

A Better Future for the Poudre River

**Alternative to the Northern
Integrated Supply Project**



WESTERN RESOURCE
ADVOCATES



This report was prepared by Laura Belanger, with valuable contributions from Stacy Tellinghuisen and Amelia Nuding. We are grateful to Drew Beckwith, John Gerstle, Charles (“Chuck”) Howe, Becky Long, Dan Luecke, and Bart Miller for their review and feedback. Their experience in Colorado water issues and thoughtful suggestions enhanced the content of this report. We also thank Lee Rozaklis for his input on initial report concepts, municipal and irrigation water uses, and water rights considerations. Thanks for editing and report production assistance to Jason Bane, Anita Schwartz, and Nicole Theerasantiankul.

This report was funded by grants from the William and Flora Hewlett Foundation and the Compton Foundation, and by our generous supporters.

Design by Jeremy Carlson

Cover photo courtesy of John Bartholow

Copyright December 2012



WESTERN RESOURCE
ADVOCATES

Western Resource Advocates is a nonprofit conservation organization dedicated to protecting the West’s land, air, and water.

Western Resource Advocates
2260 Baseline Road, Suite 200
Boulder, Colorado 80302
Tel: (303) 444-1188

www.WesternResourceAdvocates.org

Contents

Definitions	4
Executive Summary	7
Better Future Alternative Water Supply Portfolio	8
Recommendations	10
Background	11
The Northern Integrated Supply Project	11
Importance of Maintaining Poudre River Flows	12
The Better Future Alternative	15
NISP Participant Water Demands	17
Key Definitions	17
Projected Populations	17
Baseline Demands	20
Better Future Supplies	23
Existing Supplies	23
Growth onto Irrigated Lands	24
Active Conservation	27
Planned and Additional Reuse	31
Ag-Urban Cooperation	34
Conditional Inclusion: Windy Gap Firming Project	38
Cost Analysis	41
Growth onto Irrigated Lands	42
Active Conservation	44
Reuse	44
Ag-Urban Cooperation	45
Better Future Present Value of Costs	46
Recommendations	49
Conclusions	51
Appendices	55
Appendix A: Better Future Alternative Safety Factors	56
Appendix B: Better Future Alternative Population Projections and Baseline Demands	61
Appendix C: Better Future Alternative Growth onto Irrigated Lands	65
Appendix D: Better Future Alternative Active Conservation	67
Appendix E: Better Future Alternative Summary of Supplies and Demands	70





Definitions

acre-foot (AF)

Volume of water equal to 325,851 gallons. It is approximately the volume used by two to four families in a year. An acre-foot is enough water to cover an acre, one foot deep.

active conservation

Water demand reductions that result from conservation programs and measures implemented by water utilities and their customers. Active conservation can be voluntary or mandatory through regulations. Examples of active conservation include leak detection programs, tiered water rate structures that increase with higher use, improved irrigation management, switching to more water efficient landscaping, and toilet rebates.

Colorado-Big Thompson (CBT) Project

A U.S. Bureau of Reclamation project that diverts approximately 260,000 acre-feet of water each year from West Slope Colorado River headwaters to the South Platte Basin on the east slope. Northern Water apportions the water amongst irrigators and communities that receive municipal and industrial water from the project.

Colorado Water Conservation Board (CWCB)

A Colorado state agency whose responsibilities range from protecting Colorado's streams and lakes, to water conservation, flood mitigation, watershed protection, stream restoration, drought planning, water supply planning, and water project financing.

consumptive use

The portion of water that is used in a process that does not return to the adjacent hydrologic system. For example, water that evaporates or is transpired by plants during agricultural use, or water that is used up or evaporates in an industrial process.

Environmental Impact Statement (EIS) and Draft, Supplemental Draft, and Final EIS (DEIS, SDEIS, FEIS)

The National Environmental Policy Act (NEPA) requires federal agencies to consider the environmental impacts of proposed actions (projects) and reasonable alternatives to those actions. The detailed analyses contained in an EIS meets NEPA requirements.

firm yield

A measure of dependable water supply that can be expected in most (including dry) years, typically used in water supply planning. Average and wet year yields can be significantly higher than firm yield.

gallons per capita per day (gpcd)

A metric for measuring average water use. May include only residential use or be used to represent average system-wide use (residential and other uses, such as commercial, industrial, and institutional) in a community. In this report, gpcd refers to total per capita system-wide use.



Northern Colorado Water Conservancy District (Northern Water)

A public agency created in 1937, the Northern Colorado Water Conservancy District and its municipal subdistrict (both identified in this report as “Northern Water”) serve a large portion of northeastern Colorado, providing water to irrigators, cities, towns, rural-domestic water districts, and industries from the CBT and Windy Gap projects.

present value of costs

A figure reflecting the time value of money, calculated by applying a discount rate to a series of expenditures and revenues over time. Using present value allows for an apples-to-apples comparison of costs and revenues that may occur over a wide variety of time frames.

water (or water resources) charge

Several NISP participants receive water treated by other utilities. These utilities apply a water resources charge, or fee, in the form of water supplies provided by the NISP participant to the treating utility. In the Harvey Report and the Better Future Alternative, the water charges are calculated as a percentage of “water deliveries.”

water deliveries

The volume of water that is used by NISP participants’ customers at the tap. It is what is needed to meet customer demands and is usually metered at a property (home, businesses, irrigation tap, etc.). This volume does not include system losses and water charges.

water losses (or system losses)

Water loss that occurs in treating and delivering water to end use taps.

passive conservation

Water demand reductions that are associated with the impacts of improved technology and state and federal policy measures that result in lower flow standards for fixtures and appliances. Passive conservation savings are realized as more efficient new homes are built or fixtures and appliances are replaced over time in older homes.

Record of Decision (ROD)

The ROD is the final step in the process of creating an Environmental Impact Statement. It includes a decision on the alternative that has been selected.

Statewide Water Supply Initiative 2010 (SWSI or SWSI 2010)

Report that provides a comprehensive picture of Colorado’s current and future projected water needs and existing and potential supplies. It is updated by the state every few years.

total water requirements

In order to get “water deliveries” to NISP customers’ taps, additional water is needed both to cover system losses (e.g., losses during treatment and transit) and to cover “water charges” applied to treat and deliver water to NISP participants. “Total water requirements” is the total volume of “water deliveries” plus “water losses” plus “water charges.”

“ I applaud the advanced thinking that has gone into the Better Future Alternative. This report identifies innovative, workable, and viable water policy solutions that Colorado legislators and policy makers are well-advised to consider today as we work to plan our water future.” ”

– Randy Fischer, State Representative, Colorado House District 53



Executive Summary

The Better Future for the Poudre River Alternative (“Better Future Alternative” or “Better Future”) is an alternative to the Northern Integrated Supply Project (NISP). NISP is a water supply project proposed by the Northern Colorado Water Conservancy District* (Northern Water) to provide 40,000 acre-feet† (AF) of water annually to help meet the future water needs of 15 towns and water districts in northern Colorado.‡ The Save the Poudre Coalition and Western Resource Advocates (WRA) first developed an alternative to NISP, the “Healthy Rivers” alternative, in 2008. The Better Future Alternative was developed by WRA to incorporate more current Colorado State Demography Office population projections, revised NISP participant demands and supplies from a 2011 report by Harvey Economics, data from the Colorado 2010 Statewide Water Supply Initiative, and other recent reports.

A Better Future provides water supplies sufficient to meet and exceed NISP participants’ water demands while maintaining flows critical to aquatic and riparian environments and recreational opportunities in the Cache la Poudre River (Poudre River). In contrast, NISP would divert between 43% and 48% of the remaining flows from the Poudre River each year.

The Better Future Alternative relies on water from growth onto agricultural lands, conservation, reuse, and cooperative agreements with agriculture. It offers several benefits not provided by NISP:

* The Northern Colorado Water Conservancy District and its municipal subdistrict (both identified here as “Northern Water”) serve a large portion of northeastern Colorado, providing water to irrigators, cities, towns, rural-domestic water districts, and industries.

† An acre-foot of water is equal to 325,851 gallons. It is approximately the volume used by two to four families in a year. An acre-foot is enough water to cover an acre (about a football field without the end zones) one foot deep in water.

‡ The NISP participants are Central Weld County Water District, Dacono, Eaton, Erie, Evans, Firestone, Fort Collins-Loveland Water District, Fort Lupton, Fort Morgan, Frederick, Lafayette, Left Hand Water District, Morgan County Quality Water District, Severance, and Windsor.

- The Better Future Alternative meets the needs of NISP participants through 2060. In contrast, NISP is designed to meet projected demands only through 2030.
- Rather than depending on large new reservoirs and diversions, a Better Future includes a diverse supply portfolio.
- By relying on a phased approach (i.e., increasing water supplies incrementally and avoiding large, up-front investment by participants), the Better Future Alternative provides water supply flexibility and financial risk management to communities. If population growth is not as rapid as predicted, communities can delay investment and avoid burdening existing residents with debt.
- Cooperative agreements with the agricultural community provide towns with long-term secure supplies while maintaining agricultural ownership of water. Less than 1% of agricultural consumptive-use water from the South Platte Basin will be necessary for the Better Future Alternative each year.
- The cost of NISP—in present value*—is approximately \$364 million. Though not directly comparable to NISP, the Better Future Alternative’s present value to provide 40,000 AF† of water (NISP’s yield)—excluding some infrastructure costs—is \$109 million.
- The Better Future Alternative protects the Poudre River, wetlands, and other important environmental and recreational resources as well as the communities and businesses that depend on them.

Better Future Alternative Water Supply Portfolio

Based on Colorado State Demography Office population estimates, recent NISP participant per capita water use, and applying passive conservation savings, the Better Future Alternative calculates that water requirements for NISP participants will total 72,100 AF in 2030 and 109,100 AF in 2060. This is 27,000 AF and 34,300 AF less than current NISP projections for 2030 and 2060, respectively.

