Filling the Gap

THIRD IN A SERIES

Meeting Future Urban Water Needs in the Platte Basin, Wyoming

WESTERN RESOURCE ADVOCATES

TROUT UNLIMITED

This report is a collaborative effort by Western Resource Advocates (WRA) and Trout Unlimited (TU). The coordinating lead author of the report is Jorge Figueroa (WRA). Mr. Figueroa, Laura Belanger (WRA), Drew Beckwith (WRA), and Cory Toye (TU) are the chapter authors. Mr. Beckwith, Charles Card (TU), and Dave Glenn (TU) are the review editors. Production was facilitated by Nicole Theerasatiankul (WRA), Joanna Nasar (WRA), and Anita Schwartz (WRA).

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Design by Jeremy Carlson

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Cover, top: Independence Rock and Sweetwater River, Wyoming.

Water is the lifeblood of Wyoming.

The annual pattern of snowmelt from the headwaters has been one of the key ingredients that has determined the character and history of the state.

This report lays out a portfolio of water supply strategies for meeting the future urban water needs of the Platte River Basin without permanently drying up agricultural lands nor sacrificing the majestic rivers and streams of Wyoming.

Wyoming Headwaters.

Smart Principles

Western Resource Advocates and Trout Unlimited recommend that future water supply management and development efforts adhere to a set of Smart Principles. These principles were initially published in the 2005 *Facing Our Future* report, and the first two *Filling the Gap* reports, where they were used to evaluate water storage and supply projects proposed for the South Platte and Arkansas Basins in Colorado.[1,2] This third *Filling the Gap* report both builds upon and adapts these principles for the Platte River Basin of Wyoming. These principles are offered as a guide to assure protection of rivers and other natural resources against damage that often results from large structural water supply projects.

The Smart Principles are:

1. Make full and efficient use of existing water supplies and reusable return flows before developing new diversion projects.
2. Expand or enhance existing storage and delivery infrastructure before building new facilities in presently undeveloped sites and develop water supplies incrementally to better utilize existing diversion and storage capacities.
3. Integrate water supply systems and share water resources among multiple water users to avoid unnecessary new diversions and duplication of facilities.
4. Design and operate water diversion projects to leave adequate flows in rivers to support healthy ecosystems under all future scenarios, even if water availability diminishes in the future as a result of climate change or other factors.
5. Seek to develop multipurpose projects that spread the costs as well as the benefits across different users, including agriculture, recreation, municipal, the environment, and others.
6. Ensure transfers of existing water rights to municipalities are voluntary and compensated.
7. Involve all stakeholders in decision-making processes and fully address the adverse impacts of new transbasin diversions.

Contents

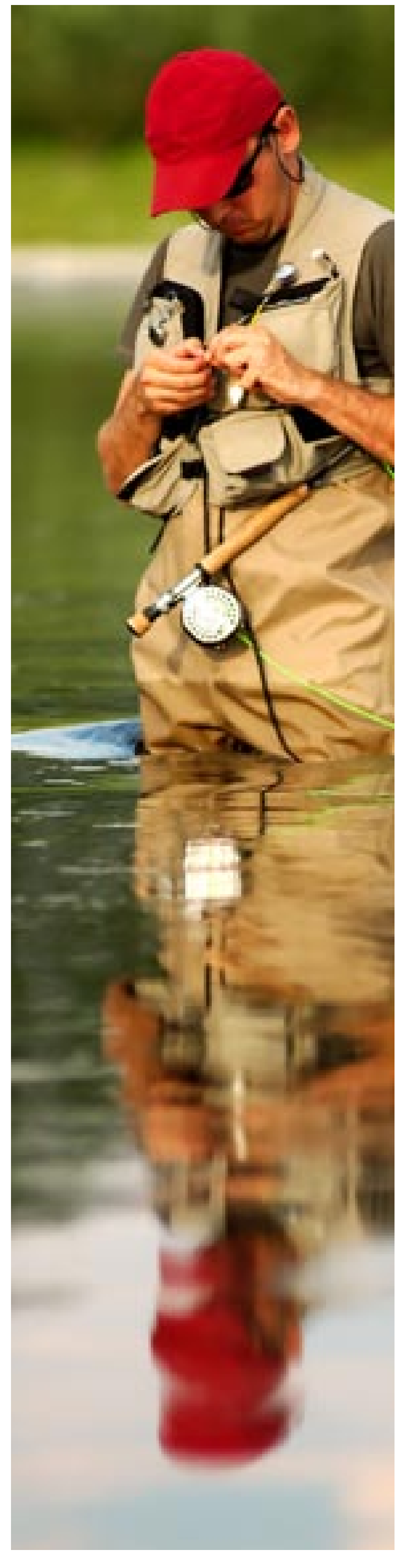
Acronyms, Abbreviations, Definitions, and Units

acre-foot	325,851 gallons (the amount of water 2–4 families use in 1 year)
AF	acre-foot or acre-feet
AFY, AF/yr	acre-feet per year
ag/urban	agricultural and urban (in reference to cooperative agreements between these two sectors)
APP	Acceptable Planned Project
BMP	Best Management Practice
CWSRF	Clean Water State Revolving Fund
ESA	Endangered Species Act (U.S.)
FHWAR	Fishing, Hunting, and Wildlife-Associated Recreation (national survey)
firm yield	A measure of dependable water supply that can be expected in most (including dry) years, typically used in municipal water supply planning. Average and wet-year yields can be significantly higher than firm yield.
FWS	Fish and Wildlife Service (U.S.)
GDP	gross domestic product
GPCD	gallons per capita per day
GPF	gallons per flush
MAF	million acre-feet
MGD	million gallons per day
M&I	municipal and industrial
MWD	Metropolitan Water District of Southern California
NRCS	Natural Resources Conservation Service (U.S.)
passive conservation	Conservation that results from new development and the replacement of inefficient fixtures and appliances over time in existing buildings.
PRRIP	Platte River Recovery Implementation Program
rotational land fallowing	Practice whereby irrigators allow portions of their irrigated land to lie idle, in sequence and across different growing seasons, to improve soil and agricultural yield and to make their irrigation water available for other uses.
SEO	State Engineer's Office
SSI	self-supplied industrial (water user)
SFR	single-family residential (water user)
TU	Trout Unlimited
Urban Subbasins	The following subbasins located in the Platte River Basin: Above Pathfinder Dam Subbasin, Guernsey to State Line Subbasin, Pathfinder to Guernsey Subbasin, South Platte Subbasin, and Upper Laramie Subbasin.
U.S.	United States (of America)
WRA	Western Resource Advocates
WWDC	Wyoming Water Development Commission
WWTP	wastewater treatment plant

Executive Summary

Stream of Benefits

Surface waters from rivers and streams are not only the lifeblood of the state's agriculture and urban areas, they also play a critical role in supporting Wyoming's world-class, vibrant outdoor recreation industry. The Outdoor Industry Association has estimated that in 2012 alone, consumers spent $4.5 billion in outdoor recreation activities in the state.[3] This *Filling the Gap* report also finds Wyoming at the top of the list among U.S. states in freshwater fishing expenditures as a percentage of state gross domestic product (Figure 2). Equally important, recent surveys show an overwhelming majority of Wyoming voters consider themselves conservationists and believe that low levels of water in the state's rivers is a serious cause for concern. Maintaining healthy rivers and streams is a very important issue for Wyoming residents and the state's economy.



An angler prepares.

Growing Water Demands

Almost half of the population of Wyoming lives in the cities of Cheyenne, Casper, Laramie, Douglas, Rawlins, and Torrington. Collectively, these cities are referred to in this report as the Urban Subbasins of the Platte River Basin. Under a medium-growth scenario, the population of the Urban Subbasins is expected to increase by 83,000 residents, to a total of 332,000 people by 2035. That is the equivalent of adding two new cities, one the size of Casper and another the size of Laramie, in the next 25 years.

Increasing population in the Platte Basin will be a primary driver for growing water demands in Wyoming. Accounting for the effects of passive conservation, which occur when inefficient water appliances and fixtures are replaced over time with new, more water-efficient ones, water demand for the 332,000 people and related industry of the Urban Subbasins will be approximately 76,000 acre-feet (24.8 billion gallons) in 2035—an increase of 15,000 acre-feet (4.9 billion gallons) per year from today's use. Some of the major cities in the Platte Basin have already bought, developed, and built most of the water supplies and water supply infrastructure needed to meet these demands. With existing supplies of 70,600 acre-feet annually and projected demands in 2035 of 76,000 acre-feet, the Urban Subbasins will need an additional 5,400 acre-feet by 2035 to fully meet projected demands.

It is worth noting that the gap assessment of this report is meant to inform water supply planning from a state- and basin-wide perspective, and the data presented herein should not supplant individual water provider information for local planning purposes. Furthermore, the water supply gap is projected for the Urban Subbasins as a whole and does not take into account more localized water supply and demand issues, such as climate variations and water infrastructure system flexibility. This aggregation of data to a multi-subbsasin level assumes a more dynamic and integrated water system along the Platte Basin than what currently exists today, a goal worthy of pursuing.

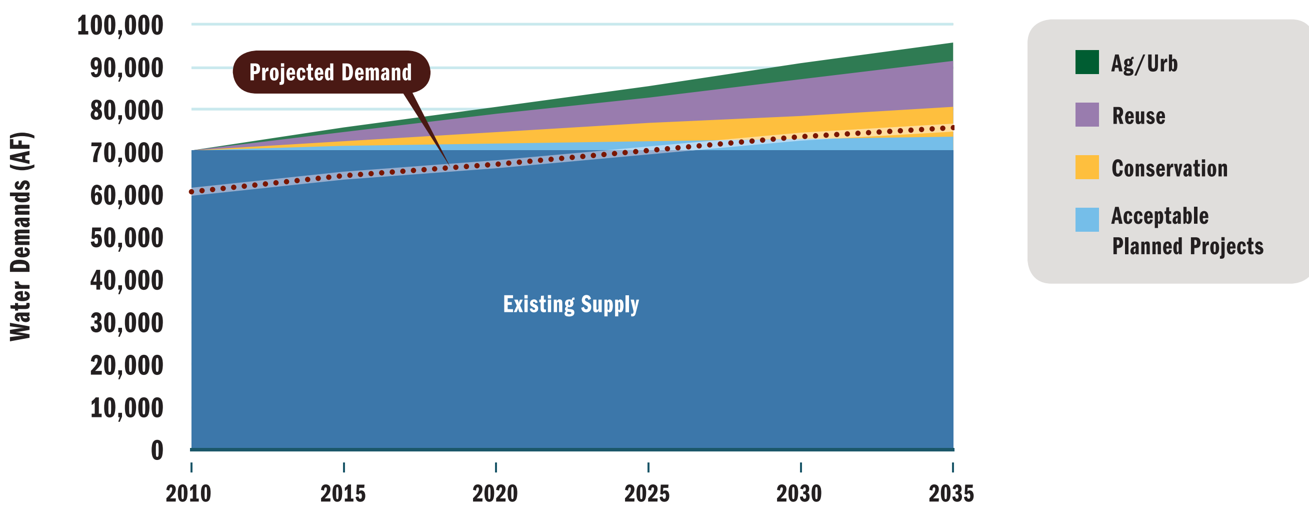
Our Water Management Portfolio

As advocates for the protection of Wyoming's rivers and natural heritage, Western Resource Advocates and Trout Unlimited believe it is imperative for water planning to account for instream flow needs and to minimize the adverse environmental impacts of water supply strategies. This report explores four water supply strategies for meeting growing needs in the Urban Subbasins:

- Acceptable Planned Projects
- Water conservation
- Reuse
- Voluntary water sharing with the agricultural sector

FIGURE ES 1 OUR PORTFOLIO FOR MEETING THE PROJECTED DEMAND OF THE URBAN SUBBASINS.

Our balanced portfolio of water supply strategies more than fills projected needs in the Urban Subbasins communities while protecting Wyoming's environment.



Our integrated portfolio approach more than fills the projected needs of the Urban Subbasins, while protecting the state's rivers, economy, and quality of life. Importantly, this portfolio meets future needs more cheaply and without the need for the types of new, large, environmentally damaging transbasin diversions that have been a hallmark of traditional water supply planning.

Acceptable Planned Projects

Some of the structural water supply projects currently proposed for meeting Platte Basin water needs could be acceptable if designed and implemented pursuant to our Smart Principles. This report refers to these projects as Acceptable Planned Projects (APPs). The APPs highlighted in this report are the Laramie River Pipeline and Belvoir Ranch, which collectively can provide 3,040 acre-feet of new supply annually by 2035.

Conservation

Published literature and multiple studies indicate that per capita water use can be significantly reduced over the next 25 years through conservation techniques, practices, and technology. Accounting for both active and passive conservation savings, a 20 percent per capita reduction in water demand between 2012 and 2035 would result in an annual reduction in water demand of 16,650 acre-feet by 2035 (ES Table 1).

Achieving water savings from a high conservation strategy will require an immediate and enduring investment in conservation programs. Many of these strategies are already being implemented in the Platte Basin and other Western communities. In addition, water utilities should not be expected to do this alone: Realizing the proposed conservation levels will require a sustained, coordinated effort between utilities, the state, city planners, private industry, the general public, and the conservation community. By dedicating

TABLE ES 1 ALLOCATION OF CONSERVATION STRATEGY'S WATER SAVINGS.

	M&I Passive Conservation	M&I Active Conservation	Total Acre-Feet
Savings allocated as reduction in future demand projections	100%	0%	4,850
Savings allocated to meeting future demands	0%	60%	7,100
Savings allocated to system reliability	0%	40%	4,700
Total			**16,650**

	Passive Conservation	Active Conservation
% of total savings for the conservation strategy	30%	70%

a little more than half of active water conservation savings to meeting future needs, 7,100 acre-feet of "new" water will be made available annually by 2035.[4]

Reuse

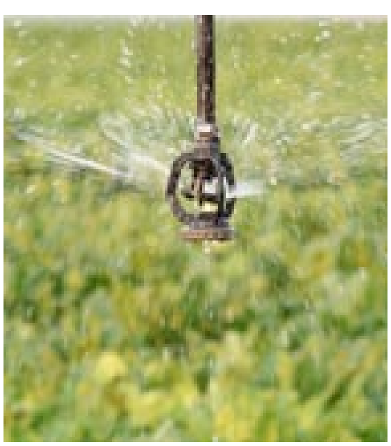
Reuse is becoming an important strategy to meet Wyoming's growing water demands as the costs and challenges of developing new water supplies increase. Although existing reuse is limited in the Urban Subbasins, significant potential exists to increase reuse, and communities are already planning to develop this potential. As an example, the city of Cheyenne plans to increase reuse in the future by 4,150 acre-feet per year. This report also identifies more reuse opportunities that can provide an additional 6,380 acre-feet to the Urban Subbasins in the following decades, for a total increase of reuse of 10,530 acre-feet by 2035.

Ag/Urban Cooperation

The agriculture and urban (ag/urban) cooperation strategy presented in this report is premised on agreements based on rotational land fallowing and temporary water leasing. These agreements would lease water to municipalities at a price attractive to irrigators, and on schedules that are sufficiently reliable for municipal suppliers and that are established well in advance of actual reallocation of water. Based on studies conducted in the Platte Basin, and assuming the physical and administrative structures are put in place over the next 20 years, voluntary and compensated ag/urban cooperative water sharing arrangements can provide 1,900 acre-feet of new supply annually by 2035 without permanently drying irrigated acreage. Water supply from Cheyenne's Monolith Ranch (2,500 acre-feet) is also included in this category because it is a municipal acquisition of agricultural water whose yield is not taken into account in other sections, even though the Monolith Range purchase does not exemplify the ag/urban cooperation strategy.

