Source Water Assessment and Protection Plans (SWAPP): Aquilogic staff has developed SWAPPs that consider the threat that releases of contaminants may pose to water resources. A SWAPP may also define management actions to minimize or mitigate the threat.

Water Quality Monitoring: Water quality is monitored on a regular basis to identify impacts to that resource and threats to a water supply. **Aquilogic** staff has implemented water quality monitoring programs for groundwater, flood control systems, streams and rivers, wetlands, lakes, and marine environments.

Contaminant Hydrogeology: Aquilogic staff has worked on some of the most complex groundwater contamination issues in the nation, including recalcitrant chemicals such as fuel oxygenates, solvents, rocket propellants, soil fumigants, and hexavalent chromium. Further information can be found in our Groundwater Contamination Brochure.

Drinking Water Treatment: In some cases, water supplies need to be treated to reduce naturally occurring compounds or remove man-made chemicals. Water treatment options are evaluated as part of a feasibility study (FS). Whatever treatment is selected, the design and permitting process is rigorous, given that the treated water will be used for public supply. **Aquilogic** staff has experience preparing engineering designs, permit applications, tender documents, and installation and performance reports for drinking water treatment systems.

Water Re-use and Conjunctive Use: Storm water and treated water from a wastewater treatment plant are usually discharged to a surface water body. Increasingly, this discharge is being used for irrigation, direct potable re-use (DPR) or, more often, indirect potable re-use (IDPR) using ASR. With increasing water supply demands and declining supplies, a conjunctive use program can be used to optimize yields allowing excess water to be transferred from one user (e.g. agriculture) to another (e.g. domestic supply). **Aquilogic** staff has experience supporting the design, installation and operation of ASR systems, and working with multiple stakeholders to develop conjunctive use plans.

Geomatics and GIS: Aquilogic has Geomatics staff capable of developing databases and Geographic Information System (GIS) platforms for water resources projects that allow for the rapid generation of tables, graphs, and maps.

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Other Services

Groundwater Contamination

- Responsible Party Identification
- Remedial Investigation
- Contaminant Hydrogeology
- Fate & Transport Modeling
- Risk Assessment
- Remediation Feasibility Studies
- Soil & Groundwater Remediation
- Environmental Permitting
- Facility Decommissioning
- NRDA

Strategic Solutions

- Litigation Support
- Expert Witness
- Forensic Engineering
- Environmental Risk Management
- Stakeholder/Public Participation
- Regulatory Strategy
- Environmental Cost-Benefit Analysis
- Public Relations Support

Groundwater Management

- Water Resources Assessment
- Water Balance & Safe Yield
- Groundwater Modeling
- Groundwater Development
- Contaminant Hydrogeology
- Source Water Assessment
- Water Re-use & Conjunctive Use
- Aquifer Storage & Recovery
- Drinking Water Treatment
- GIS & Geomatics

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With increasing demand for limited water supplies, each drop of water must be protected, restored, developed, treated, used, re-used, and managed effectively. Without water, there is no agriculture, no power, no industry, no economic growth, and no prosperity. At **aquilogic**, we offer a range of services focusing on the management, protection, restoration, development, and re-use of this finite resource. Whether it's protecting a groundwater resource, removing industrial contaminants, or re-using water to enhance supplies, we have the capability and experience needed to address the water challenges facing society. Some of the services we offer are described in this brochure. More detailed information on these services, along with descriptions of current and completed projects, can be found at our website: www.aquilogic.com

Water Resources Assessment: The location, yield, seasonal variation, and quality of water resources need to be assessed prior to the development for domestic, agricultural, or industrial use. **Aquilogic** staff has conducted water resources or source water assessment for new water supplies, optimization of existing supplies, or enhancement of existing supplies.

Water Balance and Safe Yield: A water balance analysis defines and quantifies all water inputs and outputs to a given area, plus the volume of water in storage and any additional storage capacity. The safe yield is the volume of water that can be withdrawn on an annual basis without any net change in storage. **Aquilogic** staff has developed water budgets and safe yield estimates for groundwater basins, sub-basins, and defined areas within a basin.

Hydrological System Modeling: Hydrologic models are often developed to simulate complex natural systems. Hydrologic models can evaluate the physical movement of water, the chemical character of the water, and/or the transport of sediments or solutes. **Aquilogic** staff has developed a variety of hydrologic models to assess, manage, develop, and restore complex hydrologic system.

Groundwater Resource Development: Aquilogic staff has overseen the installation of water supply wells in a variety of geologic settings, and secured appropriate regulatory approvals. We have also supported the implementation of aquifer enhancement programs, such as recharge basins, percolation wetlands, and treated water reinjection programs for aquifer storage and recovery (ASR) and saline intrusion barriers.

water in any language

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Water Volume Conversion

Unit	GPM	GPD	GPY	CFD	CFY	CMD	CMY	AFY
GPM	1	1,440	525,600	192	70,080	6.207	2,266	1.609
GPD	1,440	1	365	0.133	48.667	0.004	1.573	0.001117
GPY	525,600	365	1	48.667	0.133	1.573	0.004	0.000003
CFD	192	0.133	48.667	1	365	0.032	11.801	0.000023
CFY	70,080	48.667	0.133	365	1	0.000	0.032	0.008379
CMD	6.207	0.004	1.573	0.032	0.000	1	365	0.000001
CMY	2,266	1.573	0.004	11.801	0.032	365	1	0.000271
AFY	1.609	0.001117	0.000003	0.000023	0.008379	0.000001	0.000271	1

Volume of Soil per foot of Boring Depth

Diameter (in)	2	4	6	8	10	12	16	20	24	30	36
Volume (ft^3)	0.022	0.087	0.196	0.349	0.545	0.785	1.396	2.182	3.142	4.909	7.069

Volume of Water per foot of Casing

Diameter (in)	1	2	3	4	6	8	10	12	16	20	24
Volume (gal)	0.041	0.164	0.368	0.655	1.473	2.618	4.091	5.891	10.472	16.363	23.562

Typical Soil Properties

Soil Type	porosity	effective porosity	hydraulic conductivity (range)	
	%	%	ft/year	ft/year
Clay	50	2	0.01	10
Sandy Clay	40	8	0.1	100
Silt	40	8	10	1,000
Sandy Silt	35	15	100	1,000
Silty Sand	30	18	1,000	10,000
Sand	25	22	1,000	100,000
Gravel	20	19	10,000	1,000,000

Darcy's Law

$$Q = K \cdot i \cdot A$$

Where

Q =	volumetric discharge across area (A)
K =	hydraulic conductivity
i =	hydraulic gradient

Groundwater Velocity

$$v = K \cdot i / n_e$$

Where

n_e = effective porosity

Useful US to SI Conversion Factors

convert from	to	multiply by
in	m	0.0254
ft	m	0.3048
in^2	mm^2	645.16
ft^2	m^2	0.0929
acre	ft^2	43,560
ft^3	m^3	0.028317
quart	liter	0.9464
gallon	m^3	0.003785

convert from	to	multiply by
lb (mass)	kg	0.4536
lb (force)	N	4.4482
in Hg	atmosphere	0.0334
in Hg	in H^2O	13.2
lb/in^2	atmosphere	0.06805
cm^2/sec	in^2/yr	4,881,000
ft/lb (energy)	joule	1.3558
g/cm^3	lb/ft^3	62.4279