The Better Future Alternative water supply portfolio (Figure 1), excluding Windy Gap Firming Project (WGFP) supplies, includes total firm yield

* The present value of costs reflects the time value of money by applying a discount rate to a series of expenditures and revenues over time. Using present value allows for costs and revenues that may occur over a wide variety of time frames to be similarly examined.

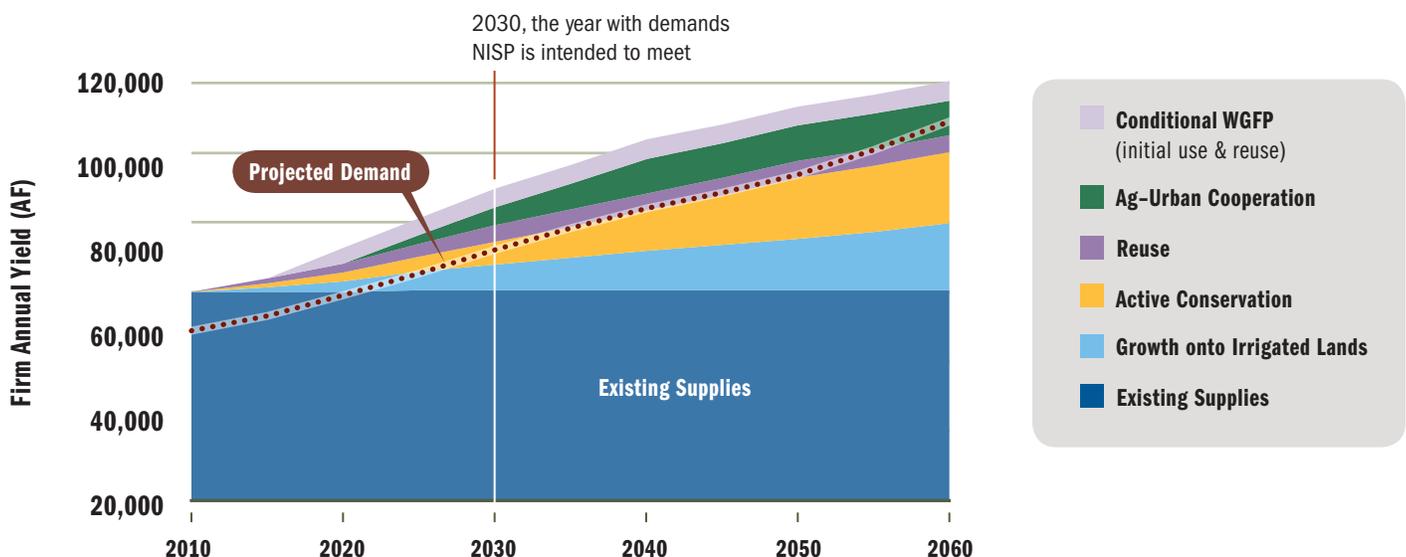
† The Better Future Alternative provides a total of more than 60,000 AF of new firm yield supplies by 2060, in addition to existing NISP participant supplies. The Better Future Alternative is projected to yield 40,000 AF of new firm yield supplies, equivalent to the NISP yield, between 2035 and 2040.

supplies of 84,200 AF in 2030 and 115,100 AF in 2060. This portfolio exceeds NISP’s projected total water requirements by 12,100 AF in 2030 and by 6,000 AF in 2060. The components of the portfolio are:

- Current firm yield supplies = 60,550 AF
- Annual firm yield from traditional agricultural transfers from urban growth onto previously irrigated lands = 7,360 AF by 2030 and 19,150 AF by 2060
- Active conservation savings = 6,401 AF by 2030 and 20,482 AF by 2060
- Reuse of existing supplies = total of 4,900 AF by 2030
- Agricultural-Urban (Ag-Urban) cooperation = 5,000 AF by 2030 and 10,000 AF by 2060

Several NISP participants have also requested Windy Gap Firming Project supplies. Because this project has not yet been approved, and because of potential impacts to West Slope streams and rivers, a Better Future only conditionally includes WGFP supplies (first-time use and reuse) of 5,500 AF. When WGFP water is included, Better Future Alternative supplies exceed demands by 17,700 AF in 2030 and 11,500 AF in 2060. NISP participant projected demands are met with or without the WGFP.

FIGURE N° 1 BETTER FUTURE ALTERNATIVE SUPPLIES MEET AND EXCEED NISP PARTICIPANTS’ PROJECTED 2060 DEMANDS.



Recommendations

Planning for and meeting the water needs of NISP participant communities is critical, as is ensuring the health of the Poudre River and the recreational, economic, and other benefits it provides. We believe that Northern Water and NISP participants can chart an innovative path forward, one that differs from the traditional approach of building very large reservoirs. The Better Future portfolio instead relies on a combination of supplies from conservation, reuse, water transferred as a result of growth onto irrigated agricultural lands, and voluntary agreements with agriculture.

We encourage the U.S. Army Corps of Engineers to incorporate elements of the Better Future Alternative into its No Action Alternative when completing the NISP Supplemental DEIS.

Western Resource Advocates offers the following key recommendations for Northern Water, NISP participants, and the U.S. Army Corps of Engineers to consider carefully in planning for the region's future water needs:

- ✓ Meet projected demands with balanced strategies that are the least environmentally damaging, in contrast to large traditional reservoir and pipeline projects.
- ✓ Protect Colorado's rivers and streams as an integral part of any future water development strategy. Nonconsumptive uses of water—for fishing, boating, and other uses—are extremely valuable to the local economy and are critical to our quality of life.
- ✓ Use reliable and up-to-date population data and projections from the State Demography Office.
- ✓ Implement more aggressive water conservation strategies. Conservation is often the cheapest, fastest, and smartest way to meet new demands, and NISP participants have significant opportunities to boost their existing water conservation efforts.
- ✓ Conservation savings—passive and active—must be integrated into water supply planning.
- ✓ Include all existing supplies, supplies from growth onto irrigated lands, and NISP participants' water dedication requirements in future supply projections
- ✓ Maximize the role of water reuse in meeting future needs. Include NISP participants' existing and planned reuse—as well as additional Better Future reuse supplies—in any analysis.
- ✓ Include increased cooperation between agriculture and local communities in the form of voluntary water sharing agreements that benefit both NISP participants and the agricultural community without permanently drying up irrigated acres. Alternatives to “buy and dry” transfers present excellent opportunities for meeting future municipal demands.

By following these recommendations, NISP communities can more than meet their future water needs while minimizing impacts to rivers and streams.

Background

The Northern Integrated Supply Project

Northern Water has proposed the Northern Integrated Supply Project (NISP) to provide 40,000 acre-feet (AF) of annual yield to help meet projected 2030 demands for 15 towns and water districts in northern Colorado (Figure 2). If approved, NISP would create two new off-stream reservoirs: Glade Reservoir,* which would inundate a valley north of the mouth of the Poudre Canyon, and Galeton Reservoir, northeast of Greeley (Figure 3). The NISP reservoirs would be supplied by increased diversions from the Poudre River, eliminating remaining peak flows that are critical to stream and riparian health, habitat maintenance, river recreation, and the businesses that rely on it. In addition to Poudre River diversions, water diverted from Colorado's West Slope may be used during Glade Reservoir's initial fill as well as during droughts. Diversions from the South Platte River would also be used to supply Galeton Reservoir.

In 2006, Harvey Economics (hired by Northern Water) developed a survey of NISP participants' supplies and projected future water demands. The report by Harvey Economics provided the basis for the preferred alternative in the Draft Environmental Impact Statement (DEIS) released by the U.S. Army Corps of Engineers in 2008.† Many concerns about the DEIS were raised and, as a result, the Army Corps of Engineers is now in the process of completing a Supplemental DEIS. Because of the amount of time that had elapsed since the demand projections were first developed in 2006, an updated report was prepared by Harvey Economics in January 2011 (referred to herein as the "Harvey Report").‡ The Harvey Report projects demands through 2060, though NISP is planned only to meet 2030 projected demands. Additional supplies will be needed to meet demands beyond 2030 levels.

* NISP's proposed Glade Reservoir would have a very large capacity of 170,000 AF. For comparison, a) Aurora Reservoir's normal storage capacity is 32,400 AF; b) Standley Lake in Westminster holds 42,000 AF when full; and c) Denver's Lake Dillon holds 257,304 AF. Sources: a) Aurora Water. 2008. "Fact Sheet—Aurora Water Reservoirs." <https://www.auroragov.org/cs/groups/public/documents/document/002386.pdf>. b) City of Westminster, Colorado. "Standley Lake Regional Park History." Accessed September 24, 2012. <http://www.ci.westminster.co.us/ParksRec/Parks/StandleyLakeRegionalPark/History.aspx>. c) Denver Water. "Dillon Reservoir." Accessed September 24, 2012. <http://www.denverwater.org/Recreation/Dillon>.

† U.S. Army Corps of Engineers, Omaha District. 2008. *Northern Integrated Supply Project Draft Environmental Impact Statement*. Applicant: Northern Colorado Water Conservancy District. April.

‡ Harvey Economics. 2011. *Water Supplies and Demands for Participants in the Northern Integrated Supply Project Final Report*. Report prepared for the Northern Colorado Water Conservancy District and the Northern Integrated Supply Participants. January 21.

