Two of our core areas: the DJ Basin (left) and the Marcellus Shale (right), along with our other onshore U.S. operations, use hydraulic fracturing for the production of oil and natural gas.

Respecting Water Resources

We recognize the importance of water quality and availability. Developing energy resources can require large volumes of water, and significant energy is needed to access, treat and deliver water. With increasing demand for energy and water, we are actively managing and conserving water resources to minimize the impact of our operations.

Life-Cycle Water Management Strategy

Water is used during many oil and natural gas activities, including drilling and completion of new wells, maintenance and upgrades on existing wells, site construction and sanitary purposes.

In 2011, Noble Energy implemented a Life-Cycle Water Management program for our DJ Basin operations focused on responsible sourcing, transport, use, treatment, recycling and disposal of water resources. This program supplements our ongoing efforts to collaborate with communities as we work to minimize consumption, properly dispose of produced water, and test and implement new water-treatment and -reuse technologies to address potential environmental and community impacts. We employ professionals with expertise in water resources to work with the community to achieve water management objectives. Efforts are underway to implement this strategy globally. The complete range of water management operations addressed by this program is described on page 30.

Our Water Use in 2011

In 2011, our U.S. operations used an estimated 19 million barrels of water – approximately 7 million of these barrels were reused during subsequent drilling and maintenance activities.

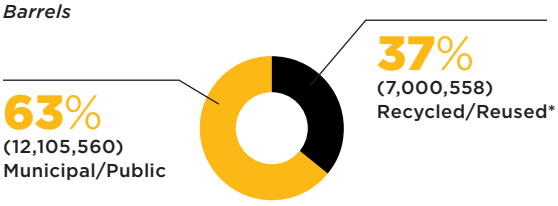
While over 12 million (of the 19 million) barrels of water were obtained from public supplies, we are seeking to reduce our acquisition of municipal or public supplies as part of our water management strategy (see page 30).

We also continue to evaluate the viability of alternative water sources (such as brine aquifers) to minimize our use of public supplies.

In 2012, we participated in the Carbon Disclosure Water Project as we continued to enhance measurement and transparency of our water use.

U.S. Sources of Water

Barrels



*Water is recycled and reused from Noble Energy produced water

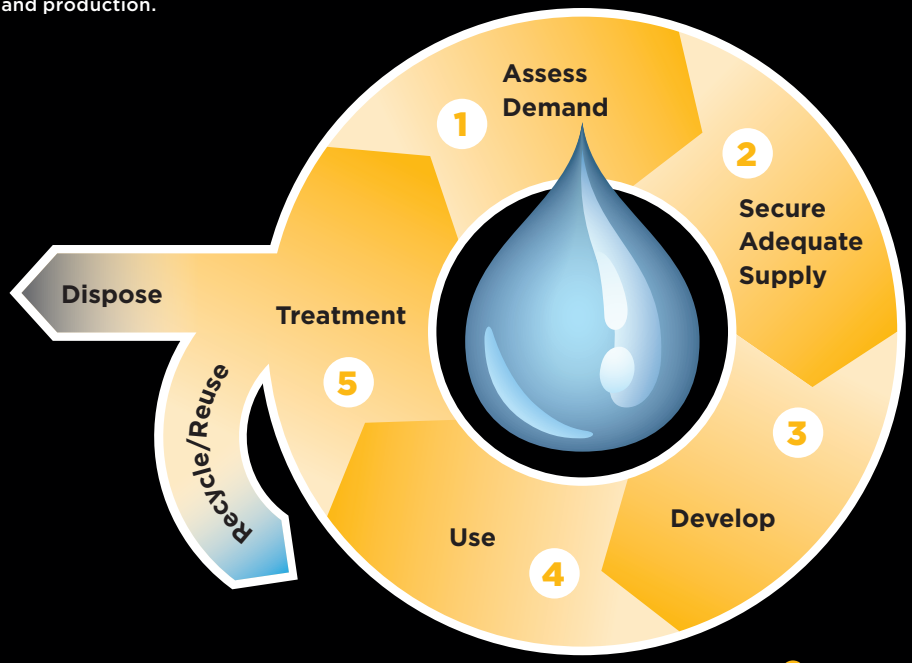
In 2011, Noble Energy implemented a Life-Cycle Water Management program for our DJ Basin operations, reflecting our commitment to responsible sourcing, transport, use, treatment, recycling and disposal of water resources. We plan to expand this program to all of our onshore operations.

