Establish an operation water footprint.

Comply with legal rules and requirements.

Conduct a site-level assessment and establish corresponding actions.

Be proactive and engage stakeholders for collaborations.

Be proactive and engage stakeholders for potential collaborations.

Regularly review water management plans; revise as needed.
Managing Water Use and Recovery

A water management program needs to not only focus on recovery, but also on conservation, environmental impact, and planning. Water is integral to aggregate operations. As the need for aggregate continues, the need for water is necessary. “All water should be recycled from tailings ponds, runoff, and wheel washes wherever possible,” says Lance Griffin, director of aggregate operations for Cemex in Texas and New Mexico. “Used water should be always looked for a better management and conserve the limited natural resource within your operation.”

Follow sound engineering practices by keeping a plant’s flow, design, and operation simple. “Prepare for breakdown by making the plant as simple to repair as possible and look at current and future water needs,” Griffin says. “Many water recovery plants are undersized and don’t perform to expectations. A complete water audit is a great plant to start when considering a water management system.”

At LafargeHolcim, water management plans in place are reviewed every five years to get a better understanding of consumption. Water flow diagrams are put together, indicating all points of consumption. “Plants change, operations change, and things move around,” says Joel Nickels, head of land and environment in the United States for LafargeHolcim. Reviewing the plans and water flow provides an accurate snapshot of water consumption. “It has provided good learning,” Nickels says. “We have found leaks in water lines. Repairing those has made a big difference.”

Nickels points out that, at one operation, nearly 1 million gallons were saved by repairing water leaks. “We recognized through metering of water that we were consuming more water than we were putting through the plant,” he says. “By doing a diagnosis, we have found areas to improve some places we didn’t know.”

Now, the level of awareness about water management and its importance is quickly being raised as an industry, especially because it is quantifiable, explains Tom O’Brien, engineer and consultant for Paschal Associates LLC. “Fifteen years ago, it was just dirty water,” he says. “Now, it has become a cost center and a point of focus. We can now evaluate a plant’s waste effective (fluent) stream and create a model for necessary fines recovery equipment, including capital and operating costs.” Ultimately, good water management can contribute to a producer’s bottom line. Although there may be some initial investment in the equipment necessary for fines recovery, there is a return on investment because there is a lower operating cost in handling all the water, O’Brien says.

“Some of the larger operations I service will use up to 35,000 gallons per minute,” O’Brien says. “If you are not using some kind of recirculating system, that is a lot of water. The amount of waste or mud washed off can be as high as 500 tons per hour. When you get into those volumes, it just makes sense to recirculate it.”

Regularly conduct a water audit to determine how and where water is used at your operation. Look for areas where the most consumption is taking place and determine if there are any opportunities to optimize use and efficiency. Use opportunities such as harvesting rainwater or using stormwater or recycled water for road dust suppression or to wash lightweight aggregates. Recycling water minimizes the risk that an operation might have to curtail operations as a result of drought conditions or increasing water costs. Be sure to inspect equipment and waterlines for leaks or worn-out parts that may be contributing to excess use.

Compose a brief narrative, photographs, and site plan describing how the plant captures and uses stormwater. Provide documentation that there is a system in place to measure the volume of stormwater harvested and used in plant operations. Putting together a water flow diagram with all points of consumption can make a big difference by understanding where the water is going. At LafargeHolcim, the producer saved about 1 million gallons by repairing water leaks at one operation. Water metering showed that more water was being consumed than being put through the plant. The plant identified that water was going to unanticipated places.

Water is integral to aggregate operations. As the need for aggregates grows and the area community and need for water. Adequately plan so the water recovery plant meets expectations. To help improve efficiencies and meet the demands of a booming Texas economy, Cemex’s Balcones Quarry installed a base stone circuit, a state-of-the-art tertiary washing and crushing plant, a new mobile repair shop, and an environmentally sensitive oil storage area, along with overall quarry and plant improvements. The new water recycling plant uses 90 percent less water annually than previously used by the aggregate operation’s wash plant.

Prior to planning a new water management system or reusing or recycling water, companies should understand applicable laws, regulations, permitting, and other requirements for local operation and design needs. Some states do not allow recycled water content in DOT- or state-specific jobs, but other states allow up to 23 percent recycled content water in the mix. In LafargeHolcim’s Northeast region, the operations look at ways to put water consumed back into concrete processes. Starting at 1 to 3 percent of water put back into the concrete, it was 13 percent by 2015. However, be cautious of legal constraints—such as in Washington, D.C., where virgin water must be used for concrete.

Water management may not have the same meaning to everyone, so it is important not to assume employees view water management in the same way as you. Educate employees on water conservation, and ensure the management team shows a commitment to conserve. The reduction in water consumption reduces the burden on local water resources and can also reduce water costs. This can be a significant operational expense, particularly in areas affected by drought. Even small operations can conserve water by simply fixing leaks, turning off water systems when not needed, and by educating employees on proper water and dust management.

Operate for current and future needs

Plan for current and future needs. Incorporate water conservation into the design and construction of new facilities. Conduct a water audit to determine how and where water is used at your operation. Look for areas where the most consumption is taking place and determine if there are any opportunities to optimize use and efficiency. Use opportunities such as harvesting rainwater or using stormwater or recycled water for road dust suppression or to wash lightweight aggregates. Recycling water minimizes the risk that an operation might have to curtail operations as a result of drought conditions or increasing water costs. Be sure to inspect equipment and waterlines for leaks or worn-out parts that may be contributing to excess use.

