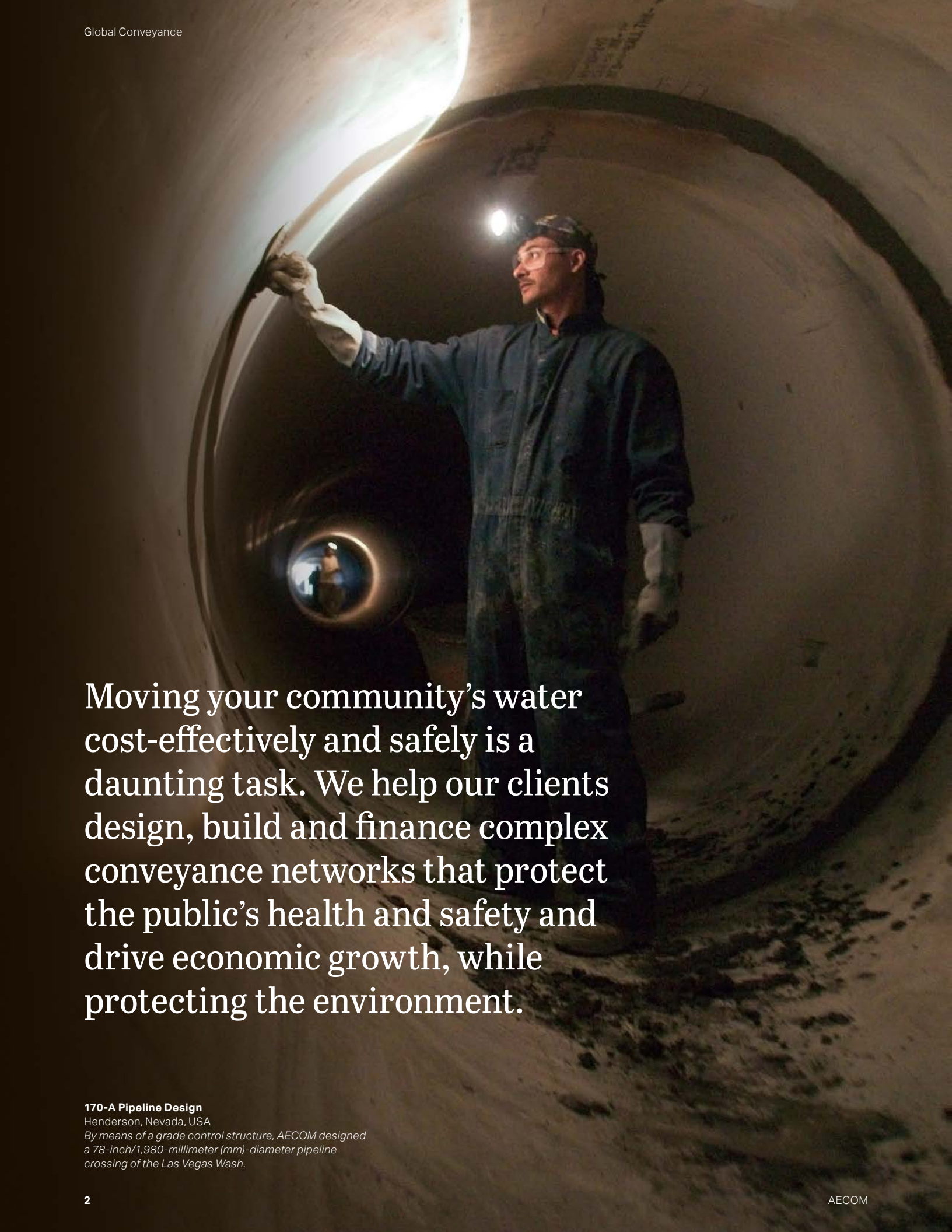
AECOM

Global Conveyance

Moving Water

Managing Today's Infrastructure to Prepare for the Future



Moving your community's water cost-effectively and safely is a daunting task. We help our clients design, build and finance complex conveyance networks that protect the public's health and safety and drive economic growth, while protecting the environment.

170-A Pipeline Design
Henderson, Nevada, USA
By means of a grade control structure, AECOM designed a 78-inch/1,980-millimeter (mm)-diameter pipeline crossing of the Las Vegas Wash.

One thing people everywhere can agree on is the universal importance of life-sustaining water and sanitation.

Access to clean water—and recovery and reclamation of wastewater—enables our communities to flourish and grow. Critical to this access are efficient systems of pipelines, tunnels, pump stations, and other structures that move water and wastewater from one place to another.

Imagine a world where everyone has access to a reliable water supply and a safe wastewater disposal system. We are working toward this goal, helping our clients address challenging water issues. We draw upon countless lessons learned across the globe to provide solutions for our clients—solutions that address real-world water challenges such as safety, schedule, reliability, stewardship, population change, more stringent regulations, shifting public policy and construction costs.

Across the globe, many existing municipal water or wastewater pipelines, tunnels and pump stations have exceeded their life expectancies. With more than a century of municipal expertise, our strategies blend innovation with flexibility to help our clients' current infrastructure planning prepare them for the future, especially when funding, schedule or regulatory challenges exist.

What sets us apart is our collaborative way of working globally and delivering locally. Together, our teams of engineers, planners, construction managers, architects, landscape architects, environmental specialists, economists, scientists and program managers are dedicated to finding the best solutions to address our clients' problems. Our integrated services for total project delivery cover everything from initial environmental planning studies to detailed design and construction, construction management, program management, design-build delivery and operations and maintenance training.

Areas of Expertise:

- Pipelines
- Tunnels and trenchless
- Intakes and outfalls
- Pump stations
- Storage facilities
- Wet weather systems
- Condition assessment
- Sustainable asset management
- Water system modeling
- Master planning

Cover image:
River Supply Conduit Upper Reach Units 5 and 6
Los Angeles, California, USA

Pipelines

From left:
Owens Lake Phase 1 Transmission Mains
Inyo County, California, USA
Design of a pipeline network, bubblers, control system and other irrigation system components helped control dust storms in one of the country's worst particulate-emission areas.

Integrated Pipeline (IPL) Project
Dallas, Texas, USA
The $2.3-billion IPL comprises approximately 145 miles/233 kilometers (km) of 84- to 108-inch/2,150 to 2,750-mm-diameter pipeline, a 5-mile/8-km 120-inch/3,050-mm-diameter tunnel, six 100-350 million gallons per day (MGD)/380 - 1,320 milliliters per day (ML/d) pump stations, and a 450-MG/1,700-ML balancing reservoir. We are serving as program manager.