1 Assess Demand

Our geologists and engineers identify multi-year water demand for drilling and production.

2 Secure Adequate Supply

Our approach to securing water rights seeks to strike a balance between effective, long-term and reliable water supply planning to meet our operational demands with the economic, social and environmental needs of landowners and surrounding communities. We work with local landowners to secure necessary water rights and use water resources in compliance with applicable laws and regulations.



3 Develop

Once we secure water, we develop water transport and storage infrastructure. Transportation and storage infrastructure – such as pipelines, pumping facilities, tanks and ponds – are designed to meet the specific physical and operational circumstances in each area of operation.

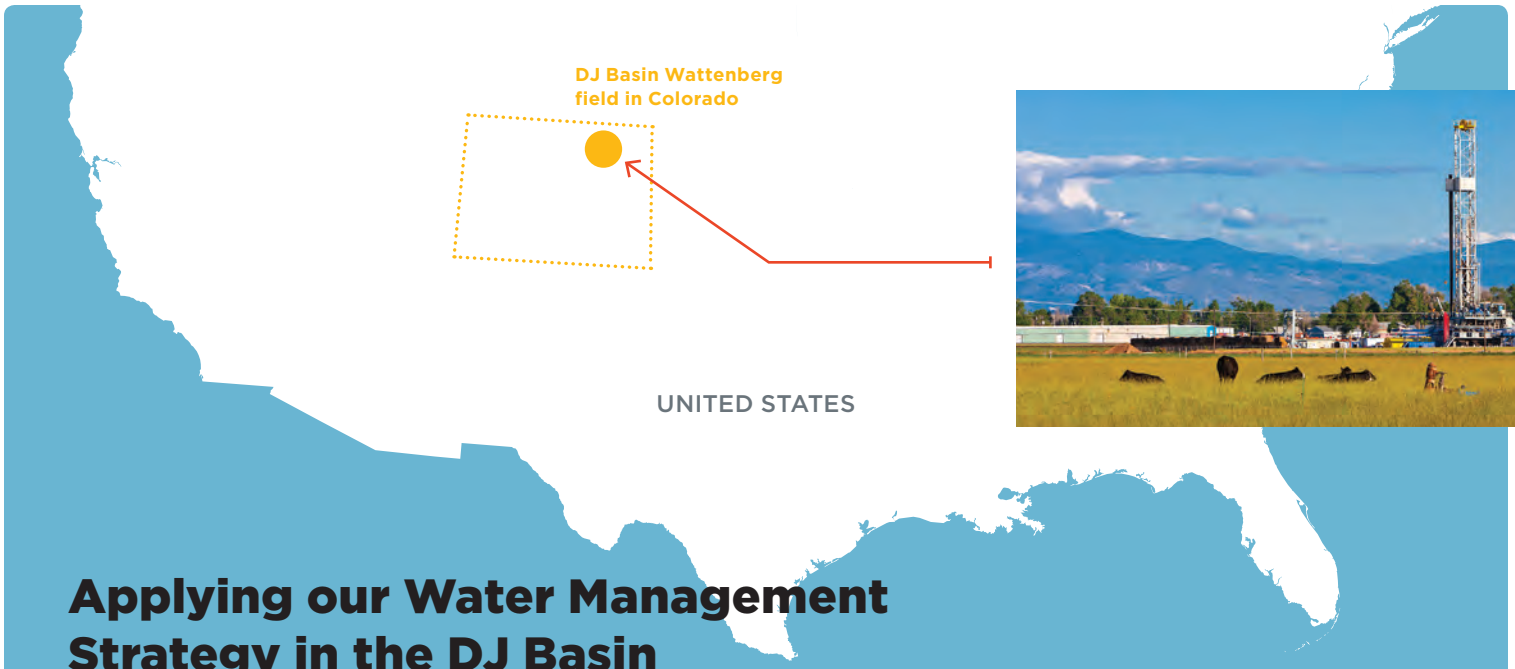
4 Use

Water is used in drilling, well completion (which includes hydraulic fracturing – see page 26) and workover activity. Site-specific water requirements can fluctuate based on a number of factors and are coordinated with water management teams and field personnel to ensure adequate supply. Effective water management also includes an accurate measurement and reporting system.

5 Treatment, Recycling and Reuse

We apply proven water treatment, recycling and reuse processes to treat wastewater captured as flowback and water produced during operations* to reduce the amount of fresh water we consume and minimize our "hydrologic footprint." These water management efforts optimize capital, water acquisition and transportation costs; minimize the amount of residual wastewater that is typically disposed of in deep injection wells; and contribute to reducing our impact on the environment and community.

* Over the lifetime of an oil or natural gas well, water is regularly brought to the surface in the form of either flowback water or produced water. Flowback: water injected into the well during drilling that returns to the surface. Produced water: naturally occurring, highly saline water that can be produced (come to the surface) during the well's life cycle.



