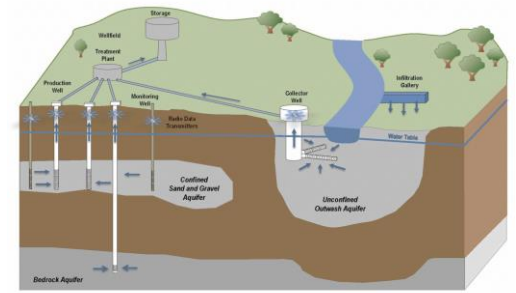
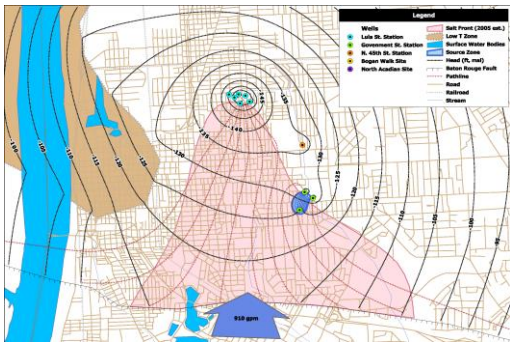




SOURCING: AQUIFER TESTING & ANALYSIS



WATER MANAGEMENT

- + SOURCING
- + WELL & PUMP MAINTENANCE
- + WATER TREATMENT TECHNOLOGIES
- + WATER RECYCLE & REUSE
- + WATER TRANSFER
- + WATER STORAGE

CONSTRUCTION

- + GEOTECHNICAL CONSTRUCTION
- + TREATMENT PLANT CONSTRUCTION
- + ALTERNATIVE DELIVERY
- + RENEWABLE ENERGY
- + SEWER SYSTEMS
- + TRENCHLESS REHABILITATION
- + WATER SUPPLY
- + WATER TRANSMISSION & DISTRIBUTION

DRILLING

- + EXPLORATION DRILLING
- + SPECIALTY DRILLING
- + WATER WELLS
- + BOREHOLE SERVICES

Layne hydrogeologists and field scientists design, instrument and execute aquifer tests and well tests to inform clients about their water supply system. Layne's scientists analyze and interpret the results accurately to ensure that clients obtain the optimum design for a sustainable source of supply.

An aquifer test is a field experiment used to discover site-specific information. During the test, a well is pumped at the highest sustainable rate for a determined amount of time (typically 24-96 hours) while water levels are recorded in three to four nearby monitoring wells. Through the data analysis, Layne can estimate the hydraulic properties of a system such as transmissivity, hydraulic conductivity, and the storage coefficient. It is also important for the identification of aquifer boundaries.

The hydraulic properties estimated through an aquifer test aid in the determination of yield and drawdown that can be expected at a location. The information can also be used in the well field design phase to formulate the most efficient design.

DESIGN AND IMPLEMENTATION

The design and layout of an aquifer test can determine the accuracy of the estimated hydraulic coefficients. Because Layne understands the science behind the interconnected hydraulic and geologic systems, its experts know how to properly design an aquifer test to collect the data best suited for the location. Additionally, Layne has all the expertise and necessary instrumentation to implement the test.

DATA ANALYSIS

The coefficients determined from the data of an aquifer test are essential to understanding what yields are sustainable at a well field. Layne has the proficiency to use all of the commonly used data analysis methods and aquifer tests, such as:

- + Theis method
- + Jacob straight-line method
- + Step-drawdown method
- + Recovery method

Additionally, because it understands the algorithms behind these methods, Layne has its own customized techniques that can be employed when necessary.

RIVERBANK FILTRATION WELL FIELDS

One critical factor in designing a high-capacity well field utilizing riverbank filtration is the hydraulic connection between the alluvial aquifer and the river. The connection is dictated by the thickness and particle size distribution of riverbed sediments and the underlying aquifer. The response of water levels in monitoring wells during an aquifer test can be evaluated using Layne's customized techniques to estimate important aquifer properties at project sites, including the degree of connection with the river.





EXAMPLES OF OUR SUCCESS



AQUIFER EVALUATION & DESIGN OF A WELL FIELD

Iowa, U.S.A.

CF Industries was expanding its operation in Iowa. In order to increase production a new water supply was needed that has the capacity to provide up to 10 MGD of raw water. A potential source of supply that could meet these requirements was a high-capacity collector well in the alluvial aquifer of the Mississippi River.

Layne's investigation included exploratory drilling at the identified reach, an aquifer test at the most promising site, groundwater monitoring to observe the response to the test pumping, and groundwater flow modeling to estimate yields and optimize the design. The results were potential designs that maximize yield and minimize construction and treatment costs.



SITE EVALUATION & DESIGN OF A RIVERBANK FILTRATION WELL FIELD

Arkansas, U.S.A.

The Arkansas River Intermodal Facilities Authority (ARRIFA) was constructing a new collector well that would become the new water source for a large manufacturing company. Layne was hired to perform an intensive field investigation designed to characterize the subsurface conditions along the Arkansas River. The objective of the was to determine the number, location and design of the wells necessary.

Layne performed sequential, increasingly detailed site exploration of the aquifer adjacent to the Arkansas River. We completed two aquifer tests at the site location and used the data collected to refine the groundwater flow model. We provided the client with a design for a 45-50 mgd firm yield collector well field. The design included the number of caissons and locations, lateral arm lengths, orientation, screen interval and depth.



DESIGNING A RIVERBANK FILTRATION WELL FIELD

Indiana, U.S.A.

Indianapolis Water Company wanted to develop a new groundwater supply system that took advantage of riverbank filtration. The objective of the project was to identify constraints on the aquifer and define an approach to site development that maximized safe yield and minimized development costs.

We collected test borings and performed two aquifer tests to characterize the aquifer. The test results were incorporated into two models, a groundwater flow model and a geochemical model. The models were used together to evaluate alternative scenarios for well field development and to investigate constraints on well field capacity. We recommended specific sites for vertical wells with adequate spacing to avoid excessive interference. To maximize safe yield at the site, we recommended installing a vertical well field in the deeper zone of the aquifer combined with riverbank filtration wells in the shallow zone.