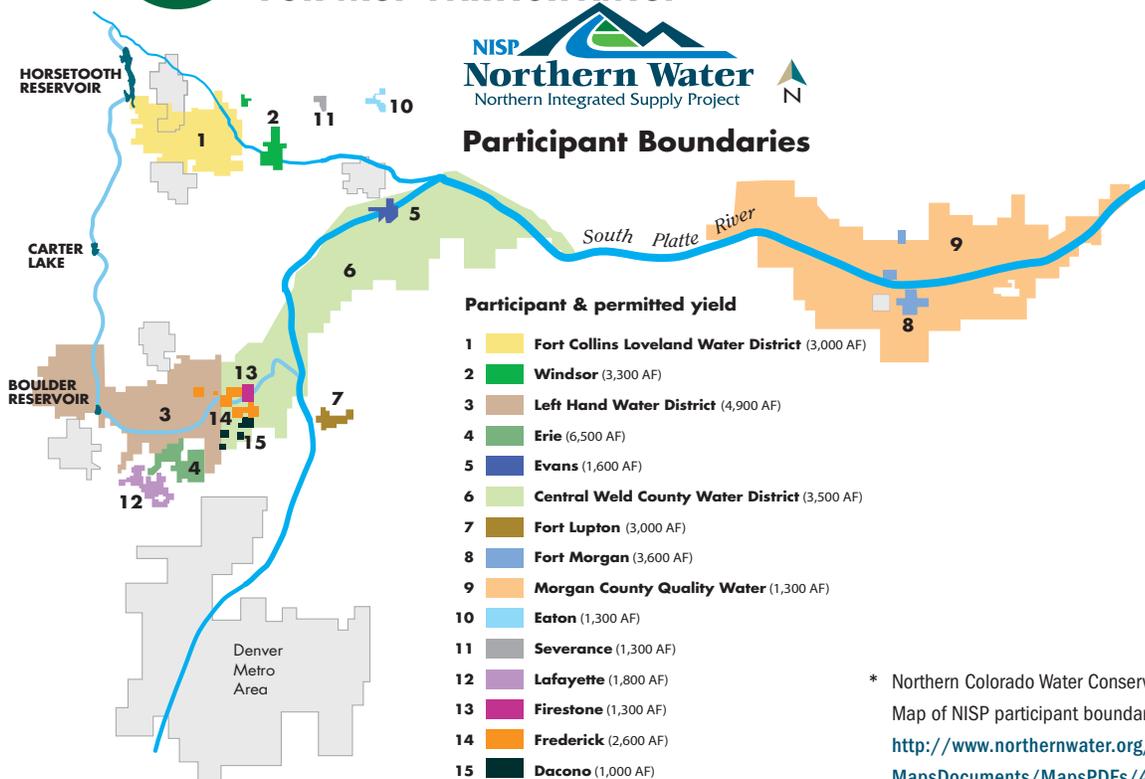
Importance of Maintaining Poudre River Flows

The Poudre River is highly valued as a recreational and scenic mecca for Colorado residents. NISP would divert between 43% and 48% of remaining flows from the Poudre River near the canyon mouth each year, on average, with greatest impacts during peak flows months. During these months, up to 71% of monthly flows would be diverted.* The impact on aquatic and riparian habitats, the species that depend on them, and the river recreation corridor could be dramatic. The Poudre River from the canyon mouth to the confluence with South Platte River is habitat for many fish, including species that are listed by the state as being “endangered, threatened, and species of concern.” Sections of this reach also provide “significant riparian and wetland habitat.”†

* U.S. Army Corps of Engineers, Omaha District. 2008. *Northern Integrated Supply Project Draft Environmental Impact Statement*. Applicant: Northern Colorado Water Conservancy District. April.

† CDM. 2010. “Appendix C: Environmental and Recreational Subcategory Flow Charts.” In *Colorado’s Water Supply Future: Nonconsumptive Needs Assessment Focus Mapping Final Report*. Report prepared for Colorado Water Conservation Board. July.

FIGURE Nº 2 MAP OF SERVICE AREA BOUNDARIES FOR NISP PARTICIPANTS.*



* Northern Colorado Water Conservancy District. 2010. Map of NISP participant boundaries. http://www.northernwater.org/docs/NISP/MapsDocuments/MapsPDFs/4_nisp_participants.pdf.

The NISP DEIS says, “On average, about 430,000 AF of the annual flow of the Poudre River is diverted for [agricultural, municipal, and industrial] use.”[‡] This current flow regime (“Without NISP” in Figure 4) has already led to degradation of the Poudre River in many places. To address current impacts to the river, the Save the Poudre organization and others have developed proposals to protect river flows and restore the river.^{§¶} NISP diversions would exacerbate flow issues through large additional withdrawals during the spring peak flow (“With NISP” in Figure 4). While the biggest impact would be felt on the Poudre River, NISP diversions would also decrease South Platte River flows below the confluence.

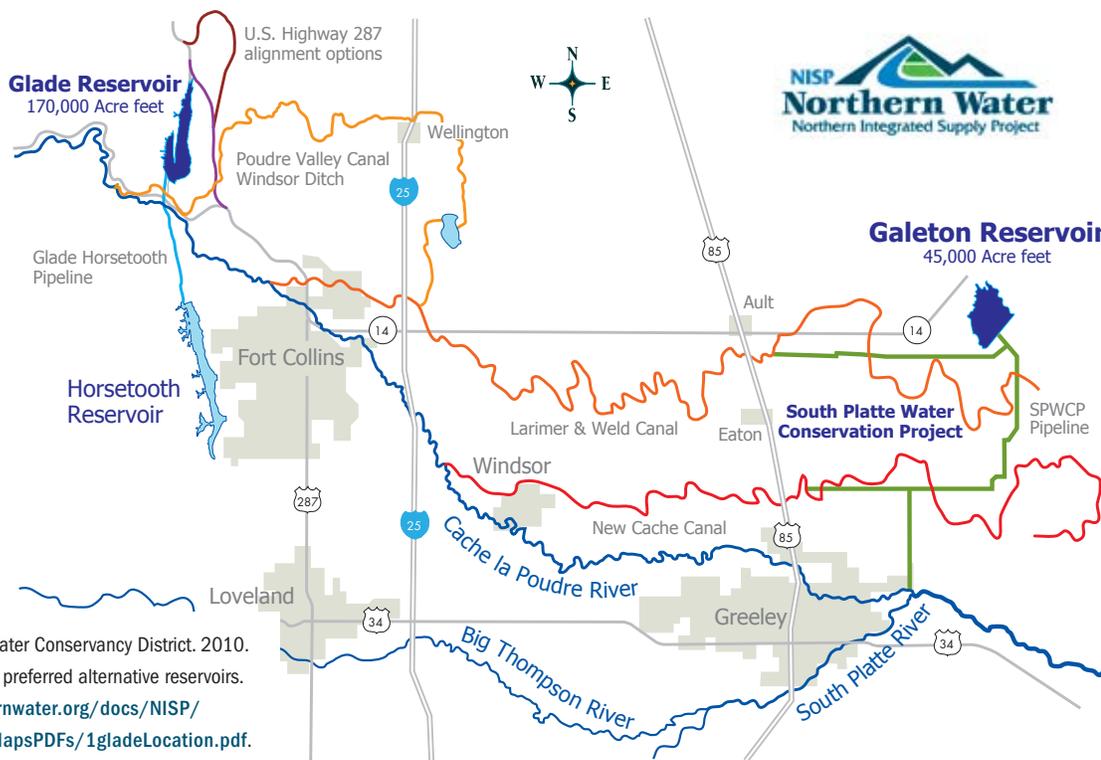
Peak flows serve many important functions. They maintain the stream channel by mobilizing sediment, forming pool and riffle zones, enhancing

‡ U.S. Army Corps of Engineers, Omaha District. 2008. *Northern Integrated Supply Project Draft Environmental Impact Statement*. Applicant: Northern Colorado Water Conservancy District. April.

§ Easter, M. 2008. *Healthy Rivers, Healthy Communities: A Balanced Proposal for the Cache la Poudre River in Colorado*. Fort Collins, Colo.: Save the Poudre Coalition.

¶ Bartholow, J. M. 2010. “Constructing an Interdisciplinary Flow Regime Recommendation.” *Journal of the American Water Resources Association* 46: 892–906. doi: 10.1111/j.1752-1688.2010.00461.x.

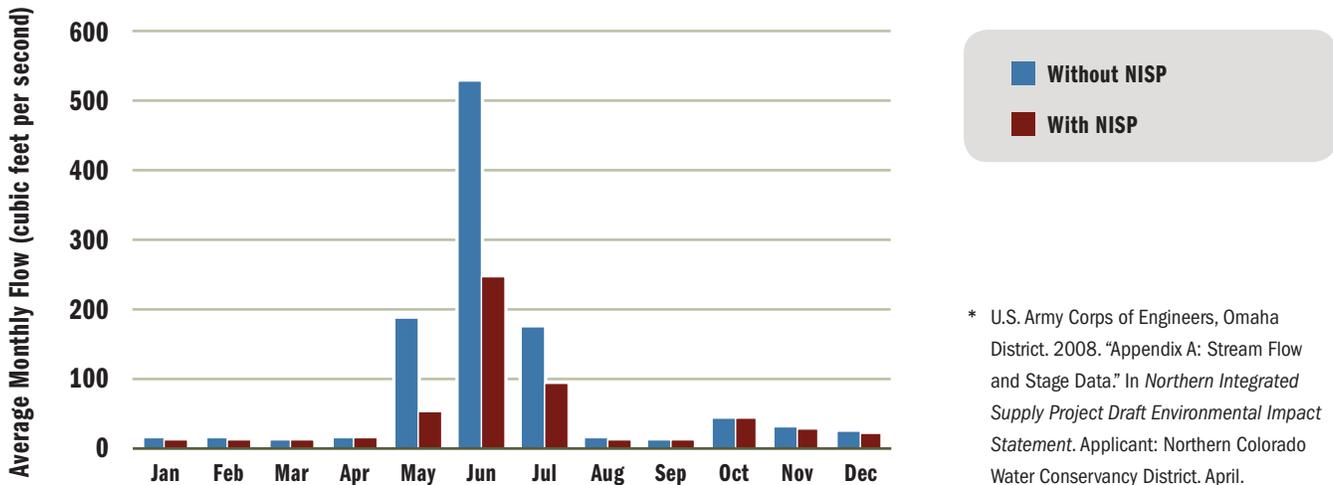
FIGURE Nº 3 LOCATION OF THE TWO PROPOSED NISP RESERVOIRS, GLADE AND GALETON.[†]



† Northern Colorado Water Conservancy District. 2010. Map of the two NISP preferred alternative reservoirs. <http://www.northernwater.org/docs/NISP/MapsDocuments/MapsPDFs/1gladeLocation.pdf>.