Continually improve water usage by establishing how and why it is being used and trying to avoid discharge of water. Set parameters and try to partner or work with other organizations or operations at a regional level to develop better efficiency. A water management program needs to not only focus on recovery, but also on conservation, environmental impact, and planning. All water should be recycled from tailings ponds, runoff, and wheel washes whenever possible. Vehicle–washing areas should also be paved so that the bottom is sealed, because the wash water cannot be discharged to surface or groundwater.

Effective Water Management

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Voices of Experience

**Lance Griffin**

At the Cemex Balcones Quarry, the operation recently installed a water recycling plant to protect critical local water resources and supply the Balcones wash plant with consistent wash water for its aggregate plant.

Lance Griffin, director of aggregate operations for Cemex in Texas and New Mexico, says the company recognizes the importance of water to local communities such as the 2 million residents in the New Braunfels area where the Balcones Quarry is located. He says that although an emphasis on water management and conservation has been a high priority at the operation for many years, New Braunfels is one of the fastest-growing cities in the nation, according to the U.S. Census Bureau — making good water management a necessity. "Sustainability is integrated and embedded into our day-to-day operations and business strategy," Griffin says. "A new water recovery plant was the right thing to do."

The Balcones system uses proven technologies paired with what Griffin says is "common-sense" engineering and full automation. The plant consists of two 60-foot thickeners, two banks of cyclones — one bank for manufactured sand production and one bank for ultra-fines production — twin, 44-inch sand screws, a dewatering screen, pinch valves, pumps, and a mixing and dosing system. All of the components were integrated into one automation platform, allowing for total plant control from any location. The water recycling system uses 90 percent less water annually than the previous quarry wash plant. It recycles 12,000 gallons of water per minute for use in the aggregate wash plant.

"Any organization looking to install a water management system needs to look at their current and future water needs," Griffin points out. "Investigate existing plants, aquifers, and technology," he adds. "Before planning the new system, companies should understand the applicable laws, regulations, permitting, and other requirements for local operation and design needs."

**Joel Nickel**

The key takeaway when it comes to water management is to be proactive, says Joel Nickel, U.S. head of land and environment for LafargeHolcim. "Water will be a scarcity in the United States, if it isn’t already like in some parts," he says. "It’s good for the industry to start working toward trying to recycle and reduce water consumption (rather) than be regulated in the future."

One challenge is to find a uniform approach that works everywhere. "I look at the U.S. as 50 different countries with 50 different rules," Nickels says. "We manage this by having tracking compliance documents in our environmental management documents that track the rules of each state."

LafargeHolcim uses a six-step process as its water management (WM) protocol. First, comply with legal rules and requirements. Next, establish an operation water footprint. "Know how much water you are using, discharging and recycling," Nickel says. "Third and fourth, conduct a site-level assessment and establish corresponding action."

"After we understand where water is going, we want to see if there are any ways to improve it," Nickels points out. "Be proactive and engage stakeholders. Talk to the plant guys, the local communities in which you operate, and local water districts to see if there could be any collaborations."

To that end, the LafargeHolcim Morrisson, Colo., operation stores water for the town. "It has a need for water storage, and we have an old pit," Nickels says. "In the arid west, we are creating reservoir space in mined-out sand and gravel operations."

Performance improvement is the fifth WM protocol step. "Set parameters from a regional level and try to work with operations," Nickels says. The sixth step is to regularly review WM plans and make changes where necessary. "We review the plans and flow diagrams every five years," he adds, noting that updates ensure accuracy.

**Tom O’Brien**

Compared to other mineral industries, the aggregate industry is still relatively young when it comes to fines recovery and treatment. "Prior to the last 20 years, the aggregate industry did not need to use any kind of water treatment for fines recovery," says Tom O’Brien, mining engineer and engineer/consultant with Paschal Associates LLC. "In the last 20 years, we have been forced to do it. Some of the reasons are economic, real estate, and environmental."

The industry’s slow adoption of fines recovery and water treatment is also a result of its fractionation.

"Our industry is so diverse and spread out," O’Brien says. "There are rock quarries all over the U.S. These quarries are owned and operated from large corporations all the way down to small, family-owned operations." For these reasons, fines recovery and water treatment are more slowly being incorporated as best practices.

Water management essentially breaks down into two overall categories — discharge water and processed water, O’Brien says. "If more water is generated than a quarry can hold, it has to be removed from the property," he says. "In some cases, that water has to be treated with specialty chemicals and must be discharged in conditions in accordance with the government."

Water used to wash aggregate to meet state specs must also be dealt with; what producers do with this processed water varies. "Fifty years ago, quarries were putting the water into a big pond or somewhere where the fines would settle and the water would recirculate," O’Brien says. "Now, environmental regulations have become more stringent, and there are more liabilities to using big settling ponds — and they have to be repeatedly cleaned."

Economics plays into water management. "Water is a resource, and it is monitored in certain areas," O’Brien says. "How much water you pull out of the ground becomes an economic driver."