Applying our Water Management Strategy in the DJ Basin

Our Wattenberg field in the DJ Basin of Colorado is our largest onshore U.S. asset. This area utilized an estimated 8.5 million barrels of water in 2011. In an effort to secure adequate water and avoid competing with public water supplies, we source water from systems that are unsuitable for drinking purposes. This includes brine aquifers, grey water or produced water.

We also reduce the quantity of water transported by truck to each site by strategically locating storage ponds and tanks, and utilizing pumps and pipelines as alternative means of water delivery. These water-supply facilities help reduce our overall footprint by serving multiple sites and reducing the number of truck trips needed to transport water. In fact, in 2011, we reduced our truck mileage by approximately 5 million miles in the Wattenberg field, yielding an annual reduction of 58,000 tons of carbon dioxide (CO_2) emissions.

Our engineers and operations staff for the DJ Basin are continually identifying and assessing opportunities to conserve water. Enhancements implemented since fourth quarter 2010 resulted in a 10 percent reduction in the volume of water consumed per well in the region.

COLORADO ENERGY WATER CONSORTIUM

In 2011, Noble Energy entered into a collaborative agreement with Colorado State University, the state government, industry partners and environmental NGOs to study the nexus between energy and water-related issues. Our initial $250,000 contribution established the Colorado Energy Water Consortium. Noble Energy experts will participate in each research project, serve on the Consortium's board of directors and coordinate activities with other energy companies. The Consortium will also include engineering corporations, environmental organizations and government agencies. We are seeking ways to expand this multi-stakeholder approach to research water and energy issues in the other regions where we operate.