A pipe is definitely not just a pipe. When completing a water or wastewater conveyance project, schedule, cost, construction safety, disruption to community life and businesses, regulatory compliance and ease of maintenance are just a few of the challenges that you may face. We can help you deal not only with the technical issues, but with a wide array of related social, environmental, economic and even political concerns.

Many pipeline projects have involved challenging circumstances, like congested urban areas, arid desert climates, mountainous terrain, residential communities, industrial parks, dense forest conditions, unstable soils, and roadway and waterway crossings. AECOM relies on its trusted local experts who know their communities and clients to overcome these challenges. Our national and global practice leaders and established techniques provide our clients with the best solutions.

Whether it's potable or raw water, wastewater or recycled water, our professionals offer a complete set of skills to implement pipeline projects of varying size and scope. Pipeline projects convey this vital resource from remote supply sources to storage and pump facilities, to users, and back to centralized treatment facilities.

Our service offerings for pipelines far surpass planning and design, encompassing pipe fabrication, inspections, condition assessments, construction management and overall program management.

From left:

Bay Division Pipelines 3 and 4 Crossovers
Palo Alto, Santa Clara and Atherton, California, USA
This project involved construction of large interconnection facilities (including pipes ranging from 72- to 90-inches/1,800- to 2,250-mm in diameter). The infrastructure provides the San Francisco Public Utilities Commission (SFPUC) with increased operational flexibility and the ability to minimize the impact of a pipeline failure following a seismic event.

River Supply Conduit Upper Reach Units 5 and 6
Los Angeles, California, USA
Subsurface investigations, a route selection study, design and rehabilitation services were completed for the Los Angeles Department of Water and Power's 3-mile/4.8-km-long, 78-inch/1,980-mm-diameter steel pipeline constructed by cut and cover, pipe jacking and tunneling techniques.

Services include:
- Capital improvement planning
- Condition assessments
- Corrosion protection
- Economic studies
- Emergency response planning and continuity of operations planning
- Hydraulic and surge modeling
- Operation and maintenance (O&M)
- Permitting and regulatory compliance
- Pipe inspection
- Pipe rehabilitation
- Stakeholder coordination
- Structural and seismic upgrades
- Sustainable water management
- Value engineering
- Water demand studies

Our major conveyance analysis, design and construction experience includes pipelines more than 144 inches/3,600 millimeters in diameter. We have also developed advanced computer programming for pipeline hydraulics and surface analysis, pipe design, pump selection, O&M cost evaluation and lifecycle cost analysis. Our pipeline specialists use computer software to assist with economic analyses of conveyance systems.

As program construction manager for the Water System Improvement Program (WSIP), a 12-year, $4.8-billion capital program of interrelated projects, AECOM is helping to reduce the vulnerability of San Francisco's water supply system to major seismic events. Since 2010, WSIP has been awarded more than 55 state, national and international awards.

Tunnels and Trenchless

Harbor Area Treatment Scheme Stage 2A
Hong Kong
We provided detailed design, construction management and supervision for the sewage conveyance system of this project. The scope included the construction of 21 km of deep sewage tunnels at a maximum depth of 160 meters below sea level. This project currently holds the Guinness World Record for the deepest urban sewage system installed tunnel.

From top:
Deep Tunnel Sewerage System (DTSS) Phase 2, Singapore
We are overseeing the engineering and construction of DTSS Phase 2, which includes 40km of deep tunnels that will connect with the existing used water infrastructure to create one seamless and integrated system.

North Dorchester Bay CSO Tunnel
Boston, Massachusetts, USA
The 17-foot/5.2-meter-diameter tunnel was constructed between 40 and 60 feet/12.2 and 18.3 meters deep in soft earth.

Tunnel projects in today's world are more complex than ever, with interrelated technical, financial, social and environmental challenges in all types of ground conditions, from soft ground to rock, and mixed face to subaqueous. Projects frequently require the construction of tunnels with high risks under rivers, harbors, roads and railroads. To mitigate these risks, we have developed tried-and-true design approaches to protect our clients, contractors and the community during the construction and operation of the system.

When open cut techniques for constructing conveyance networks are not appropriate, we deliver solutions with cutting edge designs for tunnels and trenchless technology. Our established approaches have been honed across the globe on projects ranging from small diameter microtunneling and horizontal directional drilling projects to the world's largest tunnels, at 57.8 feet/17.6 meters in diameter. Through this experience, our clients and their communities benefit from our ability to safely construct reliable tunnels.

Technical expertise and creative excellence spring from the institutional knowledge and collective history of our legacy companies' finest engineering, environmental, planning, and design experience. We offer comprehensive services for all types of water and wastewater facilities involving tunnels or trenchless technology, from planning and design through to construction management.

Our clients often need full lifecycle solutions to complex projects. AECOM's integrated tunneling service capabilities include:

- Alternative methods of procurement
- Consolidation conduit sizing and design
- Detailed design
- Drop shaft design
- Feasibility assessments
- Geotechnical investigations and geotechnical baseline reports

Central Interceptor
New Zealand
This 14.7km wastewater tunnel will be the longest bored tunnel in New Zealand. Its depth varies between 15 and 110 meters from the surface, crossing the Manukau harbor at depths of about 15m below the seabed. With a capacity of 210,000 m³, Central Interceptor will be connected to two link sewer tunnels as well as 17 above ground sites.

From top:
Dugway and Doan Valley Relief and Consolidation Sewers
Cleveland, Ohio, USA
Provided alternatives analyses, design and construction support services for combined sewer overflow (CSO) sewers installed in a rock tunnel and by using microtunneling methods.

Homestead Avenue Interceptor Extension
Hartford, Connecticut, USA
This landmark project involved the installation of 3,400 feet/1,036 meters of 72-inch/1,830-mm-diameter relief sewer—including the first curved microtunnel in the United States. We designed the interceptor extension and provided construction management services.