Looking beyond the traditional approach of building new large-scale, environmentally damaging transbasin projects, the portfolio of APPs, conservation, reuse, and ag/urban sharing described in this report would provide 25,000 acre-feet of water per year by 2035, which is 19,600 acre-feet (6.4 billion gallons) of water *in excess* of the Urban Subbasin's 2035 demands.

A single sprinkler from a center pivot sprinkler system waters sugar beets growing in the field.



Recommendations

This report offers several key recommendations for water planners and policy makers to consider carefully when forging Wyoming's water future. We believe these recommendations can help Wyoming chart a path forward to meet the future urban water needs of the Platte Basin without sacrificing the majestic rivers and streams and the state's critically important freshwater recreational industries.

- Meet the projected Urban Subbasin's gap with balanced strategies that are more cost-effective and environmentally friendly than traditional transbasin projects.

- Protect Wyoming's rivers, streams, and lakes as an integral part of any future water development strategy. Outdoor recreation and non-consumptive uses of water for fishing, rafting, and other uses are worth billions of dollars annually to the state's economy and are critical to Wyoming's quality of life.

- Pursue only those projects that can be constructed and operated according to the Smart Principles.

- Implement more aggressive water conservation strategies. Conservation is often the cheapest, fastest, and smartest way to stretch water supplies. Urban Subbasin utilities have significant opportunities to boost their existing water conservation efforts.

- Maximize the role of water reuse to meet the future needs of Wyoming's residents and work to improve public perception and acceptance of reuse projects.

- Cooperate with agriculture on voluntary water sharing agreements that benefit both municipalities and the agricultural community without permanently drying irrigated acres. Alternatives to "buy and dry" transfers present the best opportunities for Wyoming's future.

Significant strides have already been made in the Platte Basin pursuing projects that adhere to the Smart Principles and the water conservation and reuse strategies presented in this report. By further adopting these recommendations, Urban Subbasin communities can more than meet their water needs while minimizing impacts to rivers and streams.

Our portfolio would provide more than 5 times the amount of water needed to meet the 2035 demand of the Urban Subbasins without the need to build new, large-scale, environmentally damaging transbasin diversions and without drying up agricultural lands.

Brown trout (*Salmo Trutta*).

Stream of Benefits

Largely fed by seasonal snowmelt, Wyoming's rivers and streams provide a bounty of benefits to local and regional communities. Surface waters not only supply most of the municipal and agricultural water demands of the state, they also play a critical role in sustaining invaluable ecosystems and supporting Wyoming's world-class, vibrant outdoor recreation industry.

Ensuring there is enough water to support healthy ecosystems and a robust recreation economy is a no-regrets strategy for Wyoming and the Platte River Basin. Water used by fish and recreation is not consumed, but put to additional beneficial uses downstream (i.e., to grow hay and sugar beets on a farm, or wash dishes and clothes in a home).

Surface water flow reductions and alterations related to dams and increased upstream diversions from urban water users, however, may be a threat to downstream fisheries and recreational industries. This report demonstrates there are sufficient water supplies available over the next 20 years to not only meet future urban demands, but also to enhance watershed health in the Platte Basin—if the Urban Subbasins invest in smart structural water supply projects, water conservation programs, water reuse strategies, and agricultural-urban partnerships.

A beautiful Wyoming stream.

There are sufficient water supplies available over the next 20 years to not only meet future urban demands, but also to enhance watershed health in the Platte Basin – if the Urban Subbasins invest in smart structural water supply projects, water conservation programs, water reuse strategies, and agricultural-urban partnerships.

The Gaining Currency of Rivers as Natural Capital

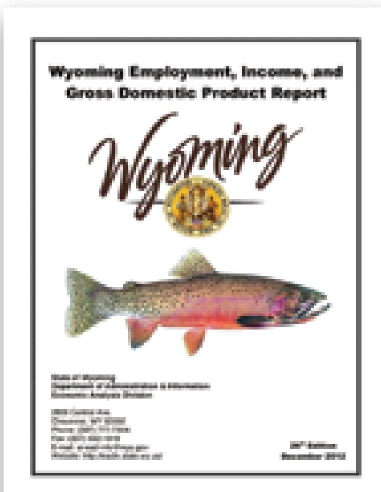
Wyoming beats the U.S. average by more than three times when considering freshwater fishing's contribution to state gross domestic product.

A glance at the cover of the 2012 *Wyoming Employment, Income, and Gross Domestic Product Report* suggests the state is keenly aware of the contribution of fishing to its economy.

The growth and economic impact of outdoor recreation on Wyoming's economy has been remarkable over the last 20 years. According to the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (National FHWAR Survey), these activities in Wyoming in 2011 resulted in $1.1 billion in expenditures—an almost doubling of expenditures from 20 years prior (Figure 1).[5,6] Another study, conducted by the Outdoor Industry Association, estimates that outdoor recreation in Wyoming generated in 2012 alone:

- $4.5 billion in consumer spending
- $1.4 billion in wages and salaries
- $300 million in state and local tax revenue
- 50,000 direct jobs in the state[8]

Looking specifically at freshwater recreation, Wyoming is at the top of the list among U.S. states in freshwater fishing expenditures as a percentage of state gross domestic product (GDP; Figure 2).



Given these numbers, it is not surprising that Wyoming voters feel strongly about conserving their environment and the state's waterways. The 2013 *Conservation in the West Poll* found that approximately 75 percent of Wyoming voters consider themselves conservationists, and more than 80 percent believe that low levels of water in the rivers of the state is a serious problem.[10]

In sum, ensuring healthy rivers and streams is a top concern for Wyoming residents—and the overall economy.

FIGURE Nº 1 TOTAL EXPENDITURES IN WYOMING FOR FRESHWATER FISHING, HUNTING, AND WILDLIFE VIEWING ACTIVITIES, IN CURRENT DOLLARS.[7]

Freshwater fishing is a growth industry that plays a key role in the state's multibillion dollar outdoor recreation economy.

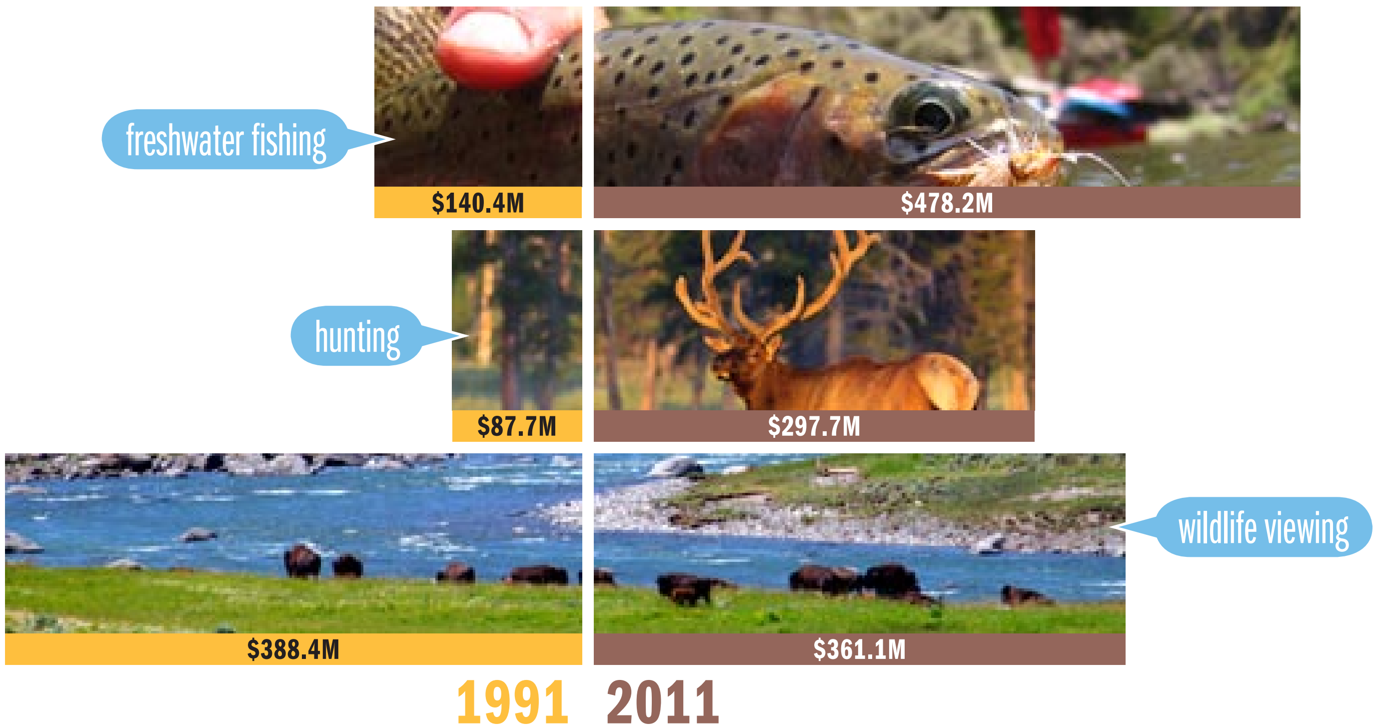


FIGURE Nº 2 IN-STATE FRESHWATER FISHING EXPENDITURES BY RESIDENTS AND NON-RESIDENTS, AS PERCENTAGE OF THE STATE GDP, 2011.[9]

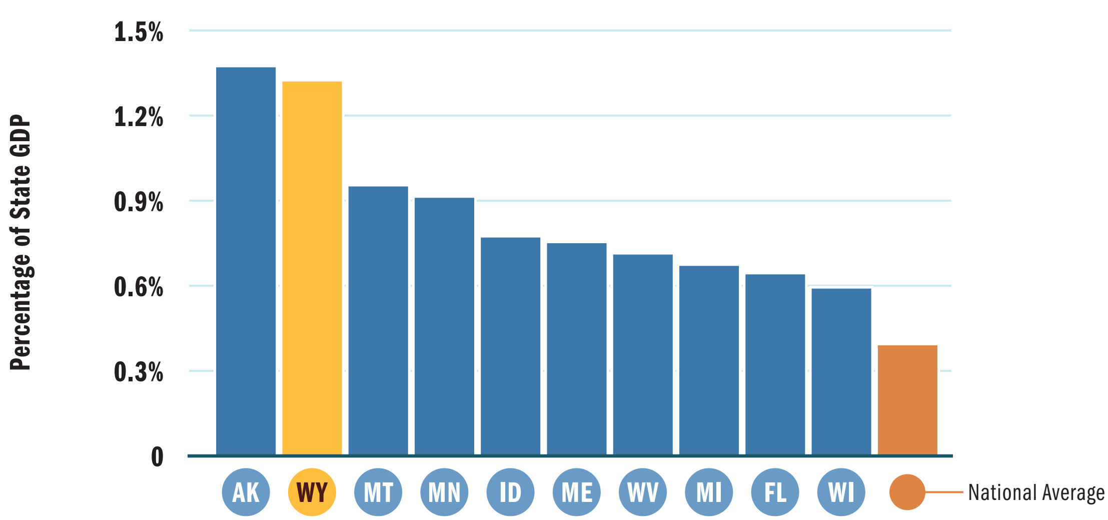
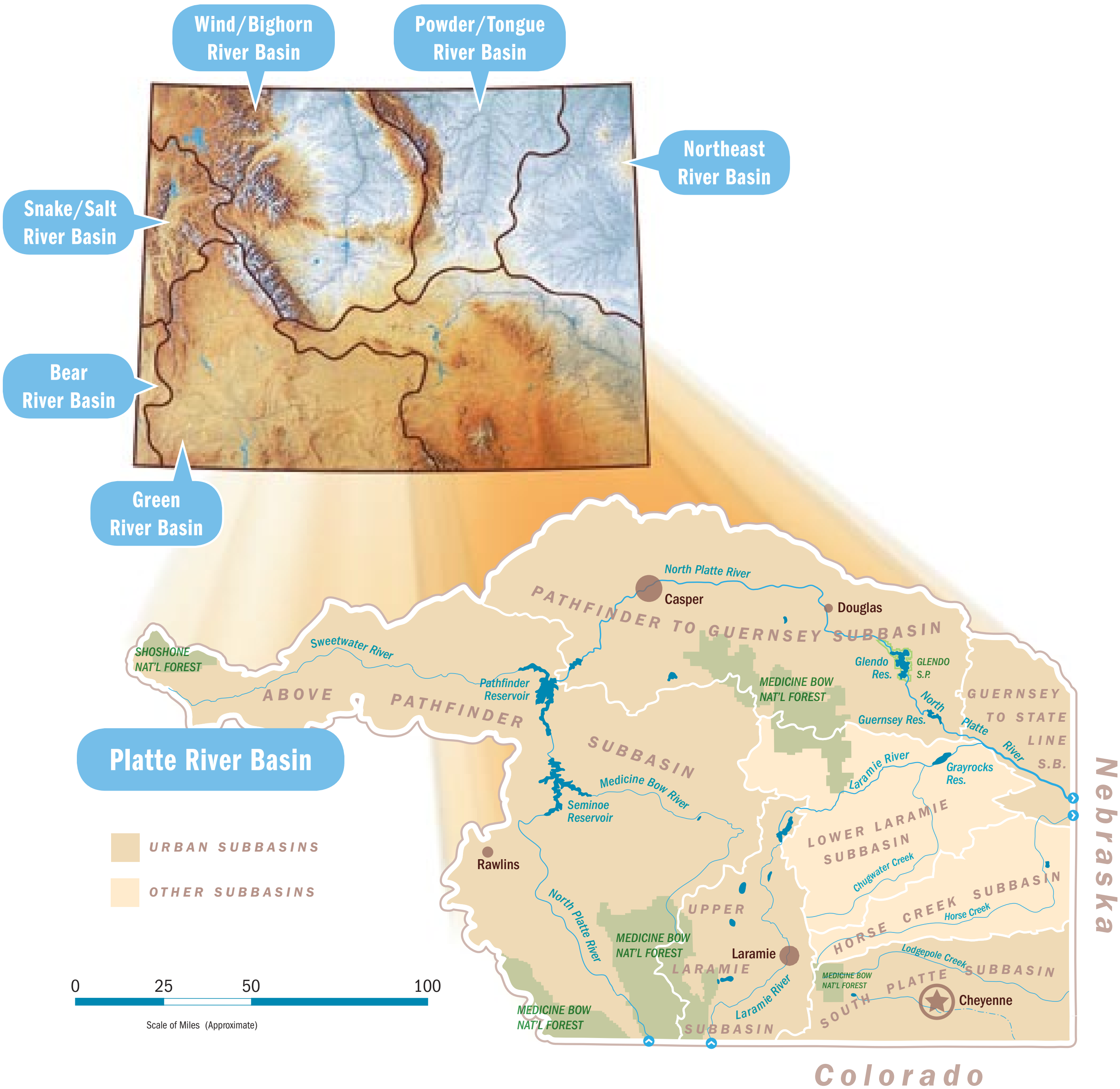


FIGURE Nº 3 PLATTE RIVER BASIN MAP.

The largest population centers in Wyoming are located in the Urban Subbasins, which represent 45% of the total population of the state and 97% of the population of the Platte River Basin in Wyoming. The Urban Subbasins of the Platte Basin are: Above Pathfinder Dam Subbasin, Guernsey to State Line Subbasin, Pathfinder to Guernsey Subbasin, South Platte Subbasin, and the Upper Laramie Subbasin.