FIGURE N° 4 MONTHLY AVERAGE FLOWS FOR THE POUDBRE RIVER.

Measured at the Lincoln Gage in Fort Collins, for average years with and without the impacts of NISP.* Flows are lower in nearly all months, and large decreases in peak flows are apparent.



“NISP would destroy the Cache la Poudre River. As a lifetime resident and fly fisher of the Poudre, it is clear that turning a river into an irrigation channel would destroy its fundamental role in the hydrological cycle.”

—Rico Moore, Fly Fisherman

wetlands, removing encroaching vegetation, and flushing away debris and pollutants. High flows are also important in the life cycles of aquatic and riparian species. Decreased flows result in sediment buildup, increased algae, loss of native plants, and channel constriction. Lower flows also degrade water temperature and quality and lead to lowered alluvial groundwater tables, impacting riparian cottonwoods, willows, and other vegetation.

The Better Future Alternative demonstrates that NISP—and the detrimental impacts it would have on the Poudre River—are unnecessary. NISP communities should pursue reasonable, lower-impact supply alternatives prior to making large new diversions that would irreparably change the Poudre River.

The Better Future Alternative

The Better Future Alternative meets and exceeds NISP participant demands through 2060 while maintaining peak flows in the Poudre River, which are critical to recreation and the aquatic environment. It relies on a combination of supplies from conservation, reuse, water transferred as a result of growth onto agricultural lands, and voluntary agreements with agriculture. It is a regional alternative that evaluates NISP participant supplies and demands together rather than evaluating each participant individually. Such regional planning is appropriate and is similar to many other initiatives, including Colorado’s Statewide Water Supply Initiative (SWSI), the Colorado River Water Availability Study, the Colorado River Basin Study, and WRA’s *Filling the Gap* reports.

In the Better Future Alternative, WRA calculates baseline demands using current State Demography Office population projections, NISP participants’ historical water use, and estimated future passive conservation savings.* The following diverse supply portfolio is then relied upon to meet demands:

1. **Existing supplies** — Firm yield from existing water supplies as specified in the Harvey Report, including an additional small volume that was documented but not included in the report’s current supply total
2. **Growth onto irrigated lands** — Water that will be transferred to towns as they grow onto previously irrigated lands (such transfers or alternative supplies are required by many town ordinances)
3. **Active conservation** — 60% of savings from active conservation measures applied towards future demands (40% of savings held for drought response and to improve system reliability)
4. **Reuse** — Current, planned, and additional reuse of existing supplies
5. **Ag-Urban cooperation** — Voluntary and compensated leasing of water from agriculture to provide municipal water supply security while maintaining agriculture and agricultural communities.†

* Passive conservation savings occur without active efforts by towns, water providers, or residents. They are water demand reductions resulting from technological advances and state and federal policies that set lower flow standards for fixtures and appliances.

† Agricultural-Urban (Ag-Urban) cooperation would maintain irrigator control of water rights while providing the long-term security needed by municipalities. The participation of a group of irrigators in an Ag-Urban cooperation program (discussed in detail below in the “Ag-Urban Cooperation” section) would provide a permanent and reliable water supply for municipalities.

We also *conditionally* include initial use and reuse from the Windy Gap Firming Project (WGFP), which would provide supplies for five NISP participants. A Final EIS for this project was released in November 2011, but a Record of Decision (ROD) has not yet been released. This project would divert additional water to the Front Range, further impacting Colorado River headwaters. Because the WGFP has not yet been approved—and because of concerns about potential impacts—a Better Future discusses water supplies both with, and without, the WGFP. The inclusion of the WGFP in a Better Future should not be construed as support of the project. It is included, however, because it is in the final stages of approval and may be considered a reasonably foreseeable project.

The Better Future Alternative water supply portfolio exceeds expected 2060 demands (water needs) by nearly 6,000 AF. When the WGFP is included, water supplies exceed 2060 demands by nearly 11,500 AF (Figure 1). As documented in Appendix A, Better Future analyses are conservative and likely result in an underestimation of future water supplies. For municipal planning, this is appropriate to ensure that adequate water supplies are available to meet future needs. See Appendices B, C, D, and E for more detailed calculations and documentation of Better Future Alternative supply assumptions.



NISP Participant Water Demands

Key Definitions

This study utilizes data provided in the Harvey Report and compares NISP participant demands from that report to Better Future demands. In reviewing this study, it is important to understand that the Harvey Report and the Better Future Alternative discuss “water deliveries” as well as “total water requirements.”

- **Water deliveries:** The volume of water that is used by NISP participant customers at the tap. It is what is needed to meet customer demands and is usually metered at the property (home, businesses, irrigation tap, etc.). This volume does not include system losses and water charges required to deliver water to the tap.
- **Water (or water resources) charges:** Several NISP participants receive water treated by other utilities. These utilities apply a water resources charge, or fee, in the form of water supplies provided by the NISP participant to the treating utility. In the Harvey Report and the Better Future Alternative, the water charges are calculated as a percentage of “water deliveries.”
- **Total water requirements:** In order to get “water deliveries” to customers’ taps, additional water is needed to cover both system losses (e.g., losses during treatment and transit) and “water charges” applied to treat and deliver water to NISP participants. “Total water requirements” is the total volume of “water deliveries” plus system losses plus “water charges.”

A Better Future is designed to satisfy both water deliveries and total water requirements.

Projected Populations

The Harvey Report states that NISP participants utilized a host of different methodologies to develop demand projections that, in some cases, were then modified by Harvey Economics. Because population projections are the major driver for increasing future water demands, it is critical to have accurate and up-to-date projections for planning efforts.

Population projections are also heavily dependent on the near-term rates of population growth, and any deviations from projections in the first few years are compounded over time. The Harvey Report population projections include an unrealistic (now known to be incorrect) initial jump between the last year of historical data (2009) and first year of projected data (2010)—a 3.5% increase in population, the highest growth rate in the entire 50-year planning period. U.S. Census data from 2010 was not available when the Harvey Report was being developed, so the report had to estimate 2010 NISP participant populations. Comparing the Harvey Report’s 2010 estimates for NISP participant towns to now-available 2010 U.S. Census data* shows that the report’s estimates are 5.5% higher than actual populations. This comparison includes only NISP participant towns and does not include water districts that cover larger geographic areas (Central Weld County Water District, Fort Collins–Loveland Water District, Left Hand Water District, and Morgan County Quality Water District—see Figure 2) because discrete Census Bureau data are not available for these districts.

Better Future population estimates improve upon the older, pre-economic slowdown data used in the Harvey Report, much of which is based on inconsistent assumptions. The Colorado State Demography Office (SDO) is the official governmental agency responsible for population projections. Consequently, SDO projections should be used unless there are specific reasons to do otherwise.† A Better Future relies on 2011 SDO-projected county growth rates‡ through 2040 (the last year for which state projections are available) and the Harvey Report’s projected growth rates for 2045 through 2060.

The Better Future 2060 projected population is 507,033, which is 12% lower (68,606 people fewer—about the current size of the towns of Eaton, Erie, Evans, Firestone, Fort Lupton, and Frederick, combined) than the Harvey Report estimate of 575,639 people (Figure 5). See Appendix B for more detailed calculations.

* Colorado Department of Local Affairs, State Demography Office. 2010. Excel file Census PopulationByAge2010_IncorporatedPlace.xls. Accessed May 25, 2012. Available at “2010 Census Data for Colorado” under Population by Age by City/Town <http://dola.colorado.gov/dlg/demog/2010censusdata.html>.

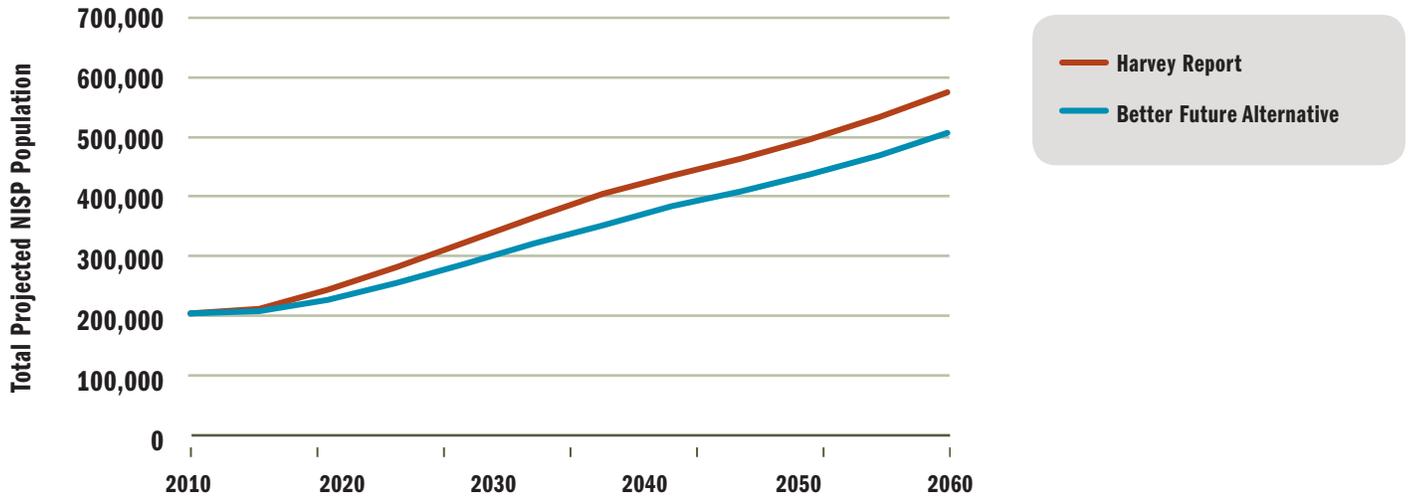
† In *Pagosa Area Water and Sanitation District and San Juan Water Conservancy District v. Trout Unlimited*, the Colorado Supreme Court found that the districts should use population projections corresponding to State Demography Office projections unless there was valid reason to do otherwise.