- Hydrologic and hydraulic modeling
- Inlet flow control design and operation
- Odor control and air management
- Program management
- Real–time control for tunnel inflows
- Risk analyses and mitigation
- Sediment deposition analysis and mitigation
- Subaqueous outfall design
- Surge/Transient modeling and mitigation design
- Trenchless technology selection and design
- Tunnel and pipeline renovation and rehabilitation
- Tunnel safety
- Tunnel system corrosion analysis and mitigation design

Our experts have developed numerous designs using conventional trenched pipelines with trenchless technology when required to deliver the best technical and cost-effective solution to the community. Our extensive experience completing design-build projects with pipeline contractors has also helped us better understand project requirements, high quality installations and cost savings.

In the past 10 years, AECOM has managed more than $30 billion in construction of large-diameter tunnels globally for water and wastewater, transit, highway and energy related projects. We have a long history of bringing innovative and cost-savings ideas to the tunnel community and our clients.

Intakes and Outfalls

Water Treatment Plant No. 4, Raw Water Intake Manifold Pipe
Austin, Texas, USA
The design of this 300 MGD/1,134 ML/d raw water intake was comprised of three intake screens, a pipe manifold connecting the screens and a 9-foot/2.7-meter-diameter tunnel from the lake tap to the raw water pump station. The intake supplies raw water for the City of Austin's new water treatment plant.

Water Treatment Plant No. 4, Raw Water Intake Screen
Austin, Texas, USA
The one of a kind, 300-MGD intake/1,134 ML/d screens we designed were each installed at a different depth to access highest quality raw water. Each screen is a 33-foot/10-meter-diameter octagon that is 15-feet/4.6-meters high and made of structural steel with a protective coating.

Problems related to intakes and outfalls can potentially go undetected for a long time and can be very expensive to fix after their impacts are finally apparent. Environmental regulations connected to outfalls that discharge wastewater and intakes that capture fresh water from streams, rivers, lakes, and oceans are very strict, and specialized expertise is required to maintain cost-effective compliance. The breadth of AECOM's experience allows us to help local, state and federal agencies avoid costly repairs and improve long-term functionality of these complex structures.

AECOM has considerable experience in the siting, design, permitting and construction of intakes and outfalls—from the sustainable withdrawal of raw water for water treatment or other water supply projects, to the discharge of wastewater, brine or other effluents into riverine and coastal waters.

This experience enables us to design intakes and outfalls accurately the first time, avoiding costly repairs for our clients and unexpected outages in plant operations.

Our experience spans the full range of intake types, from Ranney collector wells, to floating barge intakes, to screened intakes and open intakes in both freshwater and marine

Fort Kamehameha Wastewater Treatment Plant Ocean Outfall
Pearl Harbor, Hawaii, USA
Geotechnical and trenchless design services were provided for 12,000 linear feet/3.7 km of new ocean outfall. Microtunneling was used beneath live coral reefs to protect the sensitive marine environment.

environments over a flow range from small intakes to as large as 700 MGD/2,660 ML/d.

Our outfall experience extends from single port outfalls to multi-port diffusers, from piped outfalls to deep rock tunnels, with flows ranging from 10 to 1,300 MGD/380 to 4,940 ML/d.

Intake and outfall services include:
- Conceptual designs
- Dispersion and water quality impact modeling
- Environmental impact assessments
- Field measurements and sampling, for background water quality
- Field testing for dilution and hydraulics (head losses)
- Final designs
- Geotechnical surveys
- Initial dilution modeling
- Inspection
- Owner's representative (for design-build projects)
- Permitting and interaction with regulatory bodies
- Sediment transport modeling
- Siting studies, outfall planning

From top:

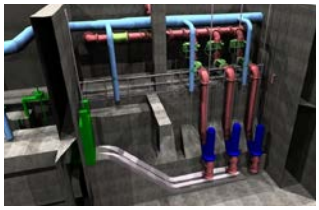
Stormwater Outfall Installation
Gloucester, Massachusetts, USA
Permitting, design and construction services were successfully delivered for the extension of this 36-inch/900-mm-diameter outfall pipe.

Deer Island Wastewater Treatment Plant Outfall
Boston, Massachusetts, USA
The Deer Island facilities, including this 26-foot/7.9-meter-diameter, 9.5-mile/15.2-km-long effluent outfall tunnel under the Atlantic Ocean, provide primary and secondary wastewater treatment and disposal for 2.5 million people.

South Bay Land Outfall Design and Construction
San Diego, California, USA
The 2.3-mile/3.7-km-long outfall carries effluent from an inland plant site to a junction with an ocean outfall. We designed and provided construction phase services for this project.

Pump Stations

Combined Sewer Overflow Pump Station
Holyoke, Massachusetts, USA
Completion of a long-term CSO control plan for the Springfield Water and Sewer Commission has helped reduce the impacts of CSOs on the Connecticut, Chicopee and Mill Rivers in Massachusetts.

