

BEST PRACTICE 11: Rules for New Construction

- Programmatic and control best practice
- Utility operations - implemented by water utilities
- Customer participation – Significant; builders (who may or may not be water customers) are required to install water-efficient fixtures and appliances in new construction

Overview

Many Colorado communities with high growth rates anticipate increasing water demand that will exceed current supplies. Water conservation measures that are “built in” to new buildings can help slow the growth of new water demands. This best practice describes water efficiency specifications that water utilities can make voluntary or mandatory for new residential and non-residential development within their service areas.

This best practice presents a framework for incorporating “built-in” indoor water efficiency in all new construction. Increased interest in “green” building and green building programs like LEED³⁶ presents opportunities for water utilities to promote water efficiency in new construction. However, green building programs including LEED are voluntary and have largely focused on energy conservation and in some cases water efficiency was only added as an afterthought. Fortunately this situation is improving as new specifications are rolled out.

Why a Best Practice?

The concept of “smart from the start” when applied to water conservation means that new properties that join a water system are efficient at the outset. This is a best practice because it costs very little to implement and it means new customers will use significantly less water and will not require water conservation interventions for the foreseeable future. New customers benefit from reduced water bills, the water system benefits from reduced growth in demand, and scarce conservation program funds can be directed toward existing customers.

State Planning Requirements

Colorado statute requires that all covered entities (water providers that deliver more than 2,000 acre-feet per year) file a water conservation plan with the Colorado Water Conservation Board (CWCB). Entities that do not have an approved plan on file are not eligible to receive grant funding from the State. Under this statute, one of the water saving measures and programs that must be considered in a conservation plan is, “Regulatory measures designed to encourage water conservation.” [CRS 37-60-126 (4) (a) (IX)].

Applicability

This best practice can be implemented by any municipality. Because this best practice targets new construction and may require changes to local building codes, enactment of this best practice may require a vote by city council or other local governing body outside of utility purview. The level of anticipated new growth is a factor to consider. Utilities anticipating

³⁶ Leadership in Energy and Environmental Design

significant growth and new construction in their service area will benefit most. Utilities nearing build out or with minimal growth projections have less to gain from this best practice.

Implementation

Mandatory implementation of this best practice is recommended. Participation in green building programs such as WaterSense and LEED is voluntary and encouragement from a water utility to participate in a voluntary program is unlikely to measurably increase participation levels. If water utilities wish to ensure a high degree of water efficiency is built into new construction, the requirement must be mandatory.

Residential

The EPA WaterSense program has created a detailed specification for new homes which includes an inspection certification process to ensure all required conservation measures are actually put in place. *Utilities implementing this best practice can simply require that all new homes joining their water system meet or exceed the EPA WaterSense specification.*



The EPA WaterSense new home specification is too detailed to present it its entirety here, but it can be downloaded from: www.epa.gov/watersense/docs/home_finalspec508.pdf.

The EPA WaterSense new home specification includes the following mandatory criteria all of which are verified through an inspection process.

Indoor Efficiency Criteria

- **Leaks** – No detectable leaks from any fixtures, appliances, equipment.
- **Service Pressure** – Maximum of 60 psi. Pressure reducing valve may be necessary.
- **Hot Water Delivery System** – No more than 0.6 gallons of water shall be collected from a hot water fixture before hot water is delivered.
- **Toilets** – WaterSense labeled 1.28 gpf HETs.
- **Bathroom faucets** – WaterSense labeled 1.0 gpm aerators.
- **Kitchen sink faucets** – 2.2 gpm max flow (1992 EPA Act standard)
- **Showerheads** – WaterSense labeled 2.0 gpm showerheads.

If installed by the builder, the following components are also mandatory and verified through inspection:

- **Dishwashers** – ENERGY STAR qualified
- **Clothes washers** – ENERGY STAR qualified with water factor less than or equal to 6.0 gallons per cycle per cubic foot of capacity
- **Evaporative cooling systems** – Maximum of 3.5 gallons per ton-hour of cooling. Blowdown based on time of operation. No once through/single pass systems.
- **Water softeners** – Self-regenerating water softeners shall meet NSF/ANSI 44 standard.
- **Drinking water treatment systems** – Must meet applicable NSF/ANSI standards.