‡ Colorado Department of Local Affairs, State Demography Office. 2011. “Population Totals for Colorado Counties.” Updated September. <http://www.colorado.gov/cs/Satellite?c=Page&childpagename=DOLA-Main%2FCBONLayout&cid=1251593346867&pagename=CBONWrapper>.

FIGURE

№ 5

**BETTER FUTURE ALTERNATIVE POPULATION PROJECTIONS
(DEVELOPED USING STATE DEMOGRAPHY OFFICE DATA)
ARE LOWER THAN HARVEY REPORT PROJECTIONS.**



As populations grow, some development will occur on agricultural lands.



Baseline Demands

Better Future NISP participant demands were developed to reflect baseline water use rates applied to our population estimates. **Total Better Future Alternative water requirements are 72,100 AF in 2030 and 109,100 AF in 2060.** This is 27,000 AF and 34,300 AF less than Harvey Report projections in 2030 and 2060, respectively.

A review of data provided in the appendices of the Harvey Report shows that for the period from 2004 to 2009, NISP participants used an average of 185 gallons per capita per day (gpcd), based on water deliveries. A Better Future uses this recent historical average to project water demands.* Passive conservation savings of 10.2%, a SWSI estimate,[†] were then assumed to occur gradually through 2050, after which per capita use was held constant.[‡] Passive savings accrue without active—or purposeful—conservation efforts on the part of towns, water providers, residents, or industry. Passive savings result from technological improvements and state and federal policies, such as new fixture and appliance flow-rate regulations. Passive savings are evident in new homes that use less water than existing homes and are realized in older homes when fixtures and appliances are replaced with new equipment that uses less water.

The Better Future Alternative projects that NISP participant populations will increase by nearly 150% from 2009 to 2060 (Figure 5). As a result, the majority of homes and businesses will be new and will use less water due to passive conservation effects. To reflect this trend, Better Future per capita use rate decreases from 185 gpcd in 2009 to 166 gpcd in 2050 (and remains constant at this rate through 2060) (Figure 6). Applying Better Future baseline demands to our population projections results in total Better Future water requirements of 72,100 AF in 2030 and 109,100 AF in 2060. See Appendix B for more detailed calculations.

The Harvey Report bases future demands on average per capita usage rates that increase from a projected 193 gpcd in 2010 to a high of 212 gpcd in 2030 (an increase of 10%), before falling back to 193 gpcd in 2060 (Figure

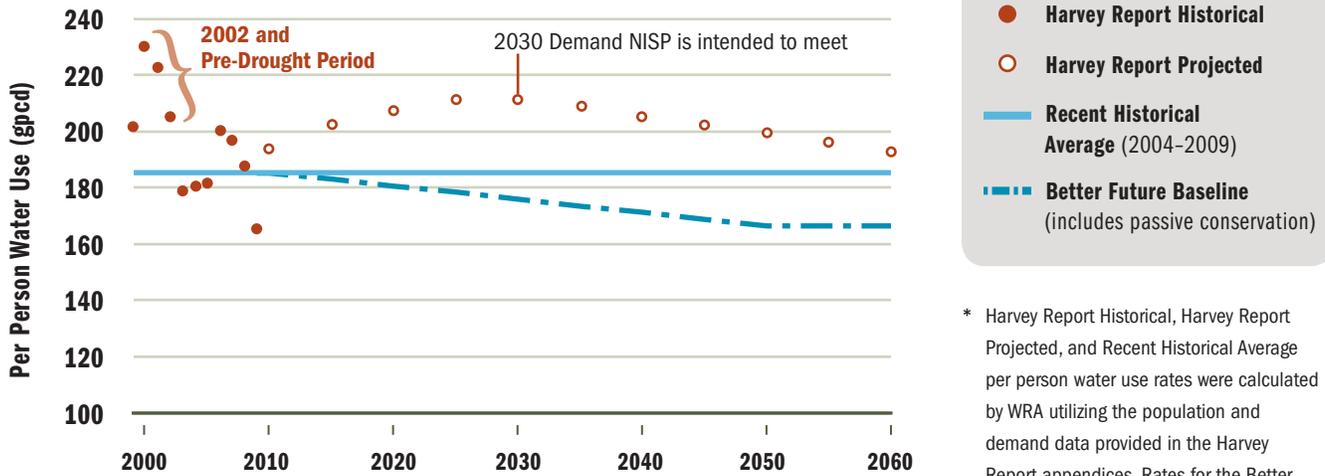
* The Better Future Alternative average, which is based upon Harvey Report data, is higher than the 177 gpcd that Northern Water frequently refers to for NISP participants and is higher than the rates provided in Table III-1 of the Harvey Report.

† Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. "Appendix L: SWSI 2010 Municipal and Industrial Water Conservation Strategies," prepared by Aquacraft, Inc. and Headwaters Corporation, January 2011. In *Colorado's Water Supply Future, Statewide Water Supply Initiative 2010, Final Report*. January.

‡ Savings were implemented through 2050, which is the end of the SWSI planning period. 2050 use rates were then held constant for the Better Future Alternative through 2060.

FIGURE Nº 6 PER CAPITA DATA* BASED ON SYSTEM-WIDE WATER DELIVERIES.

Better Future baseline usage is based on recent historical data with SWSI passive conservation savings applied. Harvey Report estimates include no conservation savings and increase (without explanation) to a peak in 2030 before decreasing.



* Harvey Report Historical, Harvey Report Projected, and Recent Historical Average per person water use rates were calculated by WRA utilizing the population and demand data provided in the Harvey Report appendices. Rates for the Better Future Baseline were developed by WRA, as described above.

6).[§] Interestingly, the peak per capita year, 2030, is the year with demands that NISP is intended to meet. No explanation for increased per capita use is provided and, in fact, the projection is contrary to a wide body of data that show use rates decline over time as a result of passive and active conservation.^{¶,**,††,‡‡} The impact of overestimated demands is then compounded in the Harvey Report when losses and water charges are applied as a percentage of water deliveries (see the “Key Definitions” section). To develop baseline demands, it is more reasonable to use recent per capita use rates and project modest decreases over time.

§ WRA calculated historical and projected average per capita usage for NISP participants utilizing the population and demand data provided in the Harvey Report appendices.

¶ LeChevallier, M. W. 2011. “Promoting Conservation Without Taking a Bath: The Cost-Benefit of Wise Water Use.” Paper presented at the third annual Colorado WaterWise Conservation Workshop, Denver, Colo., October 14.

** Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. “Appendix K: SWSI Conservation Levels Analysis,” prepared by Great Western Institute, June 2010. In *Colorado’s Water Supply Future, Statewide Water Supply Initiative 2010, Final Report*. January.

†† Cohen, M. J. 2011. *Municipal Deliveries of Colorado River Basin Water*. Oakland, Calif.: Pacific Institute. June.

‡‡ Rockaway, T.D, P.A. Coomes, J. Rivard, and B. Kornstein. 2011. “Residential Water Use Trends in North America.” *Journal AWWA* 103:2, February.



Better Future Supplies

Existing Supplies

The Better Future Alternative includes 60,550 AF of current firm yield supplies.

Existing supplies include the 59,400 AF of yield assumed in the Harvey Report as well as 1,150 AF of additional water that was documented in Appendix P of the Harvey Report but not applied to future demands in that report.

These additional supplies include:

- 270 AF of firm yield from Fort Lupton's Fulton Ditch shares was not included in the town's existing supplies.* Per Fort Lupton's water conservation plan,[†] this water is currently used by the City to irrigate the golf course and cemetery and for augmentation of the City's wells.
- 680 AF of firm yield from the consumptive use portion of North Poudre Irrigation Company shares,[‡] owned by Eaton (205 AF), Severance (54 AF), and Windsor (421 AF), which have not yet been changed to municipal use. A Better Future acknowledges that issues may arise while transferring agricultural water to municipal use. Also, once a right is changed, there can be additional issues accessing the water at the time and location it is needed. However, these shares are owned by the specified NISP participants, and it is reasonable to assume this water will become available to meet municipal needs. To provide for time to transfer the rights, the Better Future Alternative assumes yield from these shares is available beginning in 2025.
- A math error in Appendix P of the Harvey Report appears to have underestimated Fort Morgan's existing firm yield supplies by 200 AF. The Better Future Alternative assumes this water is currently available.

* The Harvey Report lists total firm yield from these shares as 700 AF. Per Fort Lupton's water conservation plan, 270 AF is the consumptive use portion of these shares, though some of this water continues to be used for irrigation so may have a higher yield.

† Clear Water Solutions, Inc. 2007. *City of Fort Lupton Water Conservation Plan*. August. http://www.fortlupton.org/DEPARTMENTS/FINANCE/water_conservation_plan/Water.pdf.

‡ North Poudre Irrigation Company has both Colorado-Big Thompson Project (see sidebar on page 43) and native (Poudre River Basin) shares. This 680 AF is native portion shares.

Growth onto Irrigated Lands

The Better Future Alternative estimates the annual firm yield from traditional agricultural transfers from urban growth onto previously irrigated lands will be 7,360 AF by 2030 and 19,150 AF by 2060.