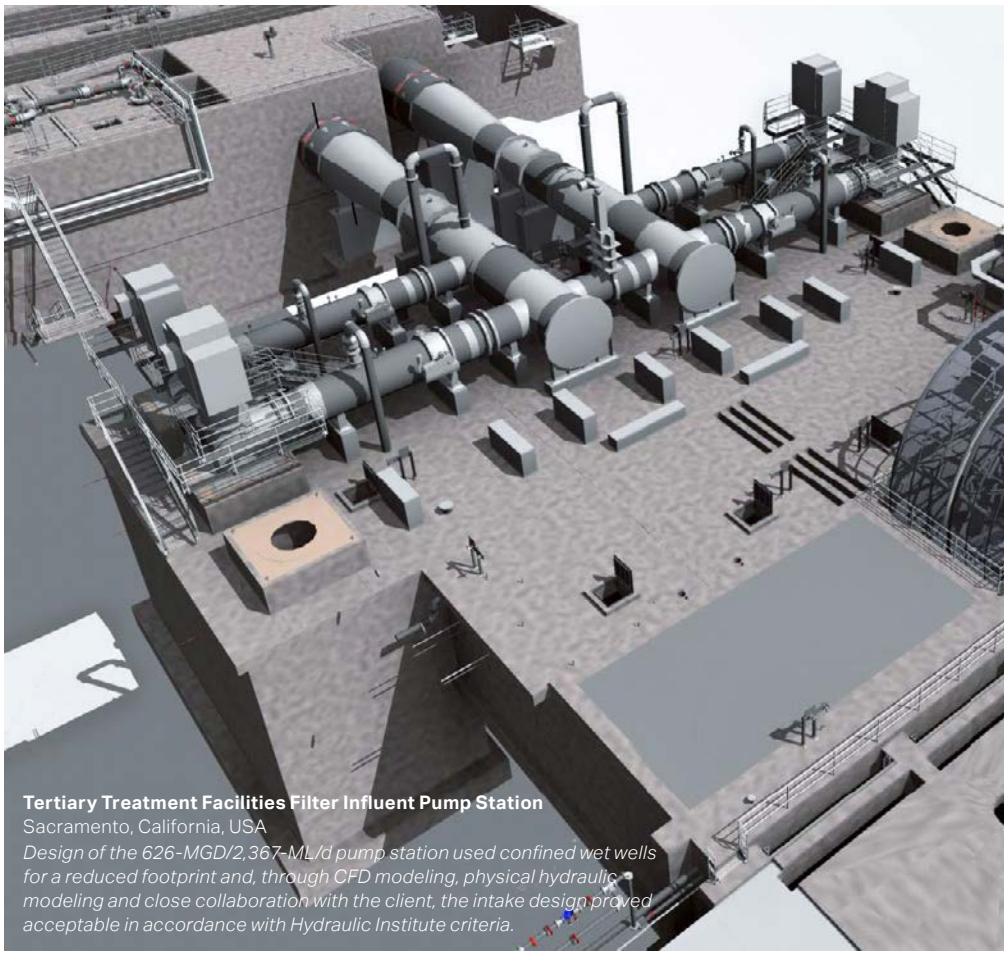


Watchemoket Pump Station from 3D Design to Operation
East Providence, Rhode Island, USA
We provided 3D modeling and design services for the 10-MGD/3.8- ML/d pump station.

Owners and managers can rely on us to design efficient, reliable pump stations that address hydraulic issues ranging from pump selection to transient analysis. Pump failure can threaten the operations of an entire system and may result in a public health catastrophe. Pump stations are also one of the most maintenance-heavy elements in a conveyance system.

Connected though a technical practice network, our pump station design engineers have experience not only in North America, but globally. As a result, our clients benefit throughout a project from our in-house design guidelines; experience in design, construction, and testing; and the lessons learned on projects from around the world.

Our pump station experience ranges in size from small systems such as 10-horsepower (hp) pump stations to 17,600 hp (8 kW to 13,150 kW) stations, with flow rates between 100 gallons per minute (gpm)/ 380 liters per minute (L/m) and 250,000 gpm/ 945,000 L/m. Every station design requires specialized hydraulic modeling for proper pump, motor, piping, and valve sizing; and in many cases, CFD and physical hydraulic modeling is required for intake comparison and selection, in addition to a transient analysis to determine whether surge mitigation is needed.



Tertiary Treatment Facilities Filter Influent Pump Station
Sacramento, California, USA
Design of the 626-MGD/2,367-ML/d pump station used confined wet wells for a reduced footprint and, through CFD modeling, physical hydraulic modeling and close collaboration with the client, the intake design proved acceptable in accordance with Hydraulic Institute criteria.

From top:
Spears Road High Service Pump Station
Houston, Texas, USA
This pump station was expanded from 75 MGD to 100 MGD/285 ML/d to 380 ML/d.

Easterly CSO Long-Term Control Plan Tunnel Dewatering Pump Station
Cleveland, Ohio, USA
Design and construction support services were provided for this 160-MGD/605-ML/d pump station.

AECOM has completed pump station designs with associated control systems and auxiliary equipment on various projects around the world. In North America, we have designed innovative pump and storage systems such as the Calumet Tunnel and Reservoir which consists of 6000-hp pumps (4,500 kW), 36,000 hp (26,900 kW) total and the San Jacinto River Authority, which incorporates in excess of 11,000 hp (8,225 kW). We have experience designing pump control systems with variable frequency drives and SCADA telemetry for monitoring the equipment.

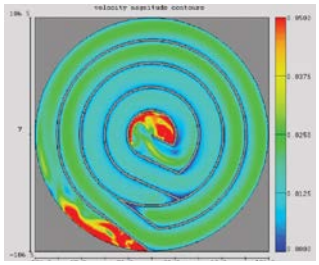
State-of-the-art design techniques help minimize clogging and maintenance to enable pump stations to handle high quantities of rags and debris. Our proven ability helps the stations to be as fail-proof as possible.

From planning conceptual design to construction and commissioning, our holistic approach to design coordinates structural, architectural, electrical, instrumentation and controls, building services, and process mechanical elements to optimize the pump station design and layout for performance and ease of O&M. Noise controls, potential for vandalism, weather protection, lightning protection and aesthetics are other criteria we often address during the design stage.

HYDRAULIC INSTITUTE
STANDARDS PARTNER

We are a standards partner with the Hydraulic Institute. Our staff serve on several committees including the intake, vibration and testing standards committees.

Storage Facilities



CFD and Dye Tracer Study of the North Royalton Water Storage Tank
Cleveland, Ohio, USA
Due to our client's concerns about possible extended water age, water quality and the need for seasonal flexibility for a new 5-MG/19-ML water ground storage tank, we developed a "tank-in-a-tank". The solution enhanced flexibility of operations during low flow periods (winter) and high flow periods (summer). Using CFD to design the tank, we proved the resulting water quality before any construction occurred—this confirmed the tank was built correctly.

Water quality is typically the biggest anxiety associated with owning and operating water storage facilities, particularly, biological and chemical concerns like taste and odor. We design new and existing storage facilities to prevent issues related to water characteristics, chemistry and age. Optimization of the storage volume and, in some cases, using CFD models and physical tracer studies, helps our clients maintain water quality at lower capital costs and reduce energy demands. We apply these capabilities to underground, at-grade and elevated storage facilities.

Not every storage facility needs CFD, however, every facility designed by AECOM benefits from the history and lessons learned from our experience using this tool. When CFD is needed to meet more challenging storage applications, we can efficiently assess complex hydraulic issues with CFD tools.

Leaders in the application of advanced hydraulic modeling, our engineers first started using CFD 25 years ago and clients continue to recognize how our in-house expertise complements our other traditional engineering services. Using this tool helps us design and operate tanks to improve the energy efficiency of the

Darree Fields Park 2 MG Elevated Storage Tank
Dublin, Ohio, USA
Design features of this 2-MG/7.6-ML fluted column elevated storage tank included a tank mixing system and water quality monitors, as well as a break room, restroom and storage for equipment for the City of Dublin's Parks and Recreation Department.