Outdoor Efficiency Criteria

The WaterSense New Home specification has outdoor criteria that apply to the front yard and any other outdoor areas improved upon by the builder. Because this best practice is focused on indoor use the details of the outdoor component are not covered here, but instead can be found in Best Practice 8. The full WaterSense New Home specification can be downloaded from: www.epa.gov/watersense/docs/home_finalspec508.pdf.

Non-Residential

Specifying built-in water efficiency in the commercial, institutional, and industrial (e.g. non-residential) sector is more challenging than for the residential sector as there is nothing analogous to the WaterSense New Home specification. Since each type of non-residential customer (i.e. hotel, school, factory, office building, supermarket, etc.) has a different set of water using fixtures and appliances an over-arching specification program that covers the entire sector is unlikely to emerge.

There are specific actions that water providers can take to ensure that new non-residential buildings include indoor water efficient technologies at the outset. The following actions are best practices for the non-residential sector.

- 1) Require that WaterSense labeled toilets, urinals, faucets, and showerheads be installed in all new non-residential buildings.
- 2) WaterSense plans to start labeling commercial equipment such as pre-rinse spray valves in the near future and these new specifications should be promptly incorporated into efficiency mandates.
- 3) Prohibit equipment that uses single-pass cooling unless there is no other alternative.
- 4) Specify high-efficiency commercial equipment wherever possible. The 2008 Watersmart Guidebook - A Water-Use Efficiency Plan Review Guide for New Businesses (available for free download from the Alliance for Water Efficiency – www.a4we.org) offers excellent guidance on water efficient equipment for 19 different types of businesses.

Additional Efficiency Specifications

The following programs and specifications may be useful when developing water efficiency regulations for new construction.

IAPMO Green Building Mechanical and Plumbing Code Supplement

IAPMO (The International Association of Plumbing and Mechanical Officials) has created a code supplement specifically supporting sustainable water using fixtures.³⁷ The supplement details proper use of high efficiency products, grey water and conservation of hot water.

The Green Building Mechanical and Plumbing Code Supplement is not a greener form of the Uniform Plumbing Code (UPC); it acts as a supplement to work with the UPC. The UPC is a recognized plumbing standard. It is a model code adopted by many communities. The green supplement basically works to reduce hindrances to conservation from conventional codes.

³⁷ The supplement was developed by a committee consisting of 25 conservation specialists, plumbers and contractors as well as code inspectors.

IAPMO states that the Green Supplement “serves as a repository for provisions that ultimately will be integrated into the Uniform [Building] Codes (UBC).”

Still in Progress - ASHRAE SPC 191 - Standard for the Efficient Use of Water in Building, Site and Mechanical Systems

ASHRAE, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, is developing a water efficiency standard for buildings that will, “provide baseline requirements for the design of buildings, landscapes, and mechanical systems that minimizes the volume of water required to operate HVAC systems, plumbing systems, common building special process systems, cleaning systems and irrigation systems.”

Once completed, the ASHRAE standard may be an effective specification tool for Colorado water providers.

Water Savings and Other Benefits

How to determine savings

Residential

The EPA estimates that the indoor use in a WaterSense new home will be 101.6 gallons per household per day per home versus 128.1 gallons per day for a standard new home. This represents a 20.7% savings in indoor use. Annually it is estimated that each WaterSense new home will save 9,672 gallons (indoors). Table 4-17 shows a side-by-side comparison of WaterSense water use and conventional new home waster use.

Non-Residential

Non-residential savings depend upon the type of building and the equipment installed. Specific water savings must be estimated on a site by site basis, but it is not unreasonable to expect reductions of 20% or better can be achieved in non-residential buildings through efficiency regulations.

Table 4-17: Estimated water savings from EPA WaterSense New Home Specification ((EPA WaterSense Program 2009 WaterSense Single-Family New Home Specification Supporting Statement)

Indoor Feature	Standard Home Water Use	Standard Use (gal/house/day)	WaterSense Criteria	Expected Water Sense Use (gal/house/day)	Expected Water Savings (gal/house/day)
Toilet	1.6 gpf	21.0	1.28 gpf	16.8	4.2 (20%)
Bathroom faucet	2.2 gpm	29.1	1.5 gpm	27.6	1.5 (4.8%)
Shower	2.5 gpm	25.4	2.5 gpm	25.4	0 (0%)
Hot water delivery	~10 gpd waste		Assumes 20% water savings for improved design	8.0	2.0 (20%)
Dishwasher	8.6 gallons per load	2.7	5.8 gallons per load	1.8	0.9 (33%)
Clothes washer	39.6 gallons per load	39.9	22.0 gallons per load	22.0	17.9 (45%)
Total Indoor		128.1		101.6	26.5 (20.7% savings)

Savings Assumptions and Caveats

The effectiveness of programs for new construction will depend on several factors. If programs consist of voluntary certifications (such as LEED), the number of new accounts with conservation measures in place will be significantly smaller than programs with mandatory standards. Green building programs encompass far more than water conservation, and in a points-based system, buildings may qualify as “green” without implementing water efficiency.