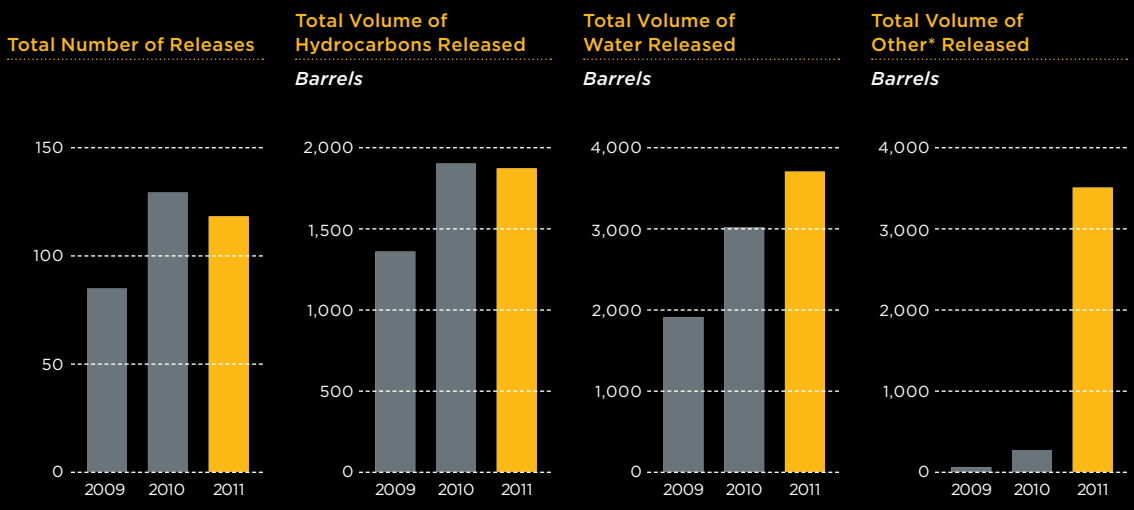
Initial activities of this group include the implementation of a Water Intensity Study and Geographic Information System (GIS) analysis of water quantity and quality in the Wattenberg field. The Consortium also outlined research projects to analyze water use during horizontal well fracturing activities and associated impacts to the local environment and communities in the Wattenberg field. In addition, they will analyze impacts of other energy and exploration activities on water resources in the field, such as the full life-cycle of water procurement, use, treatment, recycling and disposal.

ONSHORE SPILL PREVENTION AND RESPONSE

Our Spill Prevention, Control and Countermeasure Plans outline necessary mechanical integrity testing, site design, inspections, training and response procedures. If a spill occurs during field activity, personnel are trained to call our incident hotline to initiate an incident response, including any regulatory reporting requirements. If the problem is something that can be fixed safely and immediately, we proceed with this course of action. If the spill is large enough to require remediation, we excavate the soil where the spill occurred, test it, verify that all contaminated soil has been collected and haul it to an approved landfill. We then replace the remediated area with clean soil.

Noble Energy tracks all spills over one barrel and reports any spills that trigger the state reporting threshold, or that extend outside secondary containment and reach water.

U.S. REPORTABLE SPILLS



* Other: non-produced fluids on site such as diesel, chemicals and drilling mud.

We are committed to a baseline water sampling program.

Protecting Surface and Groundwater Resources

We utilize secondary spill-containment techniques to protect against contamination in the event of a spill during drilling activity, as well as additional storm water controls to manage runoff. At locations where we are past the drilling phase and are producing, we rely mainly on secondary containments, such as steel rings and liners underneath newer tank batteries, to limit the potential for contamination. To prevent the migration of fracturing fluids, we construct the wellbore with multiple layers of casing (see page 28) to maintain a buffer of more than one foot of steel and cement (total thickness varies based on the geologic conditions of the region) between the wellbore and the surrounding rock. We employ this process to help ensure that onshore natural gas development activities do not pose a meaningful risk to water supplies.

Additionally, prior to drilling selected oil or natural gas wells in the DJ Basin, we hire third-party environmental consultants to assess the baseline water quality at existing water wells. The primary oil and gas constituent we test water for is methane. Methane is the most abundant component of natural gas and, as such, serves as an indicator of potential oil and gas contamination. We also test for a range of water quality parameters, such as total dissolved solids, as well as benzene, toluene, ethylbenzene and xylenes. This information is then shared with landowners to establish a baseline condition for the existing groundwater. If we suspect a risk of impact to groundwater from our activities, we proactively sample nearby water wells.

As we begin operating in the Marcellus Shale in 2012, we will work with our joint venture partner, contractors and service companies to develop community partnerships and initiatives to address local water-related concerns. We also plan to conduct baseline assessments of drinking water quality and quantity to measure domestic and stock water wells within 2,500 feet of our wells. See pages 29–31 to read about our approach to managing water supply and quality.