From top:
Centerville, Osterville, Marstons Mill (COMM) Tank
Hyannis, Massachusetts, USA
Provided analysis, design and construction of this water storage tank to increase system capacity.

Kemper Road Elevated Water Storage Tank
Cincinnati, Ohio, USA
This 3-MG/11.3-ML tank design was the largest elevated tank in the Greater Cincinnati Water Works system.

One of the largest costs of operating, maintaining and rehabilitating storage tanks is related to corrosion and coatings. Our expertise with corrosion and coatings stems from in-house corrosion, cathodic protection and protective coatings specialists and certified coatings inspectors and NACE certified inspectors ~~w~~who our clients trust for design and assessment of new and existing storage tanks.

overall pump and distribution system in a range of operating scenarios. A further benefit of our hydraulic modeling experience with storage facilities is our ability to quickly and cost-effectively identify solutions to water quality and hydraulic issues in existing facilities.

Mabee Road 1 MG/3.8ML Elevated Storage Tank
Ontario, Ohio, USA
Completed plans and specifications and construction administration services for this new composite elevated water tank.

Wet Weather Systems

From left:

Program Management Services for Regionalization Implementation
Pittsburgh, Pennsylvania, USA
This $2-billion wet weather program involves extensive interface and communication with 83 customer municipalities including gathering infrastructure information and collecting CCTV data on the sewers.

Metropolitan Interceptor Sewer Rehabilitation Program
Milwaukee, Wisconsin, USA
Condition assessment, rehabilitation, design, and construction management services were provided for this $320-million sewer improvement program. The work was recognized as a Trenchless Technology Rehabilitation Project of the Year.

Municipalities and sewer agencies are well aware of the impacts that wet weather can have on their wastewater collection systems. Whether manifesting in the form of Sanitary Sewer Overflows (SSOs), Combined Sewer Overflows (CSOs) or flooding, wet weather has the potential to create human health and environmental hazards, and the costs to mitigate them can be significant. Left unaddressed, SSOs and CSOs can result in enforcement actions through the Clean Water Act and may hinder economic development in overflow-affected areas.

Our clients realize the economic importance of maximizing use of existing infrastructure while recognizing when to develop and prioritize improvements for long-term system reliability. As a leader in wet weather policy, we apply our 30-year history of real-world experience to resolve our clients' SSO and CSO challenges.

Using a detailed system assessment approach combined with our understanding of wet weather regulations, we help our clients achieve wet weather compliance and the best return on their investment. Our capabilities extend from research activities and development of sewer system models, through master planning and into design and construction. Boston, Cleveland, Pittsburgh, Atlanta, San Francisco, New York and Washington, D.C., are among the cities that in recent years have turned to us for planning, design or implementation of wet weather management programs.

With decades of sewer system design and construction experience, AECOM has completed thousands of miles of lateral and interceptor sewers — including collection systems of all sizes and varying degrees of complexity and those in need of sewer separation. Rehabilitation projects frequently follow our infiltration/inflow studies and sewer system evaluation surveys, which typically include closed-circuit television inspection.

From left:
Thames Tideway Tunnel
London, UK
We are designing the central 12km section of the Thames Tideway Tunnel that will modernize London's Victorian wastewater infrastructure and improve the water quality of the River Thames. The entire 25-km tunnel generally follows the route of the Thames, connecting to overflows along the riverbanks and passing through a variety of different ground conditions.

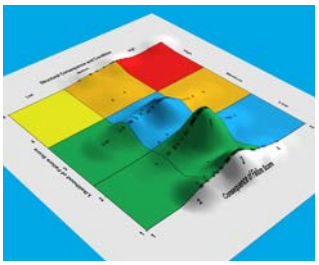
Environmental Protection Agency (EPA) Wet Weather Policy
We authored the guidance document for the EPA's long-term control plan development. The manual provides public works professionals, design engineers and regulatory agencies with information on compliance with the CSO Control Policy.

Our wet weather solutions involve regulator modifications, in-line and off-line storage (including storage tanks and tunnels), and wet weather pump and treatment facilities. In addition to our vast design and construction experience, our ability to deliver wet weather solutions is based on two other critical success factors:

- **Understanding of EPA Wet Weather Policy.** Our wet weather services rest on our unparalleled understanding of the U.S. Environmental Protection Agency's (EPA) wet weather policy, in fact, AECOM provided technical assistance during its development. Many municipalities look to us for the technical guidance needed for development and implementation of CSO and SSO programs.
- **Commitment to Advanced Collection System and Receiving Water Modeling.** Since our development of the original stormwater management model (SWMM) for the EPA, AECOM has continued to refine and update our detailed modeling approach. Our in-house experts are adept in numerous computer models, including SWMM (EPA SWMM, XPSWMM, PCSWMM, and InfoSWMM), MIKE Urban, and InfoWorks. Applying detailed, fully dynamic receiving water models we can accurately understand the impacts of wet weather discharges, and the effects of remediation measures on water bodies. We also analyze complex hydraulic structures using CFD modeling and can conduct surge analyses of tunnel systems.

Tunnel Dewatering Pump Station
Washington D.C., USA
Construction of the DC Water tunnel dewatering pump station that will feed the largest ballasted flocculation wet weather treatment system in the US.

Condition Assessments



From left:
High Risk River Crossing Management Program
Winnipeg, Manitoba, Canada
A remote field eddy current inspection platform was used in this City of Winnipeg program as a continuous assessment tool to identify remaining wall thickness and defect geometry of ferrous metal pipes.

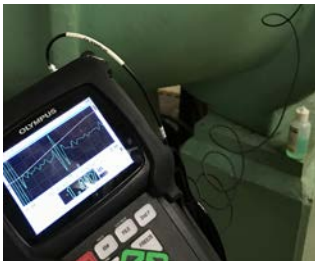
Sewer Force Main Risk Analysis
City of Ottawa, Ontario, Canada
Our 3D risk matrix, with the length of the asset in Z-plane, depicts combined consideration of probability and consequence of failure.

Assessment and Rehabilitation of Potable Water Mains
Colorado Springs, Colorado, USA
Condition Assessment Technical Practice Leader, Christopher Macey, measures the pipe thickness using ultrasonic technology equipment to estimate the remaining pipe life.