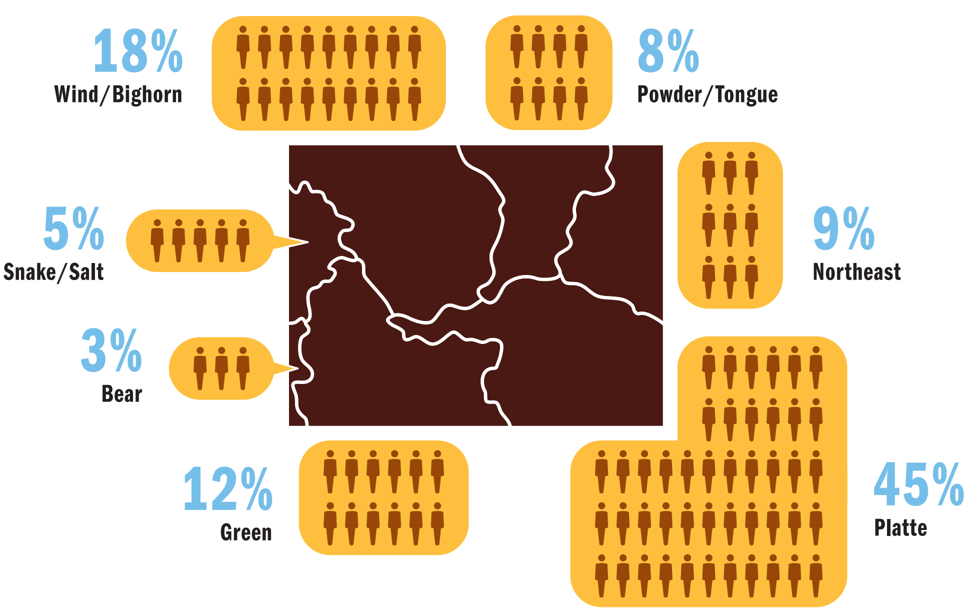
Environmental Water Use

Water uses for the environment are considered in Wyoming's planning processes. The *Platte River Basin Water Plan* ("Basin Water Plan") defines environmental uses as those whose main goal is restoring, maintaining, or improving environmental quality, such as fish and wildlife habitat. The Basin Water Plan estimates the future environmental water uses of the following existing and potential environmental efforts in the basin:

- Instream flow (ISF) agreements
- U.S. Forest Service (minimum flow) bypasses
- U.S. Bureau of Reclamation reservoir releases
- Platte River Cooperative Agreement ("Cooperative Agreement") flow requirements

The *Platte River Basin Water Plan*'s mid-scenario projections for these environmental efforts estimate an increase of 145,000 acre-feet in environmental water use by 2035.[11] Most of these additional uses (109,000 acre-feet) would result from approval of instream flow applications already filed with the Wyoming State Engineer's Office (SEO), while the rest represent environmental flow commitments in the Cooperative Agreement (see sidebar on page 6). The state of Wyoming assumes the natural flows of the Platte River Basin can accommodate these future environmental water uses, and that the consumptive use of these would be minimal.[12]

FIGURE Nº 4 2010 POPULATION DISTRIBUTION BY RIVER BASIN.



Data sources:

2010 population, *Wind/Bighorn River Basin Water Plan*

2007 mid-scenario population projection, *2002 Snake/Salt River Basin Water Plan*

2011 population, *2011 Bear River Basin Plan Update*

2010 mid-scenario population projection, *2010 Green River Basin Water Plan Final Report*

2010 mid-scenario population projection, *2002 Powder/Tongue River Basin Water Plan*

2010 mid-scenario population projection, *2002 Northeast Wyoming River Basins Water Plan*

2010 mid-scenario population projection, *2006 Platte River Basin Plan.*

All plans from the Wyoming Water Development Office.

The Platte River Recovery Implementation Program and Municipal Depletions

Under the U.S. Endangered Species Act (ESA), federal agencies must ensure that water projects do not adversely impact threatened and endangered species. Three threatened or endangered bird species—the interior least tern, whooping crane, and piping plover—rely on the Central Platte River in Nebraska as critical habitat for survival. The Lower Platte River also provides habitat for the endangered pallid sturgeon. Because Wyoming depletions have downstream impacts in Nebraska, ESA compliance has the potential to constrain water development in Wyoming. In 1997, the federal government and the states of Wyoming, Colorado, and Nebraska signed a Cooperative Agreement to develop the Platte River Recovery Implementation Program to help listed species, improve and maintain their habitat, and provide ESA compliance for the water users in the three states. This program is led by a Governance Committee consisting of the agreement's signatories, as well as by water users and environmental groups from the three states.

▲ Whooping crane (*Grus americana*)

▼ Interior least tern (*Sterna antillarum*)

◀ Pallid sturgeon (*Scaphirhynchus albus*)

Photo: Joel Sartore

In addition to Land and Adaptive Management Plans, this program includes a Water Plan to retime and improve flows by an average of 130,000 to 150,000 acre-feet per year to reduce shortages to species' target flows in the Central Platte River in Nebraska. The purpose of spring pulse flows under the Water Plan is to create and maintain nesting sand bars through the Central Platte River Habitat Area. Each state has also agreed to limit its Platte River Basin depletions to 1997 levels, offsetting new depletions with other supplies. As a result, all potential new water supplies in the Platte Basin must be evaluated for their impact on the 1997 baseline levels, taking into account both the quantity and timing of depletions.

To meet this program's goals, Wyoming developed a Depletions Plan in 2006 that:

- Specifies the existing water related activities in Wyoming that are covered by the program
- Identifies how new water related activities will be addressed
- Describes depletion mitigation measures[13]

▲ Piping plover (*Charadrius melodus*)

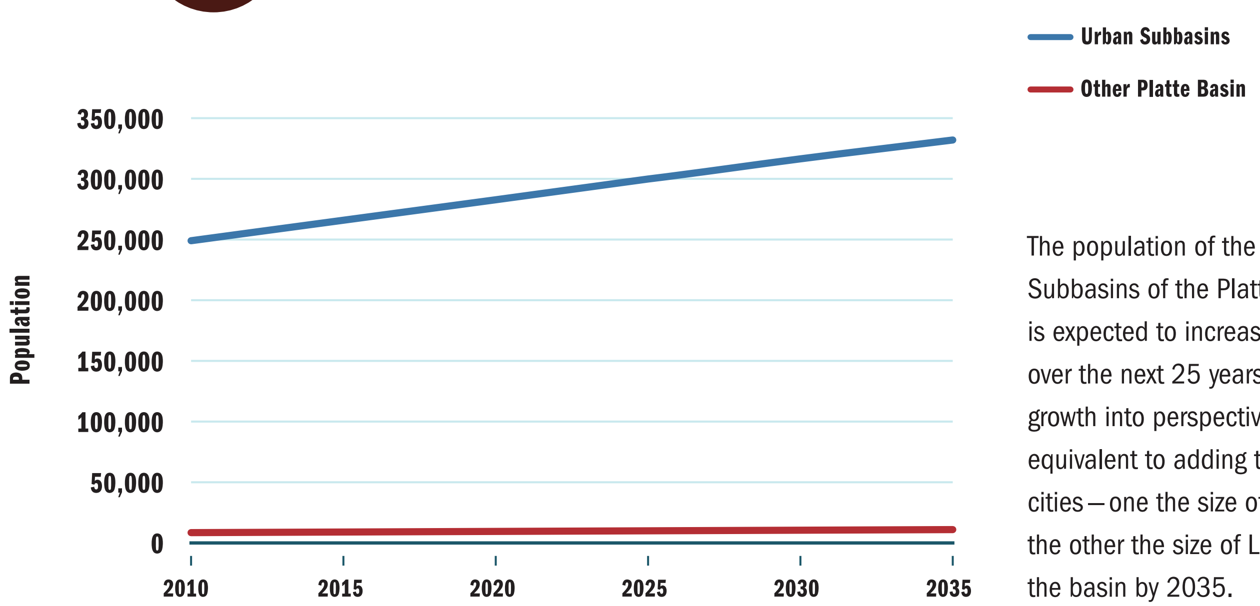
Municipal Water Needs

Population of the Platte River Basin

The Platte River Basin is located in the southeastern portion of Wyoming, covering close to one-fourth of the land area of the state.[14] The basin's population represents almost half the population of Wyoming and is concentrated in the Urban Subbasins, which include the cities of Casper, Douglas, Cheyenne, Laramie, Rawlins, and Torrington (Figure 5).

The population of the Urban Subbasins is projected to increase by 33 percent between 2010 and 2035 (Figure 5). According to the *Platte River Basin Plan*, the Urban Subbasins are expected to add 83,000 people during this period, for a total population of 332,000 people by 2035.[15,16]

FIGURE Nº 5 POPULATION PROJECTIONS FOR THE PLATTE RIVER BASIN.



The population of the Urban Subbasins of the Platte Basin is expected to increase by 33% over the next 25 years. To put this growth into perspective, this is equivalent to adding two additional cities – one the size of Casper and the other the size of Laramie – to the basin by 2035.

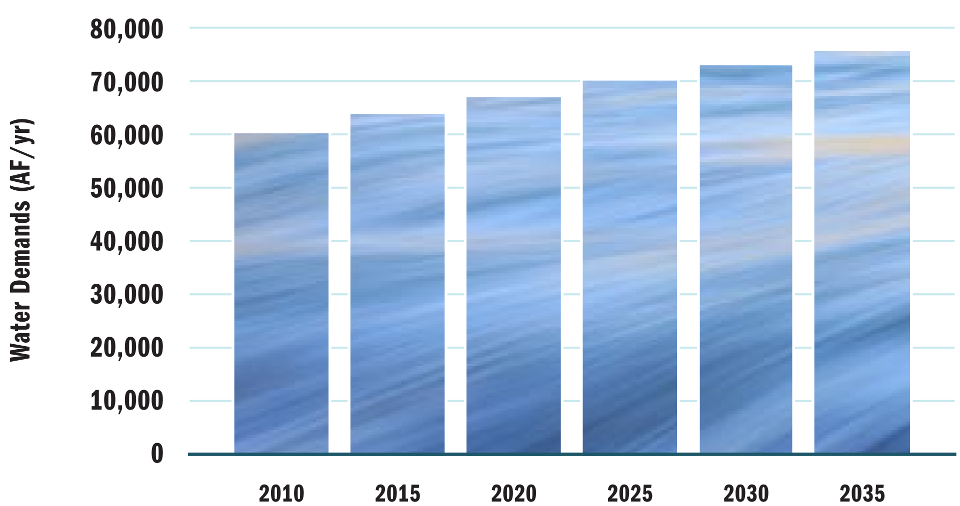
Projected Water Demand for the Urban Subbasins

Population growth is expected to drive demand for additional municipal water supplies. In May 2006, the Wyoming Water Development Commission (WWDC) published the *Platte River Basin Plan*. Water demand calculations in this report rely on the plan's 2005 and 2035 municipal/rural domestic water demand estimates, and the plan's mid-population-growth scenario. The water demand projections include the effects of passive conservation.

Water demand from industries that are not connected to a public water supply system — the self-supplied industrial (SSI) sector — is not included in the calculations because the Platte River Basin Plan projects a slight reduction in SSI demands over the next few decades. Although it is an important consideration, the water use impacts of a potential increase in oil and gas exploration in the Platte Basin is beyond the scope of this report.

Assuming that passive conservation will reduce per capita demands by 6 percent between 2012 and 2035, water demands for the projected 332,000 people in the Urban Subbasins of the Platte Basin in 2035 will be approximately 76,000 acre-feet annually (Figure 6).[17]

FIGURE Nº 6 PROJECTED URBAN SUBBASINS WATER DEMANDS.



Water demands in the Urban Subbasins are projected to increase by approximately 15,000 acre-feet between 2010 and 2035.

Existing Water Supplies

The Urban Subbasins obtain their municipal/rural domestic water supply from local surface and ground water, and from transbasin diversions (the major transbasin diversion is from the Colorado River Basin's Little Snake River for the city of Cheyenne). Surface water is the main source of water for many of the urban centers in the Platte Basin, even though groundwater and conjunctive water supply systems that use both surface and groundwater are also important sources of supply.

This report uses 2010 demands as a proxy for existing water supplies, with one particular exception. Cheyenne has the ability to collect additional water from its transbasin water system that would not be represented in the 2010 demands. Because Cheyenne intends to rely heavily on these supplies in the future and can do so with its existing infrastructure, we have decided to include them as part of the existing supply for the Urban Subbasins. This results in a current water supply for the Urban Subbasins (from both local and transbasin sources) of approximately 70,500 acre-feet annually.

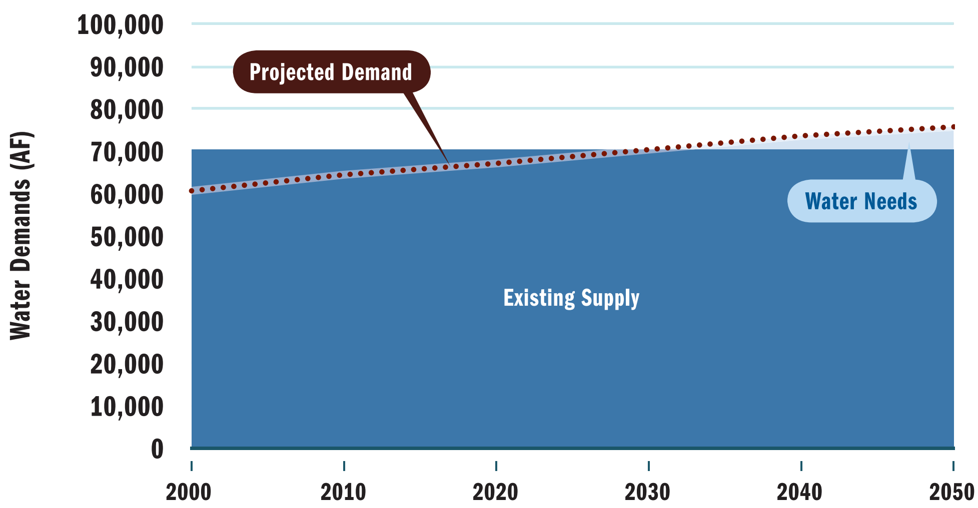
Significant up-front planning and development work has already occurred in Wyoming's major cities to secure their future water supplies. In the late 1970s and the 1980s, Wyoming water planners generally believed that the state's urban areas were going to have, in the year 2000, the same population that is now projected for 2035. As a result, some of the major cities in the Platte Basin have already bought, developed, and built most of the water supplies and water supply infrastructure needed to address future growth, system reliability, and drought management.[18] Because much of these supplies have not been included in the supply baseline, the existing supply calculation likely underestimates existing supply.

Future Municipal/Rural Domestic Water Needs

With existing supplies of 70,600 acre-feet annually and projected demands in 2035 of 76,000 acre-feet, the Urban Subbasins will need an additional 5,400 acre-feet by 2035 to fully meet projected demands (Figure 7). As detailed in the rest of this report, the portfolio of recommended water supply strategies would meet and exceed these future needs.

It is important to note that this gap assessment is meant to inform water supply planning from both a state- and basin-wide perspective. Furthermore, the water supply gap is projected for the Urban Subbasins as a whole and does not take into account more localized water supply and demand issues, such as climate variations and water infrastructure system flexibility. This report assumes a more dynamic and integrated water system (i.e., regional water systems) along the Platte River Basin than what currently exists today—a goal worthy of pursuing.

FIGURE Nº 7 FUTURE WATER NEEDS OF THE URBAN SUBBASINS.



The Urban Subbasins will need annually an additional 5,400 acre-feet of water supply by 2035 to meet future demands.

Seminoe Reservoir.

Acceptable Planned Projects

The *Filling the Gap* report series identifies water supply projects currently in the planning phases as acceptable if they are designed and implemented pursuant to the Smart Principles described below. These projects are called Acceptable Planned Projects (APPs). This section identifies APPs for the Platte River Basin. These APPs can provide approximately 3,000 acre-feet of additional water supply annually by 2035.

