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### **UTILIZING THE GLOBAL POSITIONING SYSTEM (GPS) TO MONITOR OIL FIELD SUBSIDENCE – WILMINGTON OIL FIELD**

The Wilmington Oil Field lies under the southern margin of the Los Angeles basin in the Long Beach Harbor area. Due to the extraction of large amounts of fluid from relatively shallow, uncompacted oil reservoirs beginning in 1932, the elevation of the land area above and adjacent to the Wilmington Oil Field started to subside. From the early 1940's through the early 1960's, the land area overlying the Wilmington Oil Field experienced an unusually large amount of subsidence. In the late 1950's the City of Long Beach began an aggressive campaign to arrest the subsidence, and began a monitoring program to track the deformation.

Annual deformation surveys in the Long Beach Harbor area began in 1945, and in the City of Long Beach downtown area in 1953. The City of Long Beach has historically monitored subsidence using a combination of first and second-order spirit leveling. The City of Long Beach and Condor Earth Technologies recently began a carefully defined effort to shift the emphasis of the surveying from conventional leveling to global positioning survey (GPS) method. GPS surveying is ideally suited to the Long Beach deformation monitoring program and is providing Long Beach with more timely data and is providing for a more convenient and cost-effective surveying methodology. The GPS program that Long Beach is using to monitor oilfield subsidence consists of a mobile GPS campaign (twice-a-year) and the installation of permanent GPS stations. The mobile GPS campaign is cost-effective and shortens the field data collection and office processing time when compared to the traditional spirit leveling campaign (while still providing comprehensive data). The fixed GPS array that is being installed in Long Beach is providing survey data that is more precise than previous data, and is available in real time.