Water and sewer infrastructure piping systems constitute a significant portion of a utility's investment portfolio, but they don't always receive a proportionate share of reinvestment dollars. Often, it takes a high profile failure to expose the costly consequences of unplanned failure versus timely intervention. We apply a risk-based, holistic approach to condition assessment built on a solid understanding of material science. Matching assessment techniques to materials, their exposure conditions, and the asset criticality, our clients are able to make the right decisions, at the right time, and with the right tools and levels of investment.

Our specialists are globally recognized for their understanding of material degradation and of the many varied methods to assess pipeline condition from office-based assessment techniques to field assessments using recognized methods of direct and indirect measurement. Our leaders play prominent roles in the development and dissemination of innovative and proper condition assessment methods through their participation in organizations such as the National Association of Sewer Service Companies (NASSCO), North American Society for Trenchless Technology (NASTT), and the American Water Works Association (AWWA) for gravity sewer and pressure pipe condition assessment and rehabilitation.

Sunrise Highway Aqueduct Investigation Assessment
Nassau County, New York, USA
Condition assessment was conducted on a 100-year-old steel water supply main in New York. The main had not been in use since 1967 and is successfully being rehabilitated to function as a 72-inch/1,800-mm-diameter treated effluent force main.



From top:
Iona Island Wastewater Treatment Plant Influent Pump Station
Burnaby, British Columbia, Canada
Ultrasonic thickness measurements of a pump volute helped ascertain loss of material from abrasion and remaining life of the equipment.

Preston Sewer Relining
Saskatoon, Saskatchewan, Canada
Prior to pipeline installation, AECOM impregnated an 84-inch/2,130-mm-diameter cured-in-place pipe (CIPP) liner with 147,000 pounds/66,800 kilograms of resin.

As master trainers for NASSCO, our experts teach pipeline, manhole, and lateral assessment certification programs such as NASSCO PA/MA/LACPs. We have been key contributors to manuals of practice such as AWWA's M77 (Condition Assessment of Water Mains) and M28 (Rehabilitation of Water Mains) and contributed to the NASTT's *CIPP Good Practice Guidelines,* as well as to many AWWA rehabilitation standards.

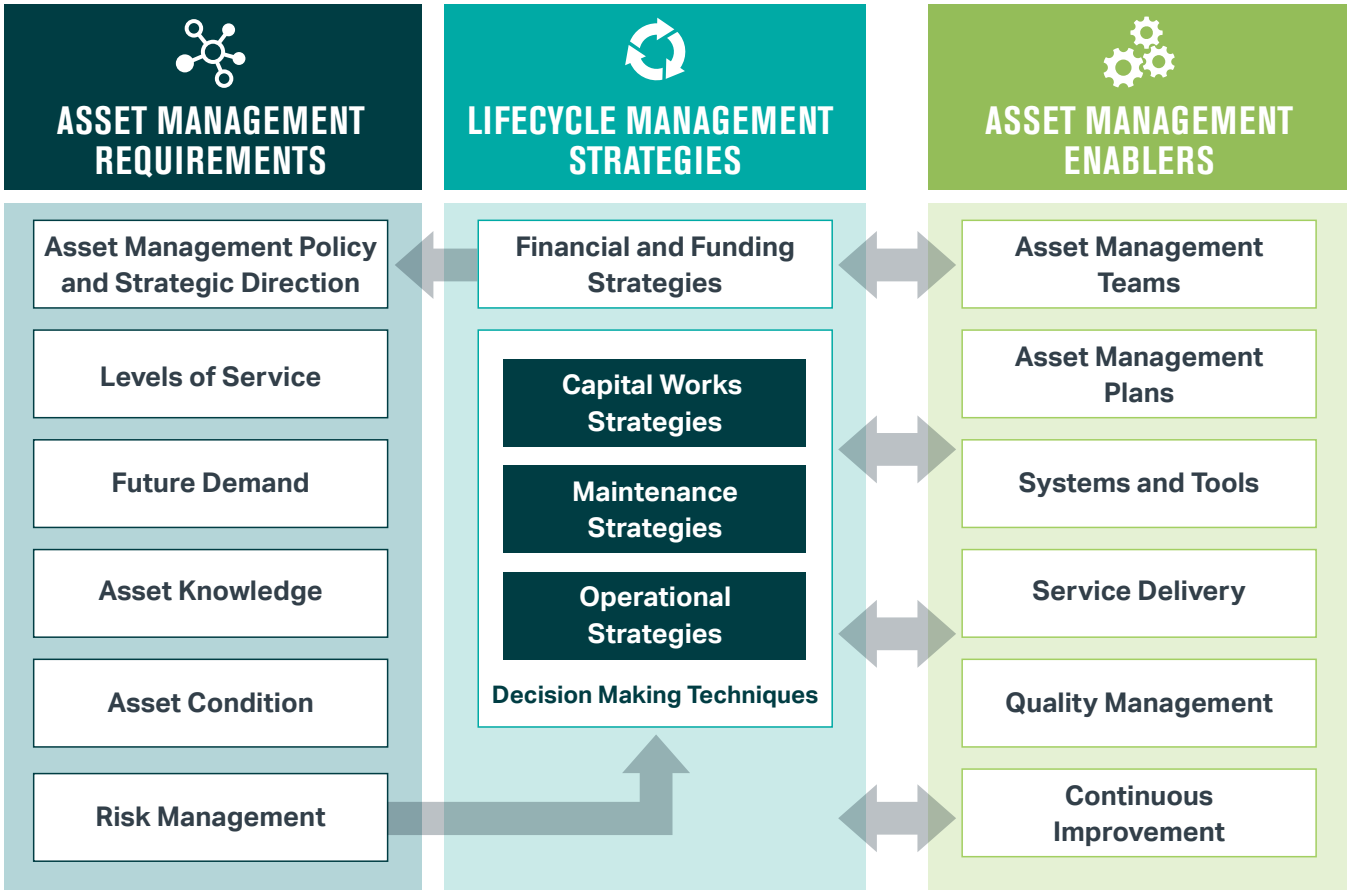
A risk-based approach recognizes the need, specifically with pressure pipe assessment, to carefully match the evaluation technique to the most probable cause of deterioration and the criticality of the pipe. While smaller diameter gravity sewers can be assessed using conventional CCTV technology, pressure pipes are far more difficult to evaluate and advanced appraisal technologies have considerable cost and deployment risk.