The Smart Principles

Beginning in 2003, Western Resource Advocates, Trout Unlimited, and the Colorado Environmental Coalition (now Conservation Colorado) developed a set of smart water supply principles as a guide to assure protection of rivers and other natural resources against the damage that often results from structural water supply projects. These principles, further refined and adapted in this report for Wyoming, are:

- Make full and efficient use of existing water supplies and reusable return flows before developing new diversion projects.
- Expand or enhance existing storage and delivery before building new facilities in presently undeveloped sites and develop water supplies incrementally to better utilize existing diversion and storage capacities.
- Integrate water supply systems and share water resources among multiple water users to avoid unnecessary new diversions and duplication of facilities.
- Design and operate water diversion projects to leave adequate flows in rivers to support healthy ecosystems under all future scenarios, even if water availability diminishes in the future as a result of climate change or other factors.
- Seek to develop multipurpose projects that spread the costs as well as the benefits across different users, including agriculture, recreation, municipal and industrial, the environment, and others.
- Ensure transfers of existing water rights to municipalities are voluntary and compensated.
- Involve all stakeholders in decision-making processes and fully address the adverse impacts of new transbasin diversions.

The Smart Principles lay the foundations for 21st century concrete-and-steel water supply projects.

Issues Associated with Large Structural Projects

Large new pipelines and reservoirs are often controversial, expensive, environmentally damaging, and not easily expanded incrementally in response to growing demand.

Large pipelines, and the water reservoirs needed to store the water diverted through them, come embedded with a host of issues. Large diversion projects often harm the environment, severely altering stream flow patterns and water temperatures, and negatively impacting aquatic and riparian habitats. As discussed in previous reports in the *Filling the Gap* series, these projects also have other major limitations, including the following: [19,20]

- Pipelines and reservoirs can be extremely costly to build and cannot easily be expanded incrementally in response to growing demands. They must often be paid for and constructed up front, which increases their financial risk and diminishes their economic feasibility.

- Structural projects can be controversial. Large pipelines that carry water between basins may raise Colorado River Compact entitlement concerns, water quality issues, and concerns among neighboring states, often attracting organized local opposition as well.

- As a result of this controversy, and because of their inherently large size, these types of projects often run into construction delays and may end up costing much more than expected.

- New large pipelines require significant energy to pump water across great distances.

With these limitations in mind, some water providers are increasingly developing smart storage projects, which incorporate smaller reservoirs designed to optimize already-developed water supplies and capture unappropriated peak-season runoff. Smart storage is now commonly developed as a means for capturing and reregulating reusable return flows, increasing the yields of exchange rights and augmentation plans, reregulating yields of changed irrigation rights to meet municipal demand patterns, and increasing yields from existing water rights and transbasin diversions. In some cases, existing traditional storage capacity has been rededicated to some of the smart storage purposes mentioned above.

Acceptable Planned Projects for the Urban Subbasins

Laramie Pipeline Project

The city of Laramie relies on Laramie River water to meet its municipal water needs. Until recently, the city diverted water through the Pioneer Canal to Sodergreen Reservoir (approximately 18 miles southwest of the city proper) and from the reservoir to the city's water treatment plant via a pipeline. Historical seepage loss from the Pioneer Canal did not allow the city to use its entire permitted water right. Although the city has the most senior (highest priority) water right in the river, infiltration and evaporation related to the open-air canal resulted in significant conveyance losses being charged — up to 100 percent during summer and drought periods.[21]

The first phase of the Laramie Pipeline Project, completed in 2010, involved the construction and relocation of a new point of diversion on the Laramie River for the city's water supply, as well as the construction of a new pipeline to minimize losses from that point to Sodergreen Lake. The second phase will involve construction of a new Laramie Transmission Pipeline from Sodergreen Lake to the Laramie Water Treatment Facility. As of this report's publication, the city of Laramie was getting ready to start construction of the Transmission Pipeline. We estimate the Laramie Pipeline project, when fully operational, will provide an additional supply of 1,540 acre-feet per year.

Laying water pipes in a construction area.

Belvoir Ranch

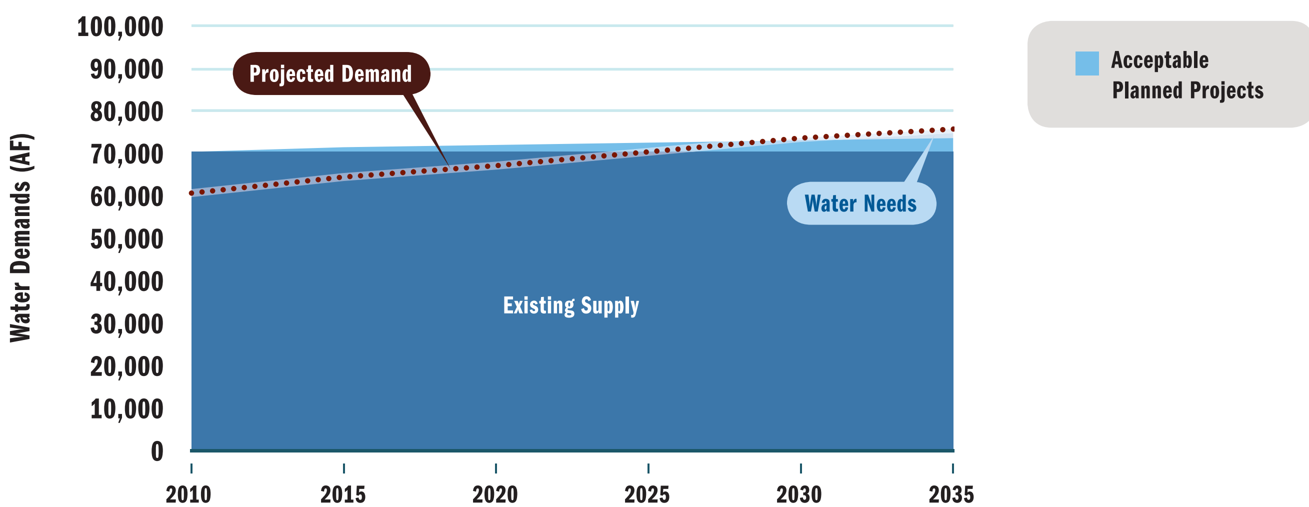
In 2003, the city of Cheyenne purchased the Belvoir Ranch as a multipurpose project.[22] The Cheyenne Board of Public Utilities (BOPU) provided funding towards the purchase of the ranch to develop its water resources from the High Plains and Casper groundwater aquifers. In addition to providing a new source of water supply for BOPU, city ownership and management of these lands will preserve ranching heritage and natural ecosystems, and provide significant open space and recreational opportunities to Cheyenne residents. The property is currently a 17,000-acre working ranch operating under a grazing management plan. The official vision for the ranch is to manage it as a sustainable working landscape that showcases Cheyenne's rich cultural heritage and contributes to the area's economy and quality of life.[23]

The water supply component of the ranch would require development of municipal supply wells ("well fields") and a transmission pipeline. This project does not involve agricultural water transfers, or a "buy-and-dry" scheme. Several studies estimating sustainable groundwater yields found a combined yield of 1,800 acre-feet per year for Belvoir Wells No. 5 and 6, and the Lone Tree and Duck Creek well fields.[24,25] Surface water supplies and other groundwater sources may also be available from the ranch. Accounting for supply uncertainties, we assume the ranch will provide a lower yield of 1,500 acre-feet of water per year.

The Laramie Project Pipeline and Belvior Ranch projects will, collectively, produce 3,040 acre-feet of new water supply annually to the Urban Subbasins by 2035. This is represented by the APP wedge in Figure 8.

FIGURE Nº 8 ESTIMATE OF URBAN SUBBASINS' WATER NEEDS INCLUDING THE ACCEPTABLE PLANNED PROJECTS STRATEGY.

Acceptable Planned Projects can provide more than 3,000 acre-feet of new water supply annually to the Urban Subbasins.



Flaming Gorge Pipeline

Overlooking Flaming Gorge Reservoir.

Two entities have explored potentially constructing a large pipeline to divert water from the Flaming Gorge Reservoir in Wyoming to southeastern Wyoming and the Front Range of Colorado. Private for-profit investors led by Aaron Million named their version of the pipeline the Regional Water Supply Project (RWSP). The media often called it the Flaming Gorge Pipeline. This project would withdraw a total 250,000 acre-feet (81.5 billion gallons) of water per year, part from the Flaming Gorge Reservoir (53.8 billion gallons/year) and part from the Green River (27.7 billion gallons/year) upstream of the reservoir. Thus far, Million's permit applications have been dismissed by the Federal Energy Regulatory Commission and the U.S. Army Corps of Engineers due to incomplete applications and delays caused by the applicant.[26,27] It is unclear whether Million's group will pursue the pipeline in the future.

The Colorado/Wyoming Coalition, a group of water providers and public entities from Colorado and Wyoming, is also currently evaluating a similar pipeline. For the past two years, the coalition has been conducting a feasibility study for the project, though no report has been published. According to the coalition, the Bureau of Reclamation has delayed releasing its Flaming Gorge model, which is necessary to complete the study.[28] While the coalition has not produced an official proposal, it was influential in forming the Flaming Gorge Task Force, funded by the Colorado Water Conservation Board (CWCB), to evaluate the various options and hurdles to build the 560-mile pipeline. In January of 2013, the CWCB board voted to defund the Flaming Gorge Task Force.

There are numerous reasons why other water supply options are preferable to these proposals:

- A pipeline of this size would be one of the largest water supply projects ever—comparable to Denver tapping the Rio Grande in Juarez, Mexico.
- The project's water would be 2 to 10 times more expensive than water from other proposed or recently developed water projects and would cost an estimated $7 to $9 billion.
- It would slow the recovery of endangered native fish, like the humpback and razorback sucker, Colorado pikeminnow, and bonytail chub.
- It would degrade the Blue-Ribbon fishery for trophy brown and rainbow trout in the Green River.
- It would impact mule deer and pronghorn habitat and diminish hunting opportunities in Wyoming and Utah.
- It would increase the risk of a compact call on the Colorado River, which could have a ripple effect on agricultural and municipal water users in Wyoming and other Colorado River Basin states.
- If powered by electricity from Wyoming, it would release the equivalent emissions of burning 48 million gallons of gasoline each year.
- It would reduce the amount of water available for hydropower generation at the Flaming Gorge Dam and all other dams downstream.
- Superior options exist that are cheaper and much better for the environment (such as those presented in this report).

Summer in the Medicine Bow mountains.

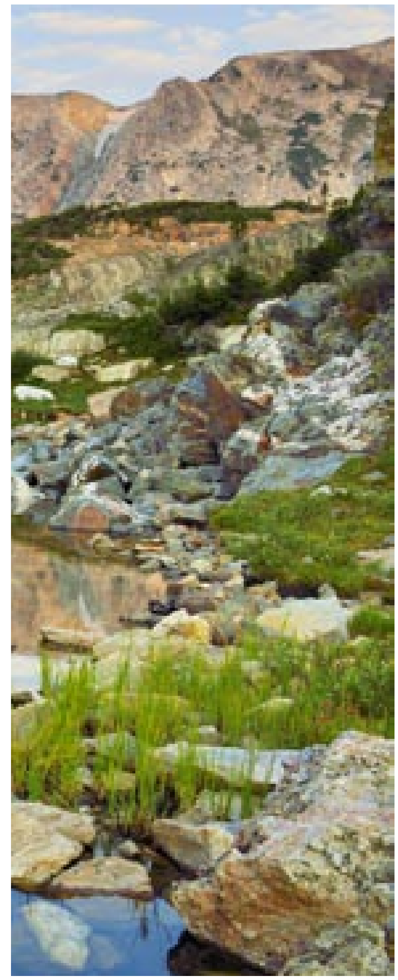
The Conservation Strategy

Defining Water Conservation

For the purposes of this report, the term "water conservation" means a permanent reduction in municipal per capita water usage resulting from long-term implementation of water saving practices and technologies. This is synonymous with improving water efficiency—conserving water allows us to do more with less.

An abundance of cost-effective water efficiency technologies exist to save water throughout a utility's system and for its users. For the utility itself, water loss detection and repair are foundational business practices that ensure water providers are paid for the service they deliver. For customers, conservation programs may focus on government, residential, commercial, or industrial sectors, and be further targeted at indoor or outdoor water uses. Water conservation can include voluntary actions, such as individuals planting vibrant landscape at their homes using plants from a city's low-water-use plant list. It may also include ordinances, such as plumbing codes that contain standards for water-efficient plumbing practices (fixtures and appliances designed to minimize water use within a home).

Conservation-oriented water rates and tap fees are critical tools in the conservation tool box that help communicate the value of water to customers, while education and public information cultivate a long-term conservation awareness and culture that underlie all water conservation programs. Although there is no one-size-fits-all set of conservation measures, conservation strategies encompass a broad range of practices and technologies that can be tailored to the specific needs of any community.



Issues Associated with Conservation

Water Quality and Fire Flows

Increased water conservation may impact potable water quality to varying degrees, depending on the design and operation of a water distribution system. Potable water may take days or even weeks to travel from the treatment plant to a homeowner's faucet, and the longer the residence time of water in the system, the greater the potential for occurrence of microorganisms.[29, 30] Water demands for firefighting is generally much higher than normal residential demands, creating the need to "up-size" a community's water distribution system to facilitate proper fire flows. The larger pipes required for fire protection can increase the residence time of potable water in the system and degrade its quality. Lower end-use demands resulting from increased water conservation can further increase the residence time that water is in pipes and may impact potable water quality to varying degrees, depending on the design of the water distribution system.

There are a number of existing technologies, methodologies, and strategies to both assess the impact that water conservation may have on water age and maintain the minimum necessary turnover in a system. Examples of these include flushing, looping flow paths, and elimination of dead ends in the system. To ensure water quality standards are met, most water providers have flushing programs in place that periodically flush water from the system. In sum, although it is rare for water quality issues to limit the implementation of conservation programs, it is important for water providers to evaluate and mitigate for their potential impact. Because every water delivery system is different, this evaluation must be very system-specific.

Conservation and Utility Revenue Requirements

Many utility managers are hesitant to invest in robust conservation programs, thinking they will have to increase their water rates to compensate for the loss of revenue resulting from reducing demand. This concern is often misplaced. Because conservation programs reduce or eliminate the need to develop new water resources and infrastructure, some of the utilities that have looked deeper into this issue have found that their water rates would actually be much higher in the absence of their conservation programs. A recent study conducted by the city of Westminster (Colo.) found that if the city had not invested in water conservation, tap fees would have increased by 80 percent and water rates by 95 percent, compared to their current rates and fees.[31] There are also proven methods and best practices to structure water rates such that utilities can sustain their revenue while investing in conservation programs.[32]

Additionally, communities need to better understand the willingness of their citizens to fund water conservation and improvements in water system infrastructure. A 2012 survey conducted by the city of Laramie indicates that customers are willing to pay for sustainable management of their water resources. The very highest priorities of Laramie residents—higher than fire and police protection, ambulance service, and encouraging business development—are first, maintaining their water distribution infrastructure, and second, preservation of their *existing* water resources.[33]

Previous reports of the *Filling the Gap* series have addressed a number of other concerns sometimes raised about urban water conservation efforts.[34] These included demand hardening, permanency of conservation savings, and the uniqueness of water providers. For brevity's sake, these issues are not repeated here, but extensive experience and data demonstrate they need not serve as barriers to investing in long-term robust conservation programs.