The WaterSense new home savings projections presented in this best practice do not include outdoor use. Since the WaterSense new home specification includes an outdoor component, additional water savings (beyond those shown here) may be achieved.

Other Benefits

In many cases, saving water has the added bonus of saving energy. This is due to the fact that a significant amount of energy use goes to heat water in the building and in some cases to pump water from the source. A 2003 study found that hot water use could be cut by 20% using high efficiency fixtures (DeOreo 2003). Western Resource Advocates released a Colorado-specific white paper about the energy intensity of four Colorado cities’ water supplies and found that in many cases water conservation results in energy conservation as well (WRA 2009), making the case that water conservation = energy conservation.

Costs

Utility Costs

Utility costs are limited and minimal. Utilities must only bear the costs of implementing the regulations themselves. Differential costs associated with installing efficiency fixtures and equipment fall on builders and customers. The cost of adopting ordinances, codes, and rules varies by agency.

Enforcement costs for any new rules can add to costs. WaterSense includes verification as part of the program and this is included in the cost of WaterSense certification. If water conservation standards are incorporated into the local building code, enforcement will be part of the building department’s permit process.

Customer Costs

Customers and other stakeholders bear the cost of rules governing new construction. Builders and buyers/occupants each face different costs and savings potentials from rules for new construction. The commercial sector sees an additional disconnect in costs for green building in that building owners may bear the costs associated with green building but tenants may reap the rewards in the form of lowered utility bills.

Builders may face increased costs from constructing green buildings, although these costs are likely to decrease in the future. A study on the costs associated with LEED certification found that green building practices added 1.5% to 3% to the so-called soft costs (such as design and certification) of building a commercial building. Complete costs, from design through implementation were estimated to be 4% to 11% (Northbridge Environmental Management

Consultants, 2003). The EPA calculates additional costs associated with WaterSense New Home Specifications to range from \$700 to \$3,000. Table 4-18 shows the breakdown of WaterSense costs.

Table 4-18: Costs associated with EPA WaterSense New Home Specification ((EPA WaterSense Program 2009 WaterSense Single-Family New Home Specification Supporting Statement)

WaterSense Criteria	Incremental Cost Estimate
Service pressure regulating valve	\$0 to \$150
WaterSense labeled HETs	\$0 to \$100
WaterSense labeled faucets and aerators	\$10
Efficient hot water delivery system	\$0 (core plumbing)
Hot water recirculating system	\$2000
Hot water manifold	\$200
Energy Star qualified dishwashers	\$30
Energy Star qualified clothes washers	\$270
Turf and mulching	\$300
Third-party certification of home	\$50 to \$400

Green building occupants will likely see savings in the form of reduced utility bills. The EPA estimates that WaterSense homes save \$100 per year in utility costs over typical new homes and \$200 in utility costs over a typical older home. The payback period ranges from 5.6 to 30.6 years depending upon factors such as water rates and water heating methods (gas vs. electricity).

Resources and Examples

Resources

The State of Colorado Department of Local Affairs (DOLA) is a good source of codes and plans for Colorado communities. The DOLA website offers links to green building programs in the state. Links and details on the Steamboat Springs and Routt County green building program can be found at: www.dola.colorado.gov/osg/modelcodes.htm#GreenBuildingProgram

Additional information on WaterSense – including information for utilities – can be found online at the EPA website: www.epa.gov/watersense/partners/promotional.html

Information on all things LEED can be found at the US Green Building Council’s website: www.usgbc.org/

Examples

Model Codes – DOLA, Steamboat Springs and Routt County

Colorado’s Department of Local Affairs has various model building codes, including a green building program. The City of Steamboat Springs, Routt County and DOLA recently

collaborated to develop a green building program which DOLA offers as a working model for other communities. The program was developed to provide guidance for green building and to raise the bar on green standards. After adopting ICEE energy code, Energy Star was identified as the minimum for the DOLA/Steamboat Green Building Program because it represents a 15% efficiency improvement.

