



Pipeline Hydraulics and Pump Station Siting

Enhanced Value through Applied Analysis

Hydraulic Head: Losses and Gains

Pipeline hydraulics are typically produced within a spreadsheet or purpose-built software. The same formulas used in these applications can also be used within a GIS to perform pipeline hydraulics. Starting with the opportunity corridor generated by a least cost path analysis, hydraulic head is calculated along the entire pipeline corridor — accounting for all elevation changes and also for fluid friction loss.

Pump Station Siting

With the hydraulic head calculated it is then possible to gain an understanding of the pumping requirements. Based on the hydraulic head surface, and because the analysis occurs within a GIS, the location of pump stations can be decided based on terrain, accessibility, pump station suction/discharge pressure, or a combination of these and other factors. Regardless of the criteria, the GIS is able to support the decision!

Results from one such pump station siting looks similar to that shown below. In this image the abrupt boundary between black and white indicates the location of a pump station.

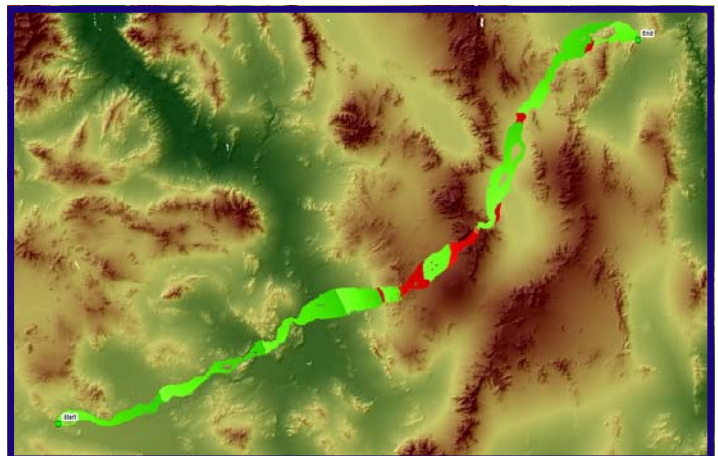
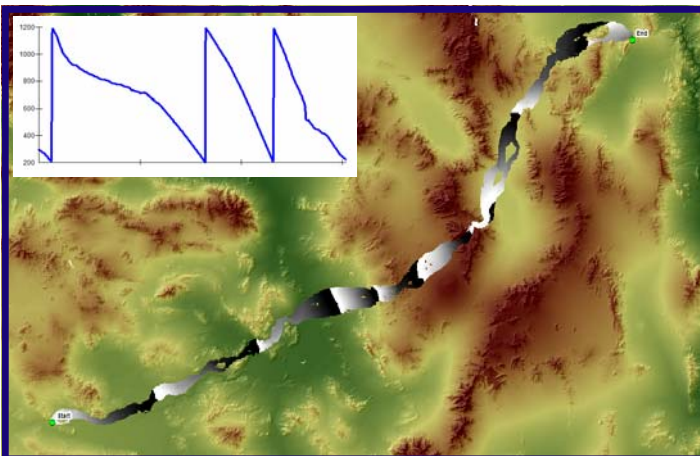
Hydraulic Surface and Profile

With pump stations already sited, it is then possible to gain an understanding of the hydraulic profile across the entire pipeline system. Using a combination of pump station locations, suction/discharge pressure, and the overall hydraulic head calculation, a three dimensional (in X, Y, and pressure) hydraulic surface is created (see left). Additionally, a hydraulic profile can be sampled from this surface (see inset image left).

Hydraulic Constraints

In the event that pump stations are sited based on accessibility, terrain, or just equally spaced along the pipeline then it is possible that the pump station placement is less than optimal with respect to the pipeline hydraulics.

Take for instance the case where pump stations are equally spaced along the pipeline corridor. The results below show that this design decision has resulted in instances where the pipeline is hydraulically constrained (shown in red), that is, there is not enough head to move the product.



Put our team to work for you! Our diverse suite of solutions is focused on establishing and enhancing the true value of GIS and applied data management in your organization.