Existing Conservation

Municipal Conservation Programs

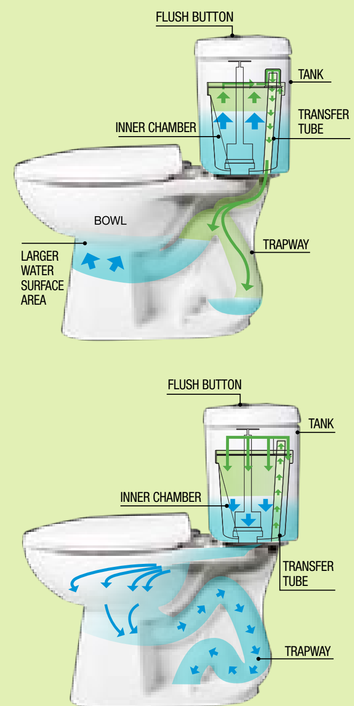
Municipal conservation programs have a track record of success in Wyoming. For example, since the city of Cheyenne started its conservation program in 2003, system-wide per capita use has decreased 12 percent. As a result, in 2012 the city's total water use was 140 million gallons *less* than in 2003, notwithstanding a 10 percent *increase* in population between these years.[35] As exemplified by Cheyenne's water conservation plan, during the past decade, Platte Basin municipalities invested in water conservation as a no-regrets strategy to:

- Reduce and delay the need to acquire or develop new water resources
- Postpone water and wastewater treatment facility expansions
- Demonstrate stewardship over water resources and their community's investment in their water system[36]

Water providers across the Platte Basin have achieved conservation successes by implementing best practices, such as:

- As an incentive for practicing water conservation, large-scale retail developments in the city of Douglas are offered a 25 percent reduction in building permit fees if they implement accepted xeriscaping methods and/or capture run-off for reuse.[37]
- The Comprehensive Plan adopted by the city of Laramie has a conservation component that includes the development of a xeriscape standard for new

Long-term water conservation savings can be achieved by implementing currently available cost-effective technologies.



Stealth 0.8 GPF Toilet, Niagara Conservation.

Up to 60% of savings on water use and utility costs can be achieved with the vacuum assisted power chamber technology of Niagara Conservation's Stealth Toilet, which uses only .8 gallons per flush with no need for double flushing.

development, a low-water-use landscape rebate program, and a gray-water-use system for open space and parks.[38]

- For the past decade, the Laramie River Conservation District's Cost-Share Program has provided up to $1,000 for residential and commercial water conservation projects on a 50-50 cash match basis. Projects funded include replacing turf with low-water-use landscaping and installation of traditional living snow fences.

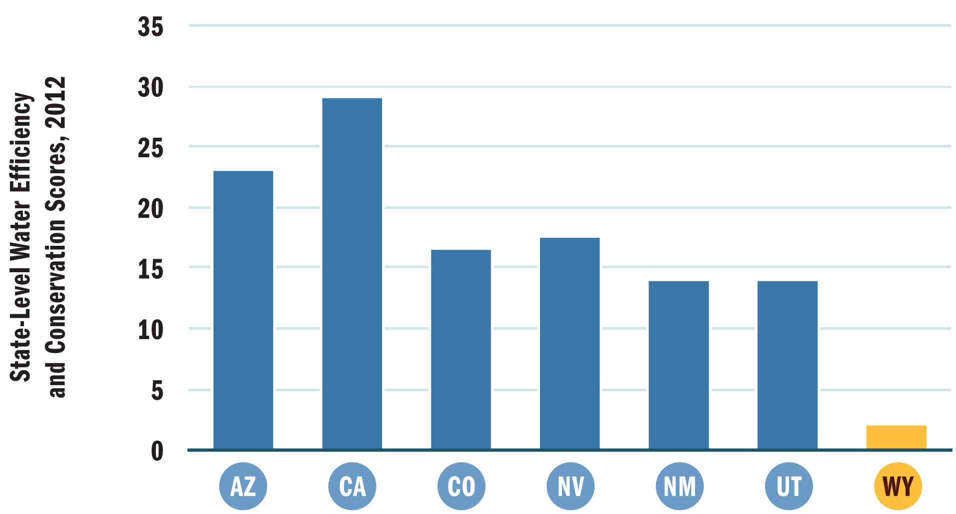
Even though water managers have implemented commendable active water conservation programs, as described in the "Future Conservation Estimates" section below, there remain significant water conservation opportunities and savings potential in the Urban Subbasins for the foreseeable future.

State Conservation Program

The Wyoming Water Development Commission (WWDC) serves as the water planning agency for the state and has a water conservation program that funds municipal master plans and water conservation plans. To maintain eligibility for state grant funding, WWDC requires municipalities to implement rate structures that encourage water conservation.[39]

The 2012 Alliance for Water Efficiency (AWE) and the Environmental Law Institute (ELI) report, *The Water Efficiency and Conservation State Scorecard: An Assessment of Laws and Policies,* evaluated state-level water efficiency policies and statutes for all U.S. states (Figure 9).

FIGURE Nº 9 WATER EFFICIENCY AND CONSERVATION LAWS AND POLICIES SCORECARD FOR THE COLORADO RIVER BASIN STATES.[40]



Wyoming's statewide conservation policies have not been as aggressive as those of other Western states.

An observation can be made that Wyoming does not have the same heightened sense of urgency to implement state-wide water conservation policies as the other Colorado River Basin states. The state has not experienced, nor is expected to experience, the prolonged population boom that has occurred in these other states. That said, the state can play a more active role in prioritizing and facilitating water efficiency over other water development that would ultimately be more expensive to taxpayers and harm the state's world-class freshwater recreation industry and farm lands.

The AWE/ELI scorecard illustrates that opportunities exist to implement additional effective water conservation policies at the state level. For example, a statewide requirement for water providers to adopt water conservation plans would be a powerful way for the state to support and accelerate water conservation. Such a requirement could also be accompanied by a state framework or guidance document, technical assistance for the development of water conservation plans, and funding opportunities for program implementation.

Future Conservation Estimates

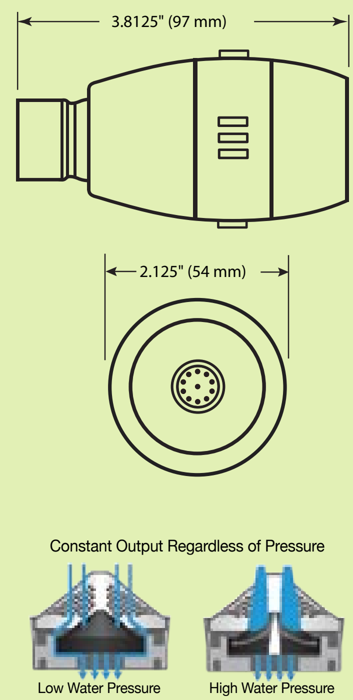
Meeting the Platte River Basin's urban "gap" will require water providers to decrease demands, increase supply, or, most likely, a combination of the two. The constraints imposed by Platte River Recovery Implementation Program commitments, together with climate and precipitation uncertainties, prioritize the need for an immediate and long-standing focus on managing water demands. Conservation and efficiency solutions are also cost-effective, incremental, and flexible—exactly the type of solutions needed to manage our urban water systems in an uncertain future.

A Goal

Water utilities and state and municipal decision-makers can provide critical leadership in this arena by setting an annual urban water demand reduction goal of 16,600 acre-feet by 2035 in the Platte Basin. This represents a 20 percent per capita reduction in water demand between 2012 and 2035, which is equivalent to a 1 percent reduction in per capita use per year. This level of reduction is already the *status quo* in some communities in Wyoming (as exemplified by Cheyenne) and can be achieved through greater implementation of *current* technologies and practices. It is important to recognize that utilities should not be expected to achieve this goal alone. Individual citizens, corporations, conservation groups, and all levels of government have an important and complementary role to play in ensuring that precious water resources are used wisely.

This report estimates passive water conservation savings—reductions that will occur naturally as the result of upgrading indoor water appliances, thus

Individual citizens, corporations, conservation groups, and all levels of government have an important and complementary role to play in ensuring that precious water resources are used wisely.



Tri-Max 3-Flow Showerhead, Niagara Conservation.

Installing a water-efficient showerhead can reduce annual water use by more than 16,000 gallons of water and save a typical family more than $450 per year in water and energy bills.

without purposeful conservation efforts—will result in more than 4,800 acre-feet of demand reduction, nearly one-third of the goal.[41] Reasonable, cost-effective active water conservation programs can save an additional 11,800 acre-feet by 2035 through some of the techniques described below.

How to Achieve the Goal

Achieving these recommended levels of active conservation savings will require an increased effort by residential and nonresidential customers, and by utilities.

Although communities in the Platte River Basin have made great strides in water conservation, significant water savings can still be achieved in the foreseeable future.

For residential customers, indoor use should be reduced to an average of 30 gallons per capita per day (GPCD). Many families today are already using less than 35 GPCD. To meet the goal, it would be necessary to install high-efficiency fixtures in new housing developments and retrofit many existing homes over the next 20 years. Several different ordinances and rebate programs can achieve this outcome. The city of Douglas, for example, provides a 25 percent reduction in building permit fees for homes that meet water efficiency guidelines.

For nonresidential customers, indoor use can be reduced through similar ordinance and rebate programs, as well as through water audits and business-specific water rates. Nonresidential customers are often concerned about how utility costs affect their bottom line and so have a natural incentive to reduce their use.

Colorful blue aster wildflowers.

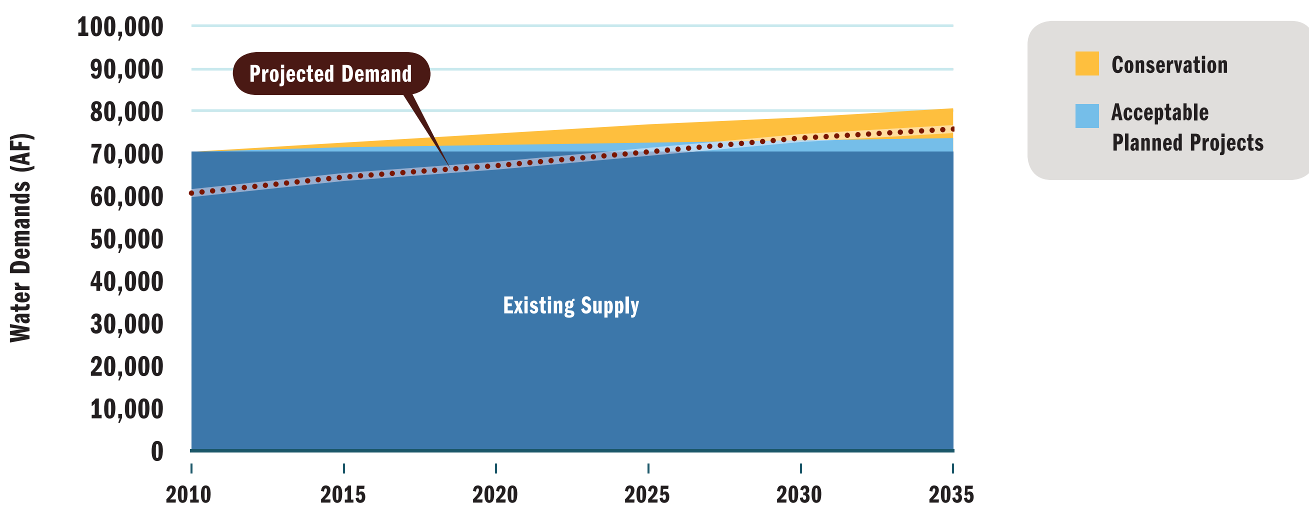
Outdoor irrigation uses at least half of annual potable water supply in the Urban Subbasins. Fortunately, residents' landscape preferences have evolved over the past decade, and the ongoing growth in urban areas will continue to further reduce outdoor water demands. Similar to indoor use, land use ordinances affecting new construction (such as irrigation design or plant lists appropriate for the community) can play a significant role in reducing water demands for homes that are yet to be built. Water audits, budget-based rates, and incentives to replace high-water-use landscapes can all be used to reduce outdoor use in existing homes.

Finally, utilities can identify and reduce system water losses. Water loss control means system auditing, loss tracking, and infrastructure maintenance. These are fundamental business practices that ensure water providers are fully paid for the services they deliver. The state could play a leadership role in this effort by providing incentives to ensure that providers take steps to reduce losses in their system.

Achieving conservation success will require sustained investment and simultaneous effort across multiple sectors with a mix of strategies. Assuming 60 percent of active conservation savings under the conservation strategy of this report are dedicated to growth (reserving 40 percent for drought protection and other uses), 7,100 acre-feet of "new" water supply will be made available in the Urban Subbasins by 2035 (Figure 10).

FIGURE Nº 10 ESTIMATE OF WATER NEEDS FOR THE URBAN SUBBASINS INCLUDING THE ACCEPTABLE PLANNED PROJECTS AND CONSERVATION STRATEGIES.

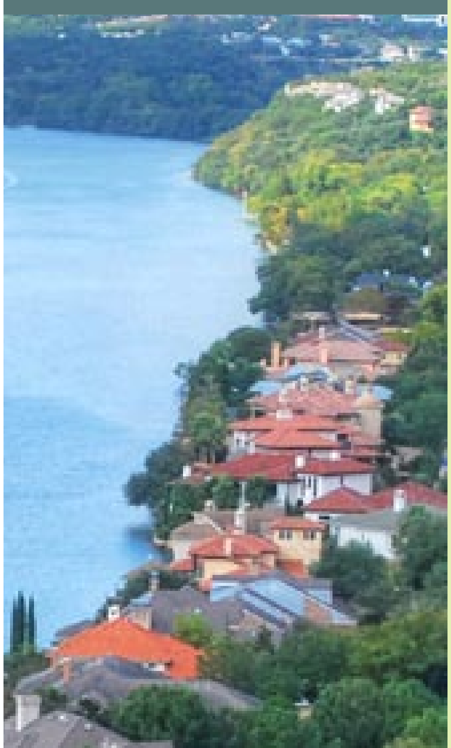
Water conservation can provide over 7,000 acre-feet of "new" water for the Urban Subbasins.



Navajo Power Plant, Lake Powell

The inextricable link between energy and water creates opportunities for water and energy utilities to collaborate on efficiency programs and strategies.

Austin, TX



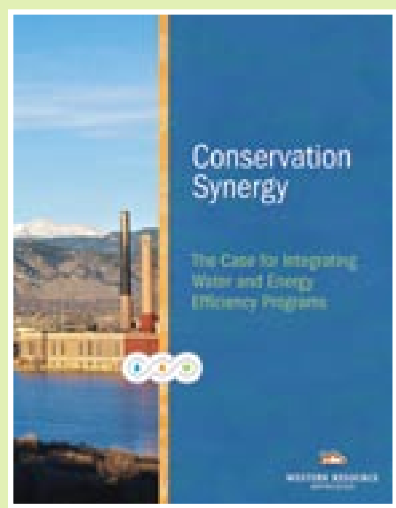
Integrating Water and Energy Efficiency Programs

Energy and water are inextricably linked, and this creates an opportunity for water and energy providers to collaborate on joint efficiency programs. Water is used to procure coal and natural gas, and significant quantities of water are used during electricity generation. In 2005, thermoelectric power plants withdrew 41% of fresh water supplies in the U.S.[42] Conversely, it is estimated that about 13% of the nation's energy use is related to water use.[43] Electricity and gas are used to pump and treat water, and energy is used by customers to heat that water. In this way, when one resource is conserved, so is another.

Water and energy efficiency programs play a critical role in resource planning. Imbalances between water supply and demand challenge the West—and efficiency can help close that gap. Energy efficiency is mandatory for electric and gas utilities in many states and is widely regarded as a less costly alternative to building new power generation facilities—about 3 to 6 times cheaper according to one study.[44]

Water and energy providers can team up on rebates, audits, education efforts, and other conservation programs that save both resources simultaneously and do so at lower costs by sharing the administrative and marketing expenses. Three utilities in Texas (Austin Water Utility, Texas Gas Service, and Austin Energy) have collaborated to offer electricity, water, and gas efficiency upgrades to multifamily housing units. Several examples also exist in California, such as the joint rebate offered by Pacific Gas & Electric (PG&E) and 29 water utilities for efficient washing machines. Customers benefit from the ease of these streamlined programs and larger rebates, and they value their utilities' ability to work smarter, not harder.