TABLE N° 1

2010 POPULATION DENSITIES FOR NISP PARTICIPANTS AND OTHER FRONT RANGE COMMUNITIES.*

NISP Participant	People/Acre
Erie	1.65
Evans	2.84
Fort Lupton	1.60
Fort Morgan	4.66
Lafayette	4.04
Windsor	1.05
Firestone	1.53
Frederick	1.01
Better Future Assumed NISP Participant Density	5.0

Large Front Range Communities	People/Acre
Denver	6.13
Boulder	6.17
Fort Collins	4.15
Longmont	5.15

* U.S. Census Bureau. 2010. "State and County Quick Facts." Revised September 18, 2012. Available at <http://quickfacts.census.gov/qfd/states/08000.html>. Data were not available for NISP communities not listed here.

As NISP participant populations increase, a portion of new growth will occur on previously irrigated agricultural lands that are adjacent to NISP towns. These are lands that are sold willingly by farmers for a variety of reasons, which may include retirement, the decision to downsize, a preference to relocate, or changes in commodity markets, among others.

To ensure that adequate supplies are available to meet the needs of new development, most towns and cities require that the water previously used for irrigation on annexed lands (also sold voluntarily by farmers) be transferred to the respective water supply utility, and that additional water supplies (frequently including storage), or at times "cash in lieu" (cash instead of water), be provided (see sidebar). Normally, only the historical consumptive use portion of irrigation water can be transferred, and the process of changing a water right can be complicated and takes time. When new supplies are acquired, additional collection infrastructure, storage, and water treatment may be required in order for municipalities to utilize the water.

A Better Future includes only the consumptive use portion of supplies that are anticipated to be transferred directly from previously irrigated lands upon which growth occurs.* It does not estimate other water dedications required by towns. Data from the state's South Platte Decision Support System, the U.S. Census Bureau, and the NISP No Action Alternative† were used to estimate a minimum volume of agricultural water that will be transferred to NISP participants. To be conservative, for this analysis the Better Future Alternative assumes a relatively high density of 5 people per acre. This is much higher than current NISP community densities (Table 1) and so minimizes the assumed acreage from which water will be transferred. The Better Future Alternative encourages higher density development for a variety of reasons, including its potential to reduce water use (through less outdoor irrigation), infrastructure costs, and water loss when compared to typical suburban, low-density developments.‡

* In Colorado, only the historically consumed portion of an agricultural water right can be transferred to ensure that other water users aren't negatively impacted by such a transfer. Better Future estimates of water transferred from growth onto agricultural lands include only the consumptive use portion of historical water use.

† An EIS requires the analysis of a No Action Alternative (or status quo) option. In this case of NISP, the No Action Alternative evaluated other options for meeting participant demands without the project.

‡ Western Resource Advocates. 2009. *New House, New Paradigm: A Model of How to Plan, Build, and Live Water-smart.*

NISP Participants' New Development Water Requirements

One of the largest costs for developers is water service. Water dedication policies vary by town and water district. Potential supplies are also evaluated for desirability based on their specifics (e.g., location, quality, seniority, storage). Some towns and water districts may require that they be given first option on any water supplies associated with a parcel. Others may not want a specific water right if it is difficult to transfer the diversion location to their water supply intake. Others may require supplies from specific sources or accept cash in lieu (cash instead of water) rather than requiring the transfer of historical water rights. Furthermore, some supplies may not be suitable for potable use, but may be useful for outdoor irrigation of parks, open space, and other common areas. In some cases, water has already been sold off from land, so either other supplies or cash in lieu are required. The following are examples of the water dedication policies for several NISP participants.

City of Evans (Municipal Code Chapter 13.08)

...It is the intent and purpose of this chapter to require the dedication or transfer of water or water rights to the city sufficient to satisfy any new or additional demand for city water service...

...any person who seeks approval of any of the following: 1. An extension of water service; 2. Annexation of land to the city; 3. Any change in land use, within or outside the limits of the city, if such change in land use will increase the demand for city water service, shall dedicate or transfer to the city a water allotment contract with the Northern Colorado Water Conservancy District (C-BT contract) for sixty-five hundredths (0.65) of an acre-foot (which will yield an average of approximately forty-six hundredths (0.46) of an acre-foot) for each EQR [equivalent residential] unit calculated

...Prior to any extension of service, any person required to comply with the provisions of this chapter shall also grant to the city the option for one year to purchase any and all water rights which are appurtenant to the land

to be annexed, or on which the land use is proposed to be changed, but which are in excess of the dedication or transfer requirement of this chapter...

Fort Lupton (Municipal Code Sec. 13-122)

...Any person annexing land to or developing within the City...shall make a cash-in-lieu-of-water payment in an amount as determined by the City or...convey water rights or shares of sufficient quantity and water quality as determined by the City...

Fort Morgan (Municipal Code Sec. 18-2-210)

... At the time of annexation, property owners shall transfer all other water rights associated with the property to be annexed...The property owner shall also purchase water from a source that can be integrated into the City's potable water system sufficient to meet the needs of the property development or the current use of the property...

City of Lafayette (Municipal Code Sec. 120-91)

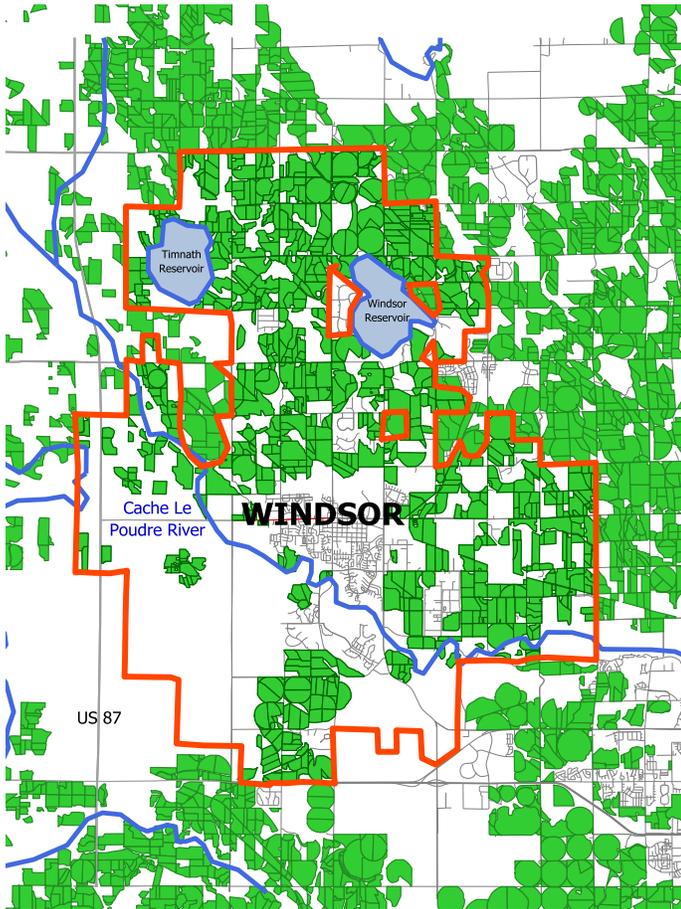
...The dedication and conveyance of CBT [Colorado-Big Thompson] water, direct flow and/or storage water rights to the city shall be required as a condition precedent to the approval of the subdivision or replatting of any land zoned and/or used as residential property. The dedication and conveyance of CBT water, direct flow and/or storage water rights to the city for all property other than residential shall be required as a condition precedent to the approval of a water service application...

Windsor (Municipal Code Sec. 13-2-80)

All premises requesting original water service...shall furnish...without cost to the Town, water rights in the amount of three (3) acre-feet of water for each acre of land zoned Single-Family Residential SF-1 District, Single-Family Attached Residential SF-2 District and Planned Mobile Home Park PD-MHP Development, and annexed to the Town...The Town may accept cash in lieu of water...

FIGURE **Nº 7**

EXAMPLE OF NISP PARTICIPANT WINDSOR'S GROWTH MANAGEMENT AREA* AND SURFACE-WATER-IRRIGATED LANDS†.



Red outline = Windsor's Planned Growth Area
Green parcels = Surface-Water-Irrigated Lands

Surface-water-irrigated parcels in Windsor's Growth Management Area. The Better Future Alternative assumes a growth footprint less than half the size of this area.

* Town of Windsor, Colorado. 2007. *2006 Update of 2002 Windsor Comprehensive Master Plan*. January 4. <http://windsorgov.com/DocumentCenter/Home/View/1665>.

† South Platte Decision Support System geographical information system and modeling data available at <http://cdss.state.co.us/basins/Pages/SouthPlatte.aspx>.

At 5 people per acre, the Better Future Alternative's projection of 302,748 new people by 2060 results in 60,550 acres being developed. Mapping by WRA was used to estimate growth footprints around each NISP participant community (see the example of Windsor provided in Figure 7).^{*} Evaluating South Platte Decision Support System data for growth areas found that, on average, 42% of NISP growth will occur on lands that are currently irrigated by surface water.[†] Based on SWSI[‡] and NISP No Action Alternative[§] consumptive use data, a Better Future assumes that the water-supply-limited transferable yield[¶] averages 1.0 AF/acre for parcels irrigated with surface water. To account for uncertainty and the complexities associated with changing irrigation water to municipal use, the Better Future Alternative further limits yields by assuming that only 75% of transferrable water is acquired and utilized by NISP participants. This results in an annual yield from growth onto previously irrigated lands of 7,360 AF in 2030 and 19,150 AF in 2060.^{**} See Appendix C for more detailed calculations.

The above calculations differ from the Harvey Report, which did not include any water supplies associated with new development growing onto agricultural lands, nor required dedications from developers.