A staged risk-based approach brings clarity as to what degree of certainty is required on a pipe-by-pipe basis and the most advantageous technical approach to achieve that certainty. Applying a science-based understanding of material degradation has benefited many of our clients by maximizing the value of lower level assessments and increasing the accuracy and success of deployments involving advanced tools that can use a broad assortment of sensory and imaging techniques.

Our staff design and develop quality assurance programs for rehabilitation technologies that focus on minimizing construction footprints in congested urban settings. These include developing state-of-the art lining technologies, corrosion protection, and minimum excavation technologies such as pipe bursting, horizontal directional drilling, microtunneling boring machines and many more.

This unique balance of holistic oversight, knowing how materials fail, the most cost-effective means to ascertain condition and select pipe repair methods—as well as the recommended timing to align a program's risk profile with a utility's policies—has served our clients well both in North America and globally.

Sustainable Asset Management



Successfully managing assets at the lowest cost is critical to providing the level of service that customers demand. Our holistic approach to asset management allows our clients to manage and maximize the full lifecycle benefit of their assets. This results in sustainable customer service at the lowest cost.

We are a Corporate Member, Endorsed Trainer and Endorsed Assessor with the Institute of Asset Management (IAM). The asset management learning portal can be accessed at https://aecom.kineoportal.com.

How much do you need to reinvest in your system? What should you do first and why? Effective asset management helps you reach evidence-based answers to target the infrastructure at highest risk. We help our clients develop prioritized budgets as well as repair and replacement schedules, so they can project the long-term revenue stream necessary to support their infrastructure in a sustainable manner.

For more than 20 years, AECOM has been at the forefront of implementing asset management and sustainable infrastructure planning solutions. Our team of management, business, engineering and technical professionals has established a strong reputation and track record for delivering industry-leading solutions and for adding value to our clients' organizations. We utilize our experts from Canada, the United States, Australia, New Zealand and the United Kingdom to deliver world class solutions and best practice expertise.

National Water and Wastewater Benchmarking Initiative
Various Locations, Canada
The APWA award-winning National Water and Wastewater Benchmarking Initiative (NWWBI) was launched in 1997 and included a group of four municipal water utilities, AECOM, and the National Research Council of Canada. Today, AECOM's NWWBI boasts participation of 53 Canadian water and wastewater utilities.

The utility management model and the benchmarking methodology developed by AECOM (pictured at left) provides infrastructure managers with the means to link their goals, strategies, performance measures, and performance monitoring/reporting.

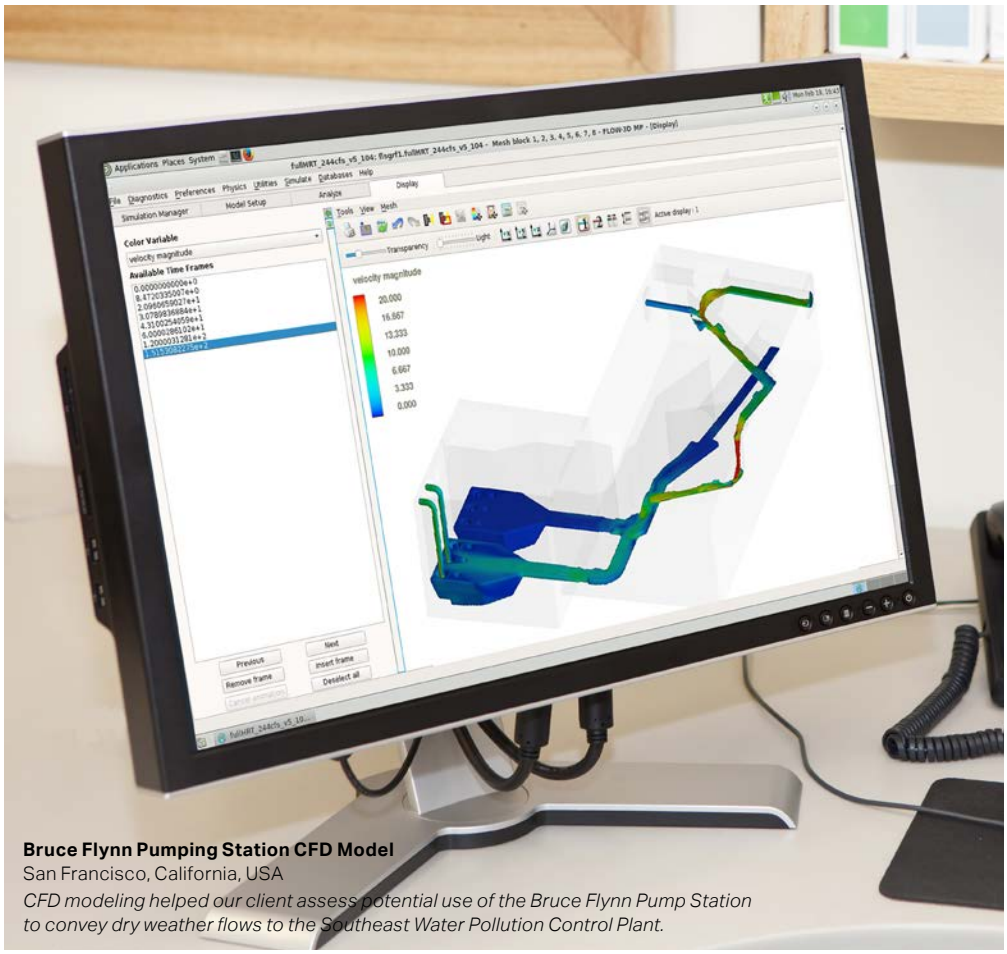
Asset management services include:

- **Strategic:** Strategic planning and facilitation, business process optimization and change management, as well as performance assessment and benchmarking.
- **Tactical:** Asset condition assessment and performance modeling, risk management and mitigation planning, and performance assessment and benchmarking.
- **Operational:** Design standards and specifications, quality assurance/quality control, failure analysis and forensic investigation.
- **Technological:** Information systems planning and implementation, data collection and management planning, and application development and integration.