For more information about these kinds of opportunities, see WRA's 2013 report *Conservation Synergy: The Business Case for Integrating Water and Energy Utility Efficiency Programs.*



Find the report at westernresources.org/conservationsynergy.php

The Reuse Strategy

Reuse is becoming an important strategy to meet growing demands as the costs and challenges of developing new water supplies increase. This reality is recognized in Wyoming's Water Quality Rules and Regulations, which state, "It is the intent of these regulations to encourage and facilitate the productive and safe reuse of treated wastewater as a viable option in the management of the state's scarce water resources."[45] Although existing reuse is limited within the Urban Subbasins, significant potential exists to increase reuse, some of which is already being planned for. Almost all existing reuse in Wyoming is focused on using treated return flows for irrigation purposes. While this is an appropriate use, a much wider range of uses is possible and should be considered when looking to the future, including industrial, cooling, and even potable uses.

Municipal water providers in Wyoming have the legal right to capture and reuse their supplies to extinction, as long as they maintain control over the water. Once the water is released to the stream, it is no longer available to the municipality—though it can be exchanged with downstream users if an agreement is in place. In the Platte River Basin, the potential for reuse is complicated by the Platte River Recovery Implementation Program (see PRRIP sidebar).

Reuse can be accomplished in two ways:

- **Direct Reuse**—Return flows can be physically reclaimed for potable and nonpotable purposes. For example, a water utility captures treated water leaving its wastewater treatment plant (WWTP) and uses this water again for municipal purposes.

- **Indirect Reuse**—Return flows can be reused under exchange arrangements.[46] An example of indirect reuse is when a water utility lets water leaving its WWTP flow downstream for diversion by a senior irrigator, and the utility diverts an equivalent amount of water into its system upstream that it otherwise would not have been legally able to divert.

Issues Associated with Reuse

Establishing a successful reuse project depends on water supply and system specifics. Potential limits to reuse include cost, infrastructure requirements, public acceptance, water quality, and stream flow issues. These are legitimate issues that will require effort to resolve. Reuse, however, remains an integral and viable water supply option for the Urban Subbasins.

Addressing Cost and Infrastructure Requirements

Depending on project specifics, reuse projects can range from inexpensive to costly. Currently, reuse in Wyoming is focused on nonpotable uses, which can be less expensive than blending and treating return flows to potable quality. In many instances, water storage and delivery infrastructure and treatment facilities are needed to implement water reuse plans. Such infrastructure requirements are dependent on the level and type of reuse activities, the number of participants involved, and the willingness of potential project participants to develop shared facilities.

As an example of cost, the city of Cheyenne's non-potable recycling program through phases I and II, designed to reuse up to 4 million gallons per day (MGD) or 1,890 acre-feet per year for irrigation of green spaces, cost $13.2 million to construct. It includes 13 miles of pipe, 3 pump stations, and expanded treatment at an existing facility. The state of Wyoming assisted Cheyenne with a $2.5 million state grant and $4.0 million in state loans. The remaining balance was funded through a sixth-penny, voter-approved, specific-purpose tax totaling $5 million and $1.2 million from water and sewer fund reserves, respectively.

Public Acceptance of Reuse

Public acceptance issues arise most often in the context of potable reuse, which is increasing, though still relatively uncommon in the U.S. In places where potable reuse has been implemented or seriously considered, public acceptance has been generally favorable, provided that adequate research, education, monitoring, and oversight activities are completed. A key focus of education is explaining the high level of water quality treatment used to make the water safe to drink.

Public acceptance of non-potable reuse has also been an issue at times, with citizens rejecting projects due to perceived health concerns. As a result, community outreach and education should be considered an essential component of any reuse program. For example, the Cheyenne Board of Public Utilities embarked on a highly successful public education campaign to educate the residents of Cheyenne on the benefits and safety of recycled water that garnered broad public support for its reuse program. This campaign not only resulted in the successful implementation of a reuse project in the community, but also won the 2008 national WateReuse Public Education Program of the Year Award for its local and national contribution to enhancing a better appreciation of water resources management and conservation (see WateReuse Public Education Program of the Year sidebar).[47]

Water Quality

Reuse water must be treated so that the quality of the water is safe and appropriate for the use to which it is being applied. While there may be perceived public health or other concerns related to water quality, reuse programs must comply with Wyoming Department of Environmental Quality regulations and, if treated for potable uses, with the Safe Drinking Water Act.[48,49]

Reuse may also result in improved stream water quality as municipal return flows are captured and reused, decreasing the amount of potentially harmful constituents being discharged to rivers. When reuse programs include exchanges of WWTP return flow with agriculture for higher quality municipal diversions, the potential for degraded stream water quality in the vicinity of agricultural return flows exists. Reuse plans should therefore be evaluated for, and designed to minimize, negative water quality impacts.

Stream Flow Issues

A reuse program may impact stream flows that benefit stream and riparian ecosystems or that downstream water users — municipal, agricultural, industrial, or others — may have benefitted from. As cities increase their reuse, it is important for impacts on stream flows to be evaluated and mitigated to the extent possible.

Paddling a racing kayak on the North Platte. Photo: Marek Uliasz.

WateReuse Public Education Program of the Year

Cheyenne Board of Public Utilities/Cheyenne Water Reuse Program (Cheyenne, WY):

Cheyenne's Water Reuse System became a phenomenal success following the implementation of its Public Information Program.

The effort resulted in a successful outreach curriculum to educate end users and residents, who now use Cheyenne's water resources wisely by irrigating with recycled water.

As Cheyenne launched the first major water recycling program in Wyoming, irrigation with recycled water was misunderstood. Other cities in Wyoming had tried to recycle water and stopped when their efforts were rejected by the public. With foresight, commitment, and a program to enhance understanding, the residents of Cheyenne rallied to show public support, resulting in the successful reuse project.

Cheyenne's Board of Public Utilities (BOPU) presented the outreach items, as well as presentations, brochures, infomercials and frequently asked Q&As. Based on its investigations of previous projects, BOPU set three objectives for the outreach campaign for use of recycled water for irrigation, including:

- Communication detailing recycled water benefits.
- Facts to prove the safety of recycled water.
- Outline of BOPU's outstanding reputation as the source of quality water in Cheyenne.

The residents of Cheyenne rallied to show public support, resulting in the successful reuse project.

Currently, Cheyenne is receiving national attention, an immense honor for a city of 54,000. The American Water Works Association and Rural Water Association have both expressed interest in using the training materials developed for the BOPU. Considering that the Public Information Program for Cheyenne's Water Reuse System was hesitantly approved by the Board, it has excelled into a nationally recognized public education program.

Source: 2008 National WateReuse Conference Agenda

Estimate of Urban County Reuse

Existing Reuse

Within the Urban Subbasins, the city of Cheyenne is the only municipality with a significant existing reuse program. Cheyenne reuse provides approximately 550 acre-feet per year of water for irrigation of parks, athletic fields, and other green spaces.[50]

Additional Opportunities

Reuse in Wyoming is primarily focused on agricultural and landscape irrigation uses. Several cities have evaluated using reclaimed water for irrigation, but have decided that currently it is more efficient to use other supplies (potable water or groundwater), though most have left open the possibility of reconsidering reuse in the future. Meeting a portion of outdoor water demand through reuse is important in order to optimize existing supplies and free up potable water supplies. However, as population grows and demand increases, communities should look beyond outdoor irrigation and consider expanding reuse to include year-round industrial, cooling, and even potable uses. Below we quantify some potential reuse opportunities, but do not specify how reusable water will be utilized.

Cheyenne—The city of Cheyenne is reusing about 550 acre-feet per year, though its system is designed to treat up to 4 MGD (1,890 acre-feet per year; assuming 5 months of irrigation) in the near term. The city plans to increase reuse to up to 10 MGD (4,700 acre-feet per year; assuming 5 months of irrigation).[51] Cheyenne currently reuses water for irrigation, but the city may also consider using reclaimed water for cooling or industrial processes in the future. The city is able to divert 17,700 acre-feet per year of transbasin imports from the Little Snake River. Because this water is imported, return flows can be reused without concerns about impacting the PRRIP. We estimate that, if fully utilized, this supply could provide annually 7,900 acre-feet of reuse.[52] That is 3,200 acre-feet per year of additional reused water beyond the amount Cheyenne is currently planning for.

Recycled water projects use purple pipes to convey supply from the treatment plant to the point of use.

Laramie – The city of Laramie evaluated potentially reusable supplies in its 2006 Water Plan. The plan estimates that, on average, 1.84 MGD (2,060 acre-feet per year) of wastewater treatment plant outflows originates from reusable groundwater sources.[53] While the plan considered, but dismissed, irrigating city parks with treated return flows, it states, "At some point in time, if municipal water demands continue to increase, it will be wise to irrigate with non-potable sources…."[54] Based on the data presented in the 2006 plan, Laramie has potentially reusable supplies of 2,060 acre-feet per year. When the Dowlin Ditch supplies associated with the Monolith Ranch are eventually transferred to municipal use, this will provide an additional reuse potential of approximately 1,120 acre-feet per year, for a total annual reuse potential of 3,180 acre-feet.[55] This exceeds the city of Laramie's estimated irrigation needs, so broader uses would be required to take full advantage of this supply.

Table 1 includes existing reuse and future reuse opportunities. Additional reuse opportunities likely exist for other towns and cities in the Urban Subbasins, but data was not readily available to estimate this. As represented by the purple reuse wedge in Figure 11, we assume new reuse in the Urban Subbasins will reach 10,530 acre-feet per year by 2035.

TABLE Nº 1 SUMMARY OF EXISTING REUSE AND ADDITIONAL OPPORTUNITIES.

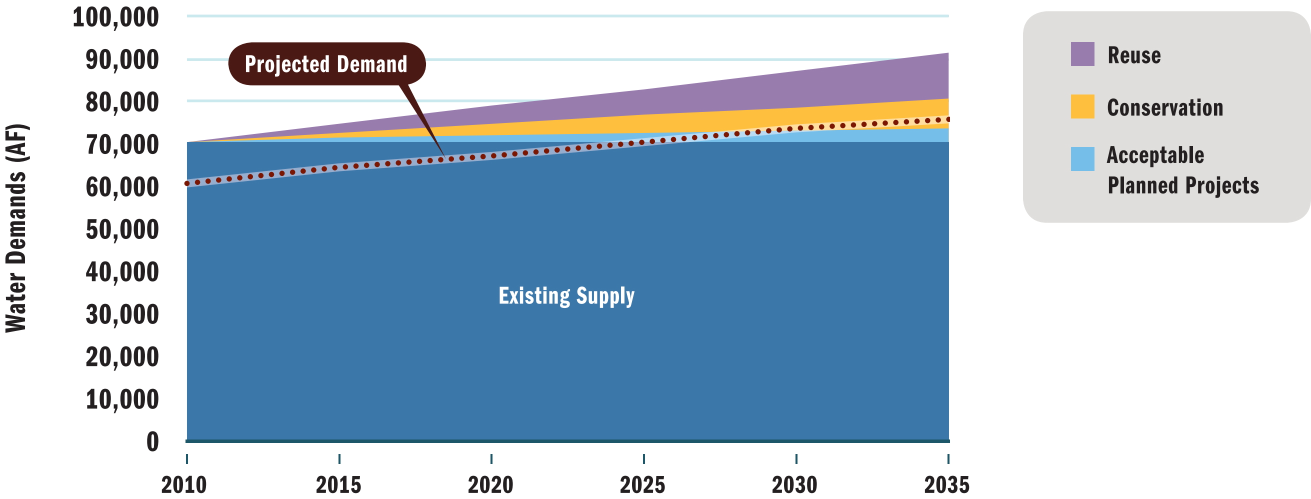
City/Utility	Reuse (AFY)		
	Existing	Future Additional	Total
Cheyenne	550	7,350	7,900
Casper/CWRWS*	–	–	–
Laramie		3,180	3,180
Total	**550**	**10,530**	**11,080**

* Some reuse for wastewater processes does occur at the Central Wyoming Regional Water System (CWRWS) wastewater treatment plant but is not quantified here.

The North Platte meanders through Casper.

FIGURE Nº 11 ESTIMATE OF WATER NEEDS FOR THE URBAN SUBBASINS INCLUDING ACCEPTABLE PLANNED PROJECTS, CONSERVATION, AND REUSE STRATEGIES.

New water reuse projects could provide more than 10,000 acre-feet of water supply annually to the Urban Subbasins.



Barbed wire fence around pasture in rural Wyoming.

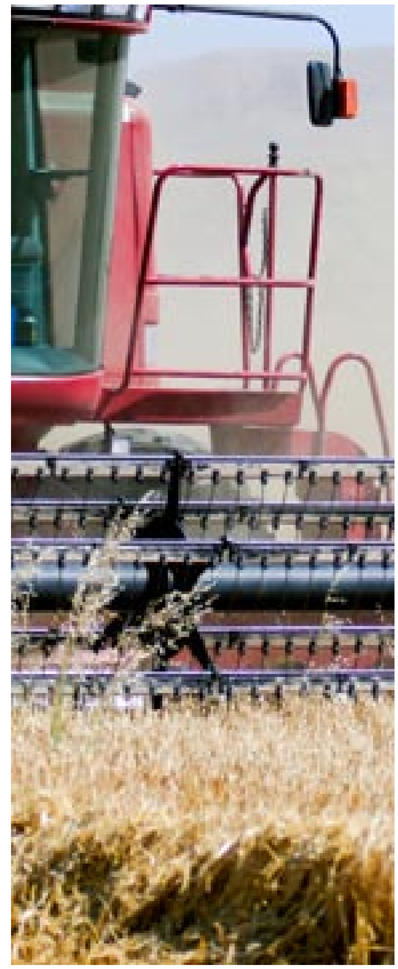
Ag/Urban Cooperation in the Urban Subbasins

Innovative arrangements, such as rotational fallowing, interruptible supply agreements, water banks, crop changes, and deficit irrigation, could allow for temporary transfer of irrigation water to municipal uses without permanently drying irrigated lands. Even accounting for the time and work that would be required to adopt the administrative and legal framework necessary to facilitate these types of arrangements, ag/urban sharing agreements may be a more realistic option than developing new, large transbasin diversions for the urban communities in the Platte River Basin. We assume the Urban Subbasins can meet their future water needs without permanently drying irrigated acreage. Specifically, this could be done with ag/urban cooperative agreements contributing 1,900 acre-feet of agricultural water annually by 2035—an amount that represents .003 percent of the total Platte River agricultural consumptive use of water.[56]

Wyoming's existing water code allows for temporary and permanent transfer of agricultural water to municipal use. However, agricultural producers remain concerned that such transfers may permanently fallow productive ground, result in the loss of livestock and crops for human consumption, and threaten the culture of traditional farming and ranching in the state.

Although the agricultural community may view growing urban demands as a threat, voluntary and compensated cooperative agreements could be an attractive option for farmers and ranchers if they are structured in ways that protect the interests of irrigators.

A major benefit of ag/urban sharing agreements to agricultural interests would be the opportunity to lease water at a profitable price on a schedule established well in advance of the actual reallocation of the water. In general, sharing agreements can provide irrigators with more stable incomes. In the context of the Platte Basin's projected urban growth and PRRIP commitments, water sharing agreements may provide irrigators with the opportunity to generate a return on a resource that will have an ever-increasing value in the urban centers of the basin, while at the same time allowing them to keep control of their water rights.



Combine harvester moving through a barley field.

