclamation, the water resource is increased because both recharge and the size of aquifer are increased. This book then derives new analytical solutions to estimate groundwater travel time before and after reclamation. Hypothetical examples are used to examine the changes of groundwater travel time in response to land reclamation. After reclamation, groundwater flow in the original aquifer tends to be slower and the travel time of the groundwater from any position in the original aquifer to the sea becomes longer for the situation of coastal hillside. For the situation of an island, the water will flow faster on the unreclaimed side, but more slowly on the reclaimed side. The impact of reclamation on groundwater travel time on the reclaimed side is much more significant than that on the unreclaimed side. The degree of the modifications of the groundwater travel time mainly depends on the scale of land reclamation and the hydraulic conductivity of the fill materials.