* Water districts covering large geographic areas (Central Weld County Water District, Fort Collins-Loveland Water District, Left Hand Water District, and Morgan County Quality Water District), in which other water providers may operate, were not included in the analysis of percentage of surface-water-irrigated lands in the growth footprint.

† Due to potential complexities, the Better Future Alternative does not consider groundwater supplies and does not include parcels that are irrigated with a combination of surface water and groundwater.

‡ Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. *Colorado's Water Supply Future: Statewide Water Supply Initiative 2010, Final Report*. January.

§ MWH. 2010. *Northern Integrated Supply Project No Action Alternative*. Prepared for Northern Colorado Water Conservancy District. April.

¶ Many farmers in northern Colorado irrigate, at least in part, with Colorado-Big Thompson (CBT) water. Because CBT water can easily be moved around, a Better Future assumes CBT supplies may not be available for direct transfer for lands, so uses a consumptive use value (1.0 AF/acre) that is lower than water-supply-limited consumptive use in the No Action Alternative. For additional information on the CBT project, see sidebar on page 43.

** Better Future yields from agriculture as a result of NISP participants' growth footprints are different than those in Save the Poudre's "The Farm Facts about NISP" (accessible at <http://www.savethepoudre.org/docs/farm-facts-april2011.pdf>). This does not undermine Save the Poudre's analysis, but is the result of the different methodology used in the Better Future Alternative.

Active Conservation

Water conservation has grown significantly in the past decade and will be a key part of meeting future water demands in northern Colorado communities. **The Better Future Alternative applies active conservation savings of 6,401 AF by 2030 and 20,482 AF by 2060 towards NISP participant demands.**

All NISP participants, with the exception of Central Weld County Water District and Morgan County Quality Water District, have conservation plans that detail active conservation measures they plan to implement in the coming years (Table 2). These measures will produce water demand savings in excess of passive conservation, which occurs as a result of new development and as older, more inefficient fixtures and appliances are replaced.

The Better Future Alternative uses the SWSI high conservation strategy goal of decreasing South Platte Basin^{††} per capita use by 38.3% by 2050.^{‡‡} Of this, 10.2% is from passive conservation already accounted for above in the Better Future baseline demands. Here we evaluate only those savings (28.1%) associated with active conservation. SWSI conservation goals include system losses of 7%, which is consistent with average NISP participant loss projections.^{§§} When planning for future demands, water providers are frequently cautious about relying on recent or expected changes in water use resulting from conservation. To address these concerns, the Better Future Alternative assumes that only 60% of active conservation savings are applied to meet future demands and that 40% is reserved to improve system reliability or for drought reserves and is not included in our portfolio.^{¶¶} See more detailed calculations in Appendix D.

The conservation measures required to achieve the high conservation strategy utilized in the Better Future Alternative are best management practices (standard practices that have been found to achieve results) and should be implemented prior to making additional diversions from the Poudre and

†† South Platte Basin planning area does not include the Denver metro area, which is evaluated separately in the SWSI report.

‡‡ Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. "Appendix L: SWSI 2010 Municipal and Industrial Water Conservation Strategies," prepared by Aquacraft, Inc. and Headwaters Corporation, January 2011. In *Colorado's Water Supply Future, Statewide Water Supply Initiative 2010, Final Report*. January.

§§ Harvey Economics. 2011. Table II-3. In *Water Supplies and Demands for Participants in the Northern Integrated Supply Project Final Report*. Report prepared for the Northern Colorado Water Conservancy District and the Northern Integrated Supply Participants. January 21.

¶¶ This methodology of assuming SWSI high conservation strategy savings, applying 60% of the savings, and retaining 40% for system reliability or drought reserve is consistent with previous WRA reports. This methodology is also consistent with portfolios developed by the Colorado River and Yampa-White Basin Roundtables – see CDM Smith. 2012. *Technical Memorandum: Basin Roundtable Portfolio and Trade-off Analysis*. February 23. <http://cwc.state.co.us/about-us/about-the-ibcc-brts/Documents/RoundtableSummit2012/TM-Basin%20Roundtable%20Summit.pdf>.

TABLE

№ 2

NISP PARTICIPANTS' WATER CONSERVATION PLAN NEAR-TERM GOALS ARE SUBSTANTIAL.

NISP Participant	Water Conservation Plan Goal^a (% Reduction in Use)	Achieve Goal by (Year)
Central Weld County Water District (CWCWD) ¹	No quantifiable goals	Not available
Dacono ²	10%	2021
Eaton ³	8%	2021
Erie ⁴	17% (achieve 190 gpcd) ^b	2014
Evans ⁵	13%	2018
Firestone ⁶	4.7% residential, 13.4% commercial, 12.1% parks, 19% open space	2017
Fort Collins-Loveland Water District (FCLWD) ⁷	13%	2017
Fort Lupton ⁸	5% by 2016, 7% by 2030	2016
Fort Morgan ⁹	No quantifiable goals	NA
Frederick ¹⁰	18.40%	2021
Lafayette ¹¹	12.7% + loss decreased by 3%	2016
Left Hand Water District (LHWD) ¹²	11.3%	2017
Morgan County Quality Water District (MCQWD)	No plan	Not available
Severance ^{13, c}	7.9%	2019
Windsor ¹⁴	12%	2017

a Reductions in system loss are included in several providers' goals.

b Erie has a goal of 190 gpcd, which it already achieves at times. This goal is equivalent to a 17% reduction as compared to use without conservation. In comparison, the Harvey Report projects Erie's per capita use rate to increase as high as 310 gpcd in 2030 (gpcd calculated by WRA based on data provided in Harvey Report, Appendix D).

c Severance doesn't have a water conservation plan, but portions of the town are served by the North Weld County Water District, whose plan has a goal of reducing use by 7.9% by 2019.

1 Central Weld County Water District. 2005. Central Weld County Water District Water Conservation Plan. April.

2 Clear Water Solutions, Inc. 2011. City of Dacono 2011 Water Conservation Plan.

3 Clear Water Solutions, 2011. "Town of Eaton 2011 Water Conservation Plan – Draft."

4 CDM. 2008. Town of Erie Water Conservation Plan. January.

5 Clear Water Solutions, Inc. 2009. City of Evans 2009 Water Conservation Plan.

6 Clear Water Solutions, Inc. 2007. "Town of Firestone Water Conservation Plan – Draft." February.

7 Clear Water Solutions, Inc. 2008. Fort Collins-Loveland Water District Water Conservation Plan. September.

8 Clear Water Solutions, Inc. 2007. City of Fort Lupton Water Conservation Plan. August.

http://www.fortlupton.org/DEPARTMENTS/FINANCE/water_conservation_plan/Water.pdf.

9 City of Fort Morgan, Colorado. 2007. City of Fort Morgan Water Conservation Plan.

10 Civil Resources, LLC. 2011. "Town of Frederick Water Conservation Plan – 75% Draft." March.

11 City of Lafayette, Colorado. 2009. City of Lafayette Water Conservation Plan. Revised April 2010.

12 Clear Water Solutions, Inc. 2008. Left Hand Water District Water Conservation Plan. July.

13 Clear Water Solutions, Inc. 2009. North Weld County Water District 2009 Water Conservation Plan.

14 Clear Water Solutions, Inc. 2008. Town of Windsor 2008 Water Conservation Plan.

SWSI Municipal and Industrial Low, Medium, and High Water Savings Strategy Measures*

This table from the 2010 SWSI Report illustrates the type of conservation measures assumed to be applied to realize low, medium, and high conservation savings. Measures may be included under all strategy levels (i.e., marked in multiple columns), but levels of implementation or penetration can vary. Additional details regarding implementation assumptions can be found in Table D-2 in Appendix D.

Conservation Measures	Water Saving Strategy		
	Low	Medium	High
Passive water conservation savings from natural replacement of fixtures and appliances	X	X	X
Public information and education	X	X	X
Reduction in customer side leakage	X	X	X
Conservation-oriented plumbing and building codes	X	X	X
Landscape water use reductions	X	X	X
Improved utility water loss control measures	X	X	X
Conservation-oriented and water budget-based water rates		X	X
Smart metering with leak detection		X	X
Submetering of new multi-family housing		X	X
Targeted utility audits for high demand non-residential landscape customers		X	X
Irrigation efficiency improvements		X	X
Informational landscape water budgets and customer feedback		X	X
Landscape water budgets tied to the rate structure and customer feedback	X	X	X
Landscape transformation from high water requirement turf to low water requirement		X	X

* Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. "Appendix L: SWSI 2010 Municipal and Industrial Water Conservation Strategies," prepared by Aquacraft, Inc. and Headwaters Corporation, January 2011. In *Colorado's Water Supply Future, Statewide Water Supply Initiative 2010, Final Report*. January.



This is currently about 100dpi, 1/3 of desired resolution for print. Nicole is searching for a replacement

South Platte rivers (see page 29). Notably, the vast majority of measures will not require significant behavioral changes on the part of customers.

Lower per capita usage resulting from conservation provides system security, which is of utmost importance to water providers. If more people's needs are met with less water, this decreases the impacts of drought. Additionally, lower demands under the Better Future conservation strategy reduce the need for additional water storage. Water conservation also decreases water treatment costs, as water demands increase more slowly, providing utilities with more time to upgrade or develop new facilities. Decreasing demands through conservation also leads to lower losses and system delivery charges.

It is in the best interest of Northern Water and NISP participants to support and encourage water conservation. A 2012 survey of Northern Water municipal customers about water conservation found that municipal suppliers support conservation for the following key reasons: it's the right thing to do, for drought preparedness, to reduce peak expansion cost, and to offset increased demand of future growth.* This is supported by the fact that nearly all NISP participants have water conservation plans (Table 2) with quantifiable goals, many of which are comparable to—or exceed—SWSI high conservation strategy reductions of around 1% per year. Most water conservation plans have planning periods of 7 to 10 years (Table 2). As a result, additional savings beyond current goals are very likely by 2060.