Ag/Urban Cooperation Examples

The best known example of a fallowing agreement is the Palo Verde Land Management, Crop Rotation, and Water Supply Program between Metropolitan Water District (MWD) of Southern California and the Palo Verde Irrigation District. Palo Verde farmers enrolled in this program agree to refrain from irrigating between 7 percent to 28 percent of their lands in a given year at the request of MWD. The program provides a stable income to the farming community every year while also providing a reliable water supply to urban communities in Southern California, when needed. Land taken out of production is rotated every one to five years, and maintained under approved soil and management plans. It involves no changes in water rights, land ownership, or loss of prime agricultural lands. Lands rotated out of production can be made more productive before being placed back into production, resulting in increased crop yields.[57] A summary of the program is provided in Table 2.

Another example is the Super Ditch concept in the Arkansas River Basin of Colorado. The Super Ditch was formed in 2008 to make water leases available through rotational fallowing in this basin. The basic idea of the Super Ditch is that a centralized entity will negotiate and facilitate, on behalf of famers, the collective leasing of water to municipalities from shareholders on one or more Arkansas River ditch companies. The main objective of the Super Ditch is to

TABLE Nº 2 PALO VERDE LAND MANAGEMENT, CROP ROTATION, AND WATER SUPPLY PROGRAM EXAMPLE.[58]

Program length	35 years, from Jan. 1, 2005 to July 31, 2040
Estimated water supply for urban Southern California each year	25,000 to 118,000 AF
Estimated total water supply over program length	1.8 to 3.9 MAF
Total Palo Verde Valley farmland in production	91,400 acres
Maximum amount of farmland taken out of production in any year	28% or 26,000 acres
Sign-up payments received by participating farmers	One-time payment of $3,170/acre enrolled for a total of $73.5 million
Annual fallowed land maintenance payments per acre	$733 for 2013, adjusted upward annually for inflation for future years
Annual payment to Palo Verde Irrigation District for its administrative program costs	$246,000 for 2012/2013 (payment varies annually)
Amount expensed for program environmental documentation and implementation	$3.3 million

Photo courtesy of the Metropolitan Water District of Southern California.

make leases attractive to potential lessors (irrigators) and lessees by combining lease price, reliability of and access to supply, and long-term conditions that work for all parties. The Super Ditch Company has signed two leases and several letters of intent for lease terms of 40 years at prices for water within the range of $500 per acre-foot. At present, the Super Ditch Company is developing pilot projects for 2014 and 2015 to operate under a new state law enacted in 2013 to facilitate the demonstration of ag/urban water sharing through leasing-fallowing. The legislation is intended to bypass legal issues raised by opponents of the Super Ditch when it tried to do a 250 acre-feet pilot program in 2012 under then-existing law.

Issues Associated with Ag/Urban Cooperative Agreements

Ag/urban sharing agreements must meet the needs of the agricultural community. There are no fixed rules for how such contracts must be structured, but, at a minimum, they should address the following issues:[59]

- Temporary transfers must not be the precursors to permanent transfers.
- Temporary transfers must be protected against claims of abandonment for non-use or in loss of priority.
- A balance must be struck between the irrigators' preference for short-term arrangements and the municipal utilities' interest in long-term security.
- Transfer obligations should be shareable among multiple participating irrigators to provide flexibility.
- Transfers must not affect the water supplies of non-participating irrigators or ditch companies.
- Market tiers and associated prices must be established to allow participation by irrigators with water of varying reliability.
- The structure, if not the detail, of agreements must be standardized to reduce time and administrative commitments necessary for both their negotiation and implementation.

Ideally, transfers should also be designed so as not to affect the water supplies of non-participating farmers. This will require that return flows associated with the supplies of participating farmers be maintained.

Estimate of Water Available via Ag/Urban Cooperation

Laramie Basin

In 2004, a team of economists from the University of Wyoming and Oregon State University estimated the water supply potential and cost of acquiring water from agriculture in the Laramie Basin under a short-term water leasing program.[60] Although this study involved using voluntary leases to enhance instream flows to meet PRRIP commitments, it nevertheless quantified the amount of irrigation water that could be made available in the Laramie Basin through a voluntary leasing program in which each participant offers a rotating contribution of water during two or three non-consecutive irrigation seasons over a 10-year contract period.[61] This study estimated that, depending on participation and contribution rates, such a water leasing program could generate annually, in drought years, from 940 to 11,250 acre-feet of water. Assuming drought-year yield, with 25 percent of the irrigators included in the Laramie Basin rotational leasing program study fallowing 20 percent of their irrigated acreage, such ag/urban cooperative agreements would provide 1,880 acre-feet of water per year to the Urban Subbasins.[62]

Monolith Ranch

The city of Laramie purchased the Monolith Ranch (11,440 acres) in 1981 to acquire the Dowlin Ditch water right—a reliable water supply that will help the city meet future water demands. The city expects to transfer the Dowlin water to municipal use by 2025–2030.[63] Prior to the transfer, the city plans to produce crops that consume large amounts of late-season water to increase revenue and maximize the amount of water that can be ultimately transferred to municipal use under Wyoming law.[64] Accounting for losses, low-flow periods in the river, and other uncertainties, we calculate 2,500 acre-feet of water would be available annually from Monolith Ranch to meet urban needs in the future.

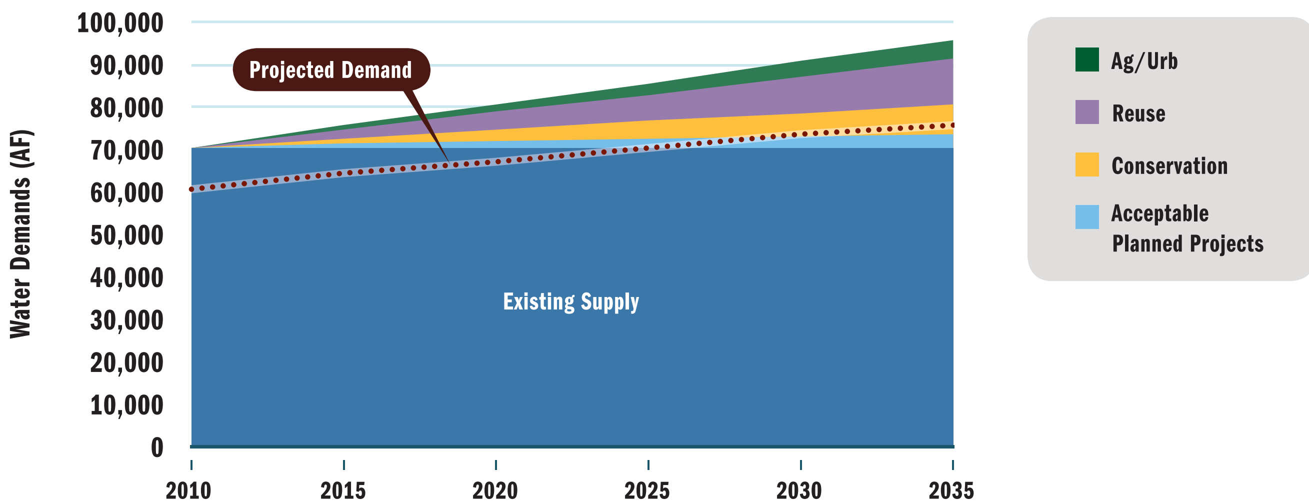
We do not include the Monolith Ranch as an example of ag/urban cooperation because it would result in permanent dry-up. However, its water supply is included in this section because it is a municipal acquisition that does not constitute an *existing* supply, and its future yield needs to be taken into account. It is also worth noting that the Monolith Ranch is not a traditional buy-and-dry scheme. The city has adopted a management plan for the ranch that proposes to optimize grazing and pasture to maximize the ranch value after Dowlin Ditch water has been transferred to municipal use and make the ranch a self-sufficient entity.[65] Additionally, the ranch currently provides, and plans to keep providing in the future, hiking, fishing, and hunting amenities to city residents and tourists.

Supply from Ag/Urban Cooperative Agreements

Combining 1,880 acre-feet per year from a Laramie Basin rotational leasing program (or similar temporary programs) with the Monolith Ranch water supply (2,500 acre-feet) would provide approximately 4,400 acre-feet of water per year to the Urban Subbasins by 2035. This is represented by the green ag/urban cooperation wedge in Figure 12.

FIGURE Nº 12 ESTIMATE OF WATER NEEDS FOR THE URBAN SUBBASINS INCLUDING THE ACCEPTABLE PLANNED PROJECTS, CONSERVATION, REUSE, AND AG/URBAN COOPERATION STRATEGIES.

Ag/urban cooperation could provide approximately 4,400 acre-feet of water supply annually to the Urban Subbasins.



Partnering with Agriculture to Improve Infrastructure and Habitat

In many places, rivers and streams have become fragmented by physical barriers, such as dams, road stream crossings, and irrigation diversions. These barriers and low flows block trout from reaching stretches that might provide better shelter, food, or spawning opportunities. Instream obstacles and bottlenecks can hinder trout populations throughout the watershed and prevent them from thriving. In the majority of the drainages across Wyoming, the major water delivery systems are aging (many are over 100 years old). In addition to the difficulties of delivering water to irrigated land through inefficient infrastructure, these old structures commonly create barriers for coldwater fish movement and have blocked access to historically occupied habitat.

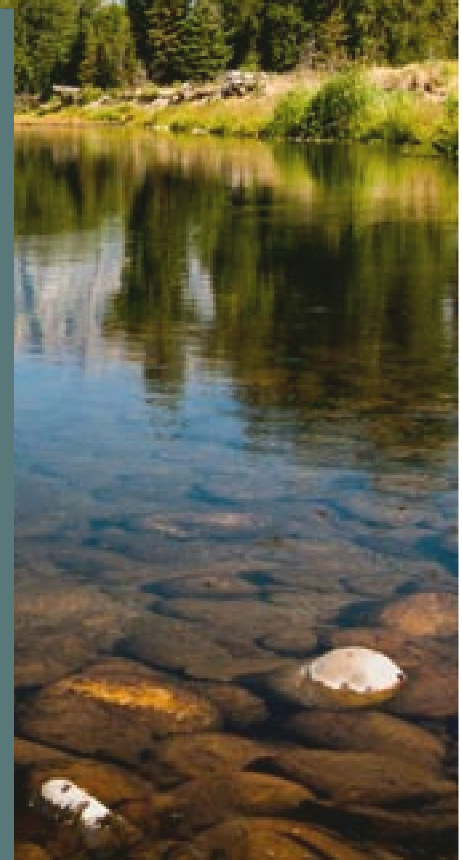
Working through partnerships with landowners and public entities, Trout Unlimited has played a foundational role in enhancing flows to improve fisheries and their habitats in stream reaches in Wyoming with little or no unappropriated water.[66]

Since 2006, Wyoming Trout Unlimited has worked with landowners across the state to upgrade irrigation infrastructure and to improve ranch operations and associated fisheries. Projects include installation of new diversion structures, replacement of road crossings, and removal of barriers that preclude the upstream movement of fish. They may also involve adoption of irrigation-efficiency technologies and practices that optimize ranch operations, improve instream flows, and leave more water in the system for other uses. The following case studies exemplify the types of projects local landowners and watershed partnerships may be able to implement to optimize farming operations while benefiting local fish populations.

Case Study: Grade Creek

Wyoming Trout Unlimited partnered with private landowners, the Natural Resources Conservation Service (NRCS), U.S. Fish and Wildlife Service (FWS), and Wyoming Wildlife and Natural Resource Trust to reconnect Grade Creek to the Smiths Fork River. Grade Creek is an important Bonneville cutthroat trout tributary located near Cokeville, Wyoming. The Grade Creek Reconnect Project included the design and reconstruction of over 4,000 feet of historic stream channel, plus the installation of a fish-friendly diversion structure, an efficient water delivery system, and multiple off-channel solar pump stock water wells. Upon completion in 2009, this project reconnected this historical tributary to the Smiths Fork River, improved the delivery system for irrigation operations, and created year-round stream flows in Grade Creek for the first time in nearly 70 years.

Farmland near Cokeville, Wyoming.



A braid of the Snake River in Grand Teton National park.

Case Study: Spread Creek

Spread Creek is located along the east margins of Grand Teton National Park, near Jackson Hole. Lower Spread Creek traverses through relatively pristine national park lands before joining the Upper Snake River approximately 15 miles below Jackson Dam. This lower section historically served as a migration corridor for fluvial Snake River fine-spotted cutthroat trout, while the upper portion of Spread Creek serves as an important spawning and rearing habitat for fluvial fish, and a year-round home for resident native cutthroat trout. Prior to 2010, a large concrete diversion made upstream migration for native fish impossible. This structure had been in place since the early 1970s, but, for the better part of a century, a diversion of some kind existed at this site to deliver water for irrigation purposes to nearby ranches. In 2010, Wyoming Trout Unlimited and other project partners removed the concrete structure and installed a new diversion to allow water users the ability to divert irrigation water while maintaining fish passage throughout the year. The project also modernized the irrigation infrastructure of the local water users. These improvements will require less annual and seasonal disturbance to Spread Creek and the associated riparian area caused by instream heavy machinery. While improving ranch operations by reducing annual maintenance on the diversion structure, the project made over 60 miles of historical habitat available for Snake River cutthroat trout and other native fish.

Large concrete diversion structure removal, Spread Creek.

Case Study: Rock Creek

Trout Unlimited worked with ranchers in Rock Creek, a tributary to the Bear River, to greatly improve irrigation practices and reconnect the entire tributary system to the Bear River for migratory Bonneville cutthroat trout and other native fish. Partnering with the NRCS, funding was obtained to consolidate eight diversions into five fish-passable structures with fish screens and install nearly 10,000 feet of gated pipe. The gated pipe replaced the previous open-ditch, flood-irrigation system and provided significant improvements in the efficiency of water use on the ranch. Completion of this project in 2008 left Rock Creek 100% fish-passable.

Recommendations

Water is the lifeblood of Wyoming. The annual pattern of snowmelt from the headwaters has been one of the key ingredients that has determined the character and history of the state. This report lays out a portfolio of water supply strategies for meeting the future urban water needs of the Platte River Basin without sacrificing the majestic rivers and streams of Wyoming. We must look beyond old ways of thinking and realize we have many solutions available for meeting our future water needs. Today's decisions are critical.

Based on the sound analysis of widely accepted data, this report offers several key recommendations for water planners and policy makers to carefully consider when forging Wyoming's water future:

Rainbow trout.

- Close the projected Urban Subbasins' "gap" with balanced strategies that are more cost-effective and environmentally friendly than traditional transbasin projects.

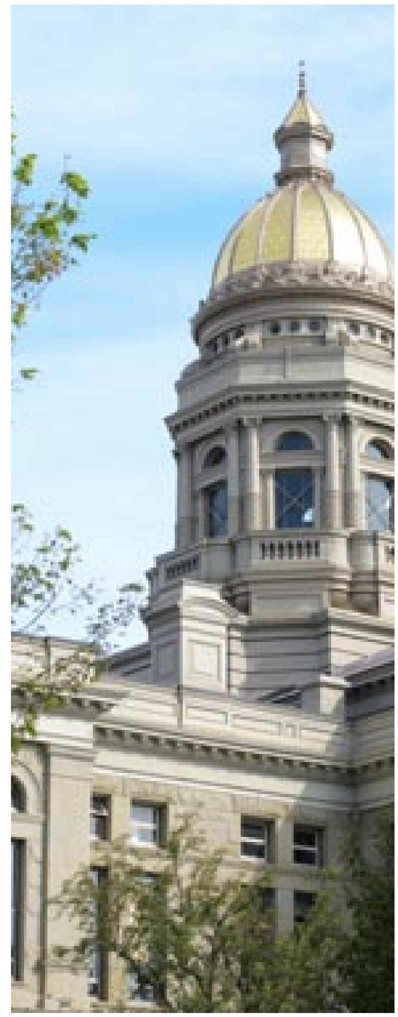
- Protect Wyoming's rivers, streams, and lakes as an integral part of any future water development strategy. Outdoor recreation and non-consumptive uses of water—for fishing, rafting, and other uses—are worth billions of dollars annually to the Wyoming's economy and are critical to residents' quality of life.

