


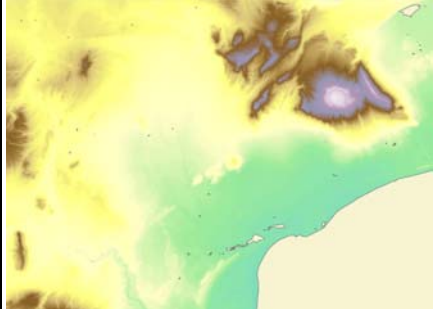


# Water Resource Associates

*A network of consultants in hydraulics, hydrology, groundwater & environmental issues*

**Project title:** Sangachal Terminal Phase 2 Expansion Surface Water Studies

**Summary:** Hydrological and Hydraulic modeling of the Shachkaiya drainage basin, for the design of surface water drainage structures and prediction and remediation of flood damage in the coastal corridor.

<b>Client:</b> BP Exploration [Shah Deniz] Ltd	<b>Financed by:</b>
<b>Period of assignment:</b> Apr 2008 - Apr 2009	<b>Location:</b> Caspian Sea, Azerbaijan
<b>Project Value:</b> £34,580	<b>WRA services:</b> £34,580
 <p>Location of Sangachal Terminal in Azerbaijan</p> <p>Map source: Central Intelligence Agency</p> 	<p><b>Overview</b></p> <p>The Shah Deniz natural gas field was discovered in 1999, located 70 km off the Caspian shoreline, where water depths range from 50 to 600 m. A geologically-complex structure with multiple reservoir horizons, it is a highly pressured field, 22 km long with an overall thickness in excess of 1000 m. The Sangachal terminal covers an area of 542 hectares, situated 55 km south of Baku, and acts as the main hub for incoming pipeline supply from the Shah Deniz field and pipeline distribution north to Russia and west to Black Sea and Mediterranean ports. In 2007, it produced 1.2 million barrels of oil and 1.25 bcf/day of gas, and the terminal has a storage capacity of 3 million barrels. Sangachal is a processing hub-terminal where hydrocarbons from offshore Caspian are processed before export.</p> <p><b>The WRA assignment</b> focused on the impact of potential flooding from catchments, and appropriate design of large drainage channels, which currently protect the perimeter of the oil and gas terminal. The terminal area sits on a coastal platform about 12m above Caspian Sea level, and drainage must cross a chaos of pipelines running parallel to the shoreline, which were laid by third parties over the past 50 years or more.</p> <p>The climate is semi-arid, and the hydrology has to take into consideration the action of mud volcanoes, which are a characteristic of this region of the Caucasus. In addition to drainage design, estimation of flood flows and hydraulic modeling using ISIS to compute resulting floodwater levels, consideration was also given to protecting wetlands to the south of the site, and to the use of natural vegetation to retain soil.</p>
 <p>Sangachal terminal from Mt Qarakush</p>	
 <p>Digital Terrain Model [DTM] showing a mud volcano in the Sangachal project catchment</p>	
<p><b>Results</b></p> <p>A complete review of the hydrology and hydraulics of the Shachkaiya drainage area demonstrated that the existing drainage system behind the coastal railway line is extremely inefficient, and could be improved significantly to reduce the risk of damage to the railway, coastal highway and associated infrastructure in severe flood events. Recommendations and outline designs were provided.</p>	

Project Number 000232

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