AECOM is a Corporate Member, Endorsed Trainer, and Endorsed Assessor with the IAM. As such, we assist our clients in navigating the sometimes challenging asset management landscape and recently launched an asset management learning portal that allows our clients to acquire an Asset Management (AM) Certificate. The objective of the course is to prepare learners to take the IAM Certificate exam, which is the internationally-recognized qualification in asset management.

Southeast Water Pollution Control Plant
San Francisco, California, USA
Analysis of the hazards, vulnerability and risks associated with the San Francisco Public Utilities Commission water assets included more than 100 facilities, such as pump stations, pipelines and tunnels.

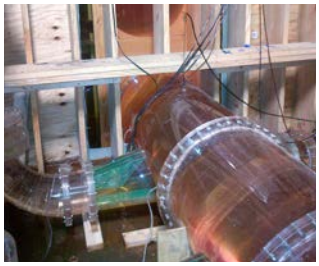
Water System Modeling



Bruce Flynn Pumping Station CFD Model
San Francisco, California, USA
CFD modeling helped our client assess potential use of the Bruce Flynn Pump Station to convey dry weather flows to the Southeast Water Pollution Control Plant.

From top:
Combined Sewer Overflow Long-Term Control Plan
Boston, Massachusetts, USA
Our hydraulic model resulted in saving the client $800 million in improvements and provided greater water quality benefits throughout Boston Harbor.

Lakeview Water Treatment Plant
Peel, Ontario, Canada
Real-time modeling helps optimize day-to-day facility operation to reduce energy consumption and cost.



Tunnel Dewatering Pump Station and Enhanced Clarification Facility
Washington, D.C., USA
As a cost-effective measure to mitigate owner risk, a thorough physical model of the 500-MGD/ 1,890-ML/d pump station was completed prior to detailed design. The physical model resulted in several changes to the concept design.

Water system models are a vital tool used to help communities optimize capital improvements and operations. Applying accurate models can save communities millions of dollars by helping to correctly size capital improvement efforts. Calibrating models to make sure they truly reflects the "real world" is key to the success of any model. AECOM has developed industry best practices for the calibration of our models, providing our clients the ability to make important capital decisions on the basis of our analyses.

Our teams deliver comprehensive expertise that incorporates modeling, mapping, engineering and scientific investigation to meet client needs and regulatory standards. AECOM has extensive capabilities and experience in the various types of modeling relevant to water and wastewater conveyance. Our modeling experts are skilled in a broad range of software, their ability to not only successfully navigate and run models, but also analyze the results, saves our clients money and helps them make the right decisions.

Water System Master Plan
Miami, Florida, USA
Modeling and mapping of Miami's water distribution and supply system helped determine the current system's capacity to deliver potable water and fire flows to Miami International Airport.

Our full service modeling capabilities include:

- CFD modeling
- Hydraulic and water quality modeling
- Physical modeling

The key to delivering successful models is to accurately reflect the system being modeled. AECOM has a systematic approach to achieve this and it results in a calibrated model that our clients can rely on to make key decisions. Our systematic approach focuses on:

- Data collection and integration with geographic information systems (GIS)
- Extensive field testing to support model calibration
- Model verification and calibration
- Validation of the model

Models are used to evaluate more than just the static hydraulic state of the system. We use models to:

- Enhance water quality
- Manage energy
- Optimize operations in real-time
- Optimize storage
- Prioritize replacement/ rehabilitation needs

DeKalb County Water and Wastewater Capacity Master Plan
DeKalb County, Georgia, USA
Flow and pressure tests are performed to assist with calibration of water distribution system models.

Master Planning

Capital Improvement Planning
Detroit, Michigan, USA
Currently engaged with the Detroit Water & Sewerage Department (DWSD), we are planning and implementing capital improvements aimed at improving levels of service. A risk-based approach helps DWSD maximize the value of system improvements for the residents of Detroit.

Expertise in asset management, hydraulic modeling, condition assessments and design is leveraged with each water and wastewater master plan to develop a long-term vision of infrastructure needs. We understand the complexity and detail required to integrate the components of a master plan that reinforces the principles of sustainability, resiliency, accountability and auditability, while providing efficient and effective water and wastewater services.

Each master plan needs to be tailored to the specific needs of the community; no two master plans are alike. Our approach and relevant experience, combined with the specific expertise of our staff, allow us to deliver a master plan tailored to the unique needs of each community — whether it is for shorter term capacity needs or longer term water supply or wastewater disposal planning.

Close collaboration with our clients helps us understand their levels of service standards and requirements to develop master plans that clearly articulate infrastructure

Various Capital Planning Projects
Toronto, Ontario, Canada
We have provided modeling and master planning services to the Greater Toronto Area's 3 million residents.

From top:
Water and Wastewater Capacity Master Plan
DeKalb County, Georgia, USA
The master plan will be used as the roadmap for the county's water and wastewater service for the next 30 years.

Capital Improvement Program Engineering Services
Chicago, Illinois, USA
As part of a joint-venture, our staff developed a water system master plan for the Chicago water system that serves 5.5 million customers.

needs in a defensible way. Tailored approaches—from initial concept through to detailed alignments—are fully auditable and articulate how key decisions are made, what circumstances trigger projects to commence, and what schedules achieve just-in-time infrastructure delivery. A master plan is not a standalone document, it is a key part of the ongoing process of infrastructure renewal and delivery. For us, the master plan and associated deliverables are living documents that form the road map for infrastructure delivery.

AECOM brings knowledge and experience of local, regional and global standards, processes and procedures. Through our global technical practice network we have established essential working relationships between our global experts to nurture and promote sharing and collaboration. For master planning, in particular, knowledge of local issues need to be combined with industry and global trends to really understand infrastructure needs that embrace socio economic, technical and financial realities. Our approach is founded on local execution supported by global expertise.

Private Water System Master Planning and Design
McKenzie County,
North Dakota, USA
A water distribution and water disposal system plan was developed for an industrial service area covering 800 square miles/2,048 square km, including multiple pressure zones.

About AECOM

AECOM is the global infrastructure leader, committed to delivering a better world. As a trusted professional services firm powered by deep technical abilities, we solve our clients' complex challenges in water, environment, energy, transportation and buildings. Our teams partner with public- and private-sector clients to create innovative, sustainable and resilient solutions throughout the project lifecycle — from advisory, planning, design and engineering to program and construction management. AECOM is a Fortune 500 firm that had revenue of $16.1 billion in fiscal year 2025. Learn more at aecom.com.

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