- Pursue only those projects that can be constructed and operated according to the Smart Principles delineated in this report.

- Implement more aggressive water conservation strategies. Conservation is often the cheapest, fastest, and smartest way to stretch water supplies, and utilities have significant opportunities to boost their existing water conservation efforts.

- Maximize the role of water reuse in meeting the future needs of Wyoming's residents and work to improve public perception and acceptance of reuse projects.

- Cooperate with agriculture on voluntary water sharing agreements that benefit both municipalities and the agricultural community without permanently drying irrigated acres. Alternatives to "buy and dry" transfers present the best opportunities for our future.


State Capitol Building, Cheyenne.

While Urban Subbasins communities are already making significant strides in pursuing projects that adhere to Smart Principles, and to the water conservation and reuse strategies presented in this report, by further adopting these recommendations, urban communities in the Platte Basin can more than meet their future needs while minimizing impacts to rivers and streams.

Ayres Natural Bridge State Park.

Appendix A

List of Major Federal Programs that Fund Water Conservation

Program	Agency / Department
Drinking Water State Revolving Fund (DWSRF)	U.S. Environmental Protection Agency
Clean Water State Revolving Fund (CWSRF)	U.S. Environmental Protection Agency
WaterSMART—Sustain and Manage America's Resources for Tomorrow	U.S. Bureau of Reclamation
Title XVI—Water Reclamation & Reuse Program	U.S. Bureau of Reclamation
Water Conservation Field Services Grant Program	U.S. Bureau of Reclamation
Water and Environment Programs, Rural Utilities Service (WEP)	U.S. Department of Agriculture
Rural Business-Cooperative Service	U.S. Department of Agriculture
National Resources Conservation Service (NRCS)	U.S. Department of Agriculture
Public Works and Development Facilities Grants	U.S. Department of Commerce
Community Development Block Grants	U.S. Department of Housing and Urban Development
Colorado River Basin Salinity Control Program	U.S. Bureau of Reclamation

North Platte River below Fort Steele. Photo: Marek Uliasz.

End Notes

1 Trout Unlimited, Western Resource Advocates, and Colorado Environmental Coalition. 2005. *Facing Our Future: A Balanced Water Solution for Colorado*. Boulder, Colo., July.

2 See notes 19 and 20, infra.

3 Outdoor Industry Association. 2012. *The Outdoor Recreation Economy*. Boulder, Colo.

4 We include passive savings as a reduction in the demand projections.

5 U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau. 2011. *2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Wyoming*. Washington, DC, June. Report FHW/11-WY.

6 U.S. Department of the Interior, Fish and Wildlife Service and U.S. Department of Commerce, U.S. Census Bureau. 1991. *1991 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Wyoming*. Washington, DC, October. Since the 2011 survey (see note 5) and the 1991 survey used similar methodologies, their published information is directly comparable.

7 Ibid.

8 Outdoor Industry Association. 2012. *The Outdoor Recreation Economy*. Boulder, Colo.

9 The in-state freshwater fishing expenditures are from the individual state surveys of the U.S. Department of the Interior, Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau's 2011 *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation*. Washington, DC. The calculation of ratios used 2010 state GDP data from the U.S. Bureau of Economic Analysis, as published in: State of Wyoming, Department of Administration and Information, Economic Analysis Division. 2009. *Wyoming Employment, Income, and Gross Domestic Product Report*, 23rd edition. Cheyenne, Wyo., December.

10 Public Opinion Strategies, and Fairbank, Maslin, Maullin, Metz & Associates. 2013. *Conservation in the West Survey: 2013 Survey of the Attitudes of Voters in Six Western States*, Colorado Springs, Colo., January. Sponsored by The Colorado College State of the Rockies Project.

11 Wyoming Water Development Commission. 2005. Technical Memorandum 4.3, "Introduction Projected Water Use Factors for Economic Sector," Exhibit 11. In *Platte River Basin Plan*. Cheyenne, Wyo., June 10.

12 Wyoming Water Development Commission. 2005. Technical Memorandum 4.3, "Introduction Projected Water Use Factors for Economic Sector." In *Platte River Basin Plan*. Cheyenne, Wyo., June 10.

13 While the state set 1997 benchmarks for each water provider, the Wyoming Depletions Plan provides flexibility for the state as a whole. If some water users use more but others use less, and Wyoming's total baseline isn't exceeded, no mitigation by the state is required. However, if the baseline is exceeded, the state is responsible for mitigating excess depletions by providing sufficient water supplies to offset depletions at the Wyoming/Nebraska state line. Within the state, individual water providers must offset depletions in excess of their baselines. Examples of supplies that can be used to offset excess depletions are return flows from non-nontributary groundwater and transbasin diversions that were not historically present in the Platte River Basin.

14 The Platte River Basin is located in the following Wyoming counties: Albany, Laramie, Platte, Carbon, Converse, Fremont, Goshen, Natrona, Niobrara, Sublette, and Sweetwater.

15 The Urban Subbasins are herein defined as the Platte River Basin Water Plan's Pathfinder to Guernsey Subbasin (cities of Casper and Douglas); South Platte Subbasin (city of Cheyenne); Upper Laramie Subbasin (city of Laramie); Above Pathfinder Dam Subbasin (city of Rawlins); and the Guernsey to State Line Subbasin (city of Torrington).

16 The 2035 population projections are from Wyoming Water Development Commission. 2005. Technical Memorandum 4.2, "Approach." In *Platte River Basin Plan*. Cheyenne, Wyo., June 10. Baseline populations for all subbasins except Guernsey to State Line Subbasin are from Wyoming Water Development Commission. 2005. Technical Memorandum 2.2, "Municipal and Domestic Water Use in the Platte River Basin of Wyoming." In *Platte River Basin Plan*. Cheyenne, Wyo., April 1. Baseline population for the Guernsey to State Line Subbasin are from Wyoming Water Development Commission. 2005. Technical Memorandum 4.2, "Approach." In *Platte River Basin Plan*. Cheyenne, Wyo., June 10.

17 This 6% reduction represents the same "high" passive conservation scenario adopted by Colorado in its state-wide water supply planning process, and it is based on existing regional and national passive conservation studies, regional M&I water demand reports, and water conservation plans on file with the state of Colorado. This reduction is estimated to occur as a result of retrofitting housing stock and businesses that exist prior to 2016 with high-efficiency fixtures and appliances. It takes into account the 1992 National Energy Policy Act, the 2002 California Energy Commission Water Efficiency Standards, and the 2007 California Assembly Bill 715. It assumes that (1) water and energy savings will become increasingly important to water customers as water and fuel costs rise; (2) high-efficiency fixtures and appliances will become increasingly efficient as technology improves and customers strive to reduce their variable costs related to water and energy; and (3) due to the size and power of California's economy, products compliant with California efficiency standards will dominate the stream of commerce in the Western U.S., including Wyoming.

Morning light on a bull elk in a Wyoming meadow.

18 As one example, the city of Cheyenne's 1978 Proposed Stage II Water System Expansion was, in large part, based on meeting an estimated 30,000 AFY water demand for a year 2000 population of 113,500. To meet this demand, the following recommendations were implemented by the city in the 1980s: Stage II of the Little Snake River Diversion Pipeline Enlargement; Stage II Rob Roy Dam and Reservoir Enlargement; and Hog Park Dam and Reservoir Enlargement. In contrast, the city's 2012 service area population was less than half of the population projected for 2000 by the Expansion Study. In addition, more recent projections from the Platte River Basin Water Plan estimate a 26,400 AFY demand for the whole South Platte Subbasin (which includes the city of Cheyenne) for 2035—less than the total demand that the expansions were supposed to help satisfy by the year 2000. See: Wyoming State Engineer's Office. 1978. *Summary and Analysis of the City of Cheyenne's Proposed Phase II Water System Expansion Study*. Cheyenne, Wyo. See also: City of Cheyenne Board of Public Utilities. 2012. *Waterworks and Sewer Enterprise Funds of the City of Cheyenne, Wyoming: Comprehensive Annual Financial Report for the Fiscal Year Ended June 30, 2012*. Cheyenne, Wyo., September 10.

19 Western Resource Advocates, Trout Unlimited, Colorado Environmental Coalition. 2011. *Filling the Gap: Commonsense Solutions for Meeting Front Range Water Needs*. Boulder, Colo., February.

20 Western Resource Advocates, Trout Unlimited, Colorado Environmental Coalition. 2012. *Filling the Gap: Meeting Future Urban Water Needs in the Arkansas Basin*. Boulder, Colo., March.

21 In 2002, it was documented that no diverted water made it to the water treatment plant because of canal seepage and evaporation. City of Laramie, Wyo. 2006. *Executive Summary: Laramie Water Management Plan, Level II*. Laramie, Wyo., August.

22 Lidstone and Associates, Inc. 2012. *Cheyenne Belvoir Ranch, Groundwater Level II*. Fort Collins, Colo., June. Report prepared for Wyoming Water Development Commission.

23 City of Cheyenne. 2008. *The Belvoir Ranch and Big Hole Master Plan*. Cheyenne, Wyo., September.

24 Ibid.

25 JR Engineering, LLC. 2007. *Cheyenne Belvoir Ranch Level II Study: Phase III–V, Executive Summary*. Cheyenne, Wyo., September 1. Report prepared for Wyoming Water Development Commission.

26 Wyco Power & Water Inc., 138 FERC ¶ 62,150 (2012), req. for rehearing denied, 139 FERC ¶ 61,124 (2012).

27 Letter from Kathryn Schenk, Chief, Operations Division, Omaha District, U.S. Army Corps of Engineers, to Aaron Million, President, Million Conservation Resource, July 14, 2011, notifying the applicant that the Corps is terminating the EIS Process for the Regional Watershed Supply Project.

28 Douglas County, Colo. County Manager report to the Board of County Commissioners, May 22, 2012.

29 Research Council of the National Academies of Science. 2005. *Public Water Supply Distribution Systems: Assessing and Reducing Risks—First Report*. Washington, DC: National Academies Press.

30 Ibid.

31 Feinglas, S., C. Gray, and P. Mayer. 2013. "Conservation Limits Rate Increases for Colorado Utility." Paper presented at Colorado WaterWise Fifth Annual Water Conservation Summit, Denver, Colo., October 25.

32 Ash, Tom. 2012. "Funding Water Conservation." *Journal American Water Works Association* 104:2, February.

33 Wyoming Survey and Analysis Center. 2012. *City of Laramie Survey, 2012*. Laramie, Wyo., May. WYSAC Technical Report No. SRC-1204.

34 Western Resource Advocates, Trout Unlimited, Colorado Environmental Coalition. 2011. *Filling the Gap: Commonsense Solutions for Meeting Front Range Water Needs*. Boulder, Colo., February.

35 City of Cheyenne Board of Public Utilities. 2012. *Waterworks and Sewer Enterprise Funds of the City of Cheyenne, Wyoming: Comprehensive Annual Financial Report for the Fiscal Year Ended June 30, 2012*. Cheyenne, Wyo., September 10.

36 City of Cheyenne Board of Public Utilities. 2011. *Plan for Wise Water Use*. Cheyenne, Wyo., July 18.

37 Douglas, Wyo. Code § 18.70.040 (B)(5) (2013).

38 Laramie, Wyo. City Council Resolution No. 2007-61 (August 16, 2007).

39 See City of Laramie, Wyo. 2013. "Water and Wastewater Rate Study—Frequently Asked Questions." Accessed August 5. http://www.ci.laramie.wy.us/index.aspx?NID=540.

40 Alliance for Water Efficiency and the Environmental Law Institute. 2012. *The Water Efficiency and Conservation State Scorecard: An Assessment of Laws and Policies*. Chicago, Ill., September.

41 See note 17 for an explanation of this report's passive conservation assumptions.

42 Kenny, J.F., N.L. Barber, S.S. Hutson, K.S. Linsey, J.K. Lovelace, and M.A. Maupin. 2009. *Estimated Use of Water in the United States in 2005*. Reston, Va.: U.S. Geological Survey. Circular 1344. Online at http://pubs.usgs.gov/circ/1344/pdf/c1344.pdf.

43 Sanders, K.T., and M.E. Weber. 2012. "Evaluating the Energy Consumed for Water Use in the United States." *Environmental Research Letters* 7:1–11.

44 Nowak, S., M. Kushler, P. Witte, and D. York. 2013. *Leaders of the Pack: ACEEE's Third National Review of Exemplary Energy Efficiency Programs.* Washington, DC: American Council for an Energy-Efficient Economy. Research Report U132.

45 Wyoming Department of Environmental Quality. 2012. Chapter 21, "Standards for the Reuse of Treated Wastewater." In *Water Quality Rules and Regulations*. Cheyenne, Wyo.

46 An exchange is an arrangement in which a junior water user makes water available to a senior water user in exchange for permission to divert an equivalent amount of water to which the senior would otherwise be entitled.

47 WateReuse Association. 2008. "WateReuse Presents Annual Awards in Dallas." Press release dated September 17, 2008. Accessed May 7, 2013, http://www.watereuse.org/information-resources/press-room/news-releases/news_091708.

48 Wyoming Department of Environmental Quality. 2012. Chapter 21, "Standards for the Reuse of Treated Wastewater." In *Water Quality Rules and Regulations*. Cheyenne, Wyo.

49 Wyoming is the only state in the U.S. that has not requested authority to administer the public water supply program. As a result, the Environmental Protection Agency, Region 8, is responsible for implementing the Safe Drinking Water Act in Wyoming.

50 City of Cheyenne Board of Public Utilities. 2011. *Plan for Wise Water Use*. Cheyenne, Wyo., July 18.

51 Wyoming Water Development Commission. 2005. Technical Memorandum 5.2, "Future Water Use Opportunities." In *Platte River Water Plan*. Cheyenne, Wyo., July 12.

52 Cheyenne does not always divert the full 17,700 AF at present, but plans to increasingly rely on this supply as populations and demands grow. Looking to the future, assuming 50% of 17,700 AFY is used indoors and 90% of that returns, is treated, and can be reused, results in approximately 7,960 AFY of reuse. Note that water from the Little Snake River Basin is not physically diverted to Cheyenne. Instead, this water is exchanged with water Cheyenne diverts from the closer Douglas Creek drainage to offset depletions to the North Platte River.

53 WWC Engineering. 2006. *Laramie Water Management Plan: Level II*. Prepared for the City of Laramie, Wyo. August 25.

54 Ibid.

55 Assuming 2,500 acre-feet of consumptively used water is transferred, 50% of that water is used indoors, and 90% of that returns, is treated, and can be reused, results in 1,125 acre-feet per year of reuse from future Monolith Ranch Dowlin Ditch supplies.

56 This estimate is based on the state's mid-scenario (normal) estimate of current and 2035 annual consumptive water use of agriculture in the Platte River. See Wyoming Water Development Commission. 2005. Technical Memorandum 4.3, "Introduction Projected Water Use Factors for Economic Sector." In *Platte River Basin Plan.* Cheyenne, Wyo., June 10.

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58 Ibid.

59 Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. "Section 7: Portfolios and Strategies to Address the M&I Gap." In *Colorado's Water Supply Future, Statewide Water Supply Initiative 2010*. Denver, Colo., January.

60 Peck, D.E., D.M. McLeod, J.P. Hewlett, and J.R. Lovvorn. 2004. "Irrigation-Dependent Wetlands Versus Instream Flow Enhancement: Economics of Water Transfers for Agriculture to Wildlife Uses." *Environmental Management* 34(6):842–855.

61 Ibid.

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63 City of Laramie, Wyo. 2004. *Monolith Ranch Agricultural Management Plan*.

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Haystacks and snow, Wyoming.

Camping in the Medicine Bow mountains.

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Back cover: At the ranch, Wyoming.