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Costs of Land Subsidence Due to Groundwater Withdrawal

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In recent years the area around Houston and Baytown, Texas, has been affected to an increasing degree by land subsidence. Sinking of the land surface has reached critical proportions in many areas, and subsidence of as much as eight feet has occurred. The severity of this phenomenon has been aggravated by the proximity of much of the affected area to bay waters, and tidal flooding has resulted in significant damages and property loss.

Subsidence has been linked by engineers to the decline of subsurface water levels due to heavy ground water withdrawals in the area. An alternative source for water demands has been introduced, although price differentials have slowed its acceptance.

Major objectives of this study included estimation of historical costs attributable to subsidence, projecting estimated costs, and examining the economics of the two

alternatives for water supply. A study area of 300 square miles was identified and sampling of residences, businesses, and public officials was carried out. The cost data resulting from those samples formed the basis for economic analysis.

Historical costs and property losses that were attributable to subsidence were estimated to be $60.7 million and $48.9 million, respectively, or $109.6 million total. Of the $109.6 million, $53.2 million were incurred in 1973, principally due to a six foot tide. Probability of the occurrence of a six foot tide in any one year is 20 percent. Given five additional feet of subsidence in the study area the occurrence of a six foot tide was projected to cause an estimated $63,5 million in costs and losses, $10.3 million more than were incurred in 1973.

Estimated annual subsidence-related costs and losses of $14.6 million for the study area, based on 1969 to 1973 data, were used to evaluate total costs associated with supplying water needs from two alternative sources, A break-even analysis indicated that to minimize total water costs, pumping only that quantity of water that would result in no subsidence could be economically justified; i,e,, water needs or demand above that rate would need to be purchased from an alternative source. This implied that when pumping is continued to the point that subsidence occurs, the cost of pumping plus associated subsidence- related costs and losses exceed water costs from an alternative source, per unit of water.

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