The program applies to single family, duplex and row townhome construction. A green building checklist is required when applying for a building permit. The building plans are reviewed against the checklist. If the minimum point threshold is met, the building permit will proceed through the usual sign-off process. The checklist is organized to follow the construction process. It comprises 17 categories and a total of 321 possible points. The categories include energy, recycling and reuse, electrical, landscaping and plumbing. Indoor water use is addressed exclusively in the plumbing section, which has a score of 28 possible points (less than 10% of the total possible). The only mandatory plumbing measure is insulating the hot water heater. Measures for conserving water included in the program are shown in Table 4-19.

Table 4-19: Water conservation measures found in DOLA Model Green Building Program

Measure	Means of Conservation
Efficient distribution of hot water	Speeds the rate of hot water delivery, which reduces time water runs. Also saves energy.
Install HET	High Efficiency Toilets (<1.3 gpf) perform well and reduce water consumption. Water and sewer costs will be lower with HET
Install composting toilet	These use little or no water.
Install showerheads with flow less than 2 gpm.	Low-flow showerheads reduce water use without changing water pressure. Hot-water savings translate to energy savings by reducing energy needed to heat larger volume of water.
Install graywater for toilet flushing	Reduces water used for flushing toilets. Local health codes must be considered.
Install real time water use read out	Leaks become readily apparent and can be quickly fixed.

DOLA has links to other green building programs in the state. Links and details on the Steamboat Springs and Routt County program can be found at:

www.dola.colorado.gov/osg/modelcodes.htm#GreenBuildingProgram

Telluride – Required green building for new construction, remodeling and additions

While most green building programs are voluntary, Telluride has established a green building standard for all residential construction including new construction, remodels and additions. Requirements exist for both multi-family and single family homes.

The Telluride green building program includes energy efficiency, material use, indoor air quality, and resource conservation (of which water is only a part). Scoring is based on square footage and is different for new construction than for remodeling. For example, a newly constructed 500 square foot residence must have 15 points worth of conservation measures. A 3,501 square foot home must have 115 points worth of conservation measures. A 2,000 square foot remodel would need 30 points worth of conservation measures. Table 4-20 lists the indoor

water conservation measures included in the Telluride program. There are additional conservation measures required for outdoor water conservation.

Compliance is assured either by an inspection conducted by the city, careful and appropriate documentation, or by self certifying green building measures. A minimum of 10 of points must come from the conservation category. However, this category includes waste reduction and land use (site soil) in addition to water conservation.

Table 4-20: Indoor water conservation measures in Telluride’s green building program

Conservation Measure	Possible points
Clothes washer is an ENERGY STAR® labeled product	2
Dual-flush toilets	3
Composting toilets	6
Bathroom faucets fitted with aerator restricting flow to 1.8 gpm	1
Kitchen faucet fitted with aerator restricting flow to 2.0 gpm	3
Installed irrigation system includes a soil moisture or rain sensor, or other irrigation efficiency device	4

Sterling Ranch – Conservation from the Developer’s Perspective

Developers have a major role to play in water conservation and one example of a development design with strong water planning is Sterling Ranch. Sterling Ranch is a 3,100 acre, multi-use development located in Douglas County. Construction is slated for 2010 or 2011, but already the water conservation plan is in place. The developer, Sterling Ranch LLC, states that they are, “a firm believer that new development must be planned to meet human needs while protecting natural resources so that these needs can be met into the indefinite future,” (Headwaters Corp. 2009). Water planning includes several aspects, such as a water supply plan (recycled water is a major part of the water supply plan), water treatment, water demand planning, and conservation.

The indoor water use target is 0.14 acre-foot per year per unit which is 42 gpcd. Sterling Ranch’s conservation plan includes both indoor and outdoor conservation. For indoor conservation, Sterling Ranch will require high efficiency model toilets, washing machines, dishwashers, kitchen and bath faucets and showerheads. The requirements will be enforced through covenants and water budgets (Headwaters Corp. 2009). The water budget component is particularly important since each budget represents a water efficiency performance standard that must be met by each individual end user. The developer will assist the water agency with developing water budgets using yard footprints. Sterling Ranch District, a special district formed for the development, in cooperation with the water supplier will undertake a study of water rate structures.