The Harvey Report's analysis did not include any new water conservation savings, passive or active, from 2009 forward. This is inconsistent with a recent brochure published by Northern Water titled "NISP Communities' Water Conservation Efforts: A Key Component to Meeting Future Water Needs"[†] and at odds with the water conservation goals established by NISP participant communities. It is also confusing because the Harvey Report includes an entire section on water conservation but does not apply any savings towards future demands. As discussed above, rather than including conservation savings, the Harvey Report's demand projections assume the opposite, that per capita use increases from current levels (Figure 6). This is contrary to a wide body of research and data, and NISP participants' own experiences, about the effects of water conservation.

* Northern Water. 2012. *NISP Communities' Water Conservation Efforts: A Key Component to Meeting Future Water Needs*. http://www.northernwater.org/docs/Brochures/conserv_brochure_NISP_Feb2012.pdf

† 2,000 AF or more was assumed to be the threshold of reusable supplies for which the benefit of developing direct and/or indirect reuse would be sufficient for a community to pursue, though this can also be feasible for communities with fewer reusable supplies. Left Hand Water District has 1,700 AF of reusable supplies, which is close to the 2,000 AF threshold selected for the Better Future Alternative, but due to its large and distributed service area, the Better Future Alternative does not include reuse for the district. All other NISP participants have less than 1,000 AF of existing potentially reusable supplies.

TABLE Nº 3 BETTER FUTURE ALTERNATIVE NISP PARTICIPANT REUSE.

NISP Participant	Potentially Reusable Supplies (AFY)		Reuse (AFY)	
	Irrigation Company Shares	Conditional WGFP	Irrigation Company Shares	Conditional WGFP
Erie	124	2,000	76	1,224
Lafayette	4,235	800	1,906	360
Evans	6,496	500	2,923	225
TOTAL	10,856	3,300	4,905	1,809

Planned and Additional Reuse

As new water supplies become more difficult and expensive to acquire, many utilities are integrating reuse of existing supplies into their water supply portfolios. **The Better Future Alternative assumes reuse supplies of 4,905 AF**, all of which are available from current supplies. The Better Future Alternative evaluated *existing* reusable supplies (see sidebar) for each NISP participant utilizing the supply data provided in Harvey Report Appendix P and requested Windy Gap Firming Project yield. Note that while reuse of WGFP supplies is discussed in this section for ease of explanation, no WGFP reuse is included in the assumed “Reuse” yield of 4,905 AF. WGFP reuse yield is instead captured in the “Conditional Inclusion: Windy Gap Firming Project” section below.

Only three towns have 2,000 AF or more of existing reusable supplies[‡] — Lafayette, Erie, and Evans (Table 3) — two of which already have reuse plans in place. *Note that agricultural water transferred as a result of growth onto irrigated land and through Ag-Urban cooperation will provide significant additional reuse opportunities not accounted for in the Better Future Alternative.* Also, Better Future calculations consider only first-time reuse, though return flows from these supplies can be reused to extinction, which increases the potential yield. An additional 1,809 AF of WGFP reuse is accounted for below in the “Conditional Inclusion: Windy Gap Firming Project” section of this report.

Erie — The Town of Erie’s water conservation plan[§] says that Erie plans to reuse 690 AF each year by 2014. Because some of this is Windy Gap water (see Table 3), and a WGFP Record of Decision has not yet been issued, a Better Future assumes Erie’s reuse of 690 AF starts in

‡ 2,000 AF or more was assumed to be the threshold of reusable supplies for which the benefit of developing direct and/or indirect reuse would be sufficient for a community to pursue, though this can also be feasible for communities with fewer reusable supplies. Left Hand Water District has 1,700 AF of reusable supplies, which is close to the 2,000 AF threshold selected for the Better Future Alternative, but due to its large and distributed service area, the Better Future Alternative does not include reuse for the district. All other NISP participants have less than 1,000 AF of existing potentially reusable supplies.

§ CDM. 2008. *Town of Erie Water Conservation Plan*. January.

2020. Erie's 2007 *Non-Potable Municipal Water System Master Plan*^{*} includes a plan to develop approximately 1,300 AF of dry year direct reuse by build-out. However, the SWSI Portfolio Tool[†] includes Erie reuse ranging from 3,700 to 4,300 AF as an Identified Project and Process (IPP).[‡] Relying on the lower Erie planning document estimates, a Better Future assumes that reuse will increase from 690 AF in 2020 to 1,300 AF in 2050, of which only **76 AF (non-WGFP reuse) is included in the reuse total** (the remaining 1,224 AF is included below in the conditional WGFP yield).

Lafayette—The City of Lafayette's water conservation plan[§] says the city currently reuses 60% of its return flows through exchange, and that the City has a conceptual design for a pipeline between its water reclamation plant and a reservoir complex that would maximize the full use of return flows from this plant. Lafayette's water conservation plan documents 1,479 AF of existing reuse. Based on the supplies identified in the Harvey Report, Appendix P, and assuming that 50% of reusable supplies are used indoors and 90% of indoor water returns and can be reused, we estimate that first-time reuse of existing supplies by Lafayette can increase to 2,266 AF. The Better Future Alternative assumes current reuse for Lafayette is 1,479 AF and that reuse increases to the full 2,266 AF by 2030. **1,906 AF of reuse** is assumed to be from existing supplies (the remaining 360 AF is included below in the conditional WGFP yield).

Evans—Evans' potentially reusable supplies are approximately 7,000 AF. Evans' water conservation plan[¶] refers to a small amount of reuse at its wastewater treatment plant. A Better Future includes 3,148 AF of reuse for the Town of Evans, assumed to be in place by 2030, calculated using the same indoor and outdoor distribution and return flow assumptions used for Lafayette. **2,923 AF of reuse** is assumed to be from existing supplies (the remaining 225 AF is included below in the conditional WGFP yield).

This analysis is consistent with the Metro Roundtable assumption of a 50% reuse factor.^{**} The 50% reuse factor means that for 1.0 AF of reusable supply, with reuse that supply increases to 1.5 AF. The Better Future Alternative's implied reuse factor is slightly lower, at 47%.

* CDM. 2007. *Town of Erie Non-Potable Municipal Water System Master Plan*. September.

† Colorado Department of Natural Resources, Colorado Water Conservation Board. 2010. "Colorado's Water Supply Future Portfolio and Trade-off Tool." Available at <http://cwc.state.co.us/technical-resources/portfolio-tool/Pages/main.aspx>.

‡ WRA followed up with the Colorado Water Conservation Board in a personal communication on May 24, 2012, which confirmed the higher reuse yield estimates for Erie.

§ City of Lafayette, Colorado. 2009. *City of Lafayette Water Conservation Plan*. Revised April 2010.

¶ Clear Water Solutions, Inc. 2009. *City of Evans 2009 Water Conservation Plan*.

** Interbasin Compact Committee, Metro Roundtable. 2012. "Selection of a Reuse Factor for the Portfolio Tool Planning Exercise - Draft." March 9.



What water can be reused?

Colorado water law is very specific in the types of water that can be reused. These are limited to:

- Non-native water that has been imported into a basin (i.e., transbasin diversions, such as WGFP water).
- The consumptive use portion (CU) of agricultural water that has been transferred to another use (such as the consumptive use portion of irrigation company shares).*
- Nontributary groundwater.
- Water diverted under a water right with a decreed reuse right.

How can you reuse water?

Reuse can be accomplished in two ways:

- **Direct Reuse** – Return flows from reusable supplies can be physically reclaimed for potable and nonpotable purposes. For example, a water utility captures reusable water leaving its wastewater treatment plant and uses this water again for urban, agricultural, recreational, environmental, or industrial purposes.
- **Indirect Reuse** – Return flows can be reused under substitution or exchange arrangements.† An example

* The consumptive use portion of water used for other purposes, such as industrial uses, may also be transferred. However, typically transfers from agriculture are discussed in this context.

† An exchange is generally an arrangement in which a junior water user makes water available to a senior water user (e.g., reusable treated effluent) in exchange for permission to use or divert an equivalent amount of water to which the senior would otherwise be entitled. A substitution or augmentation arrangement provides water supplies to replace out-of-priority diversions.

of indirect reuse is when a water utility lets reusable water leaving its wastewater treatment plant flow downstream for diversion by an irrigator, and the utility diverts an equivalent amount of water into its system upstream.

What are the impacts of reuse on downstream users?

Reuse can only occur within Colorado's priority system. That means that water cannot be reused if it will injure a senior water right holder. However, streams and downstream users may have historically benefitted when potentially reusable supplies were not used and flowed downstream. If water is then reused, either directly or indirectly, this will typically decrease streamflows and downstream supplies that had previously been available to others. This is within the rights of the owner of the reusable supplies. When water is transferred from irrigation to other uses, only the consumptive use portion can be converted.

Historical return flows (which are not included in the yield from the transferred consumptive use portion of Better Future supplies) must be maintained so as to not

injure other water users. Additionally, when historical wastewater return flows are reused, some very important environmental benefits can be diminished, e.g., streamflows and wetlands, impacting fish and wildlife. The environmental impacts of reuse, as compared to impacts associated with alternative water supply options, should be considered when evaluating reusable supplies.

The environmental impacts of reuse should be considered when evaluating reusable supplies.

Though both Erie and Lafayette have existing and/or planned reuse and Evans has significant reusable supplies, the Harvey Report did not include any existing or planned reuse.

FIGURE **Nº 8**

ANNUAL SOUTH PLATTE BASIN AGRICULTURAL CONSUMPTIVE USE (CU) COMPARED TO ASSUMED BETTER FUTURE YIELD FROM AG-URBAN COOPERATION.

Ag-Urban Cooperation proposed under the Better Future Alternative would share less than 1% of agricultural consumptive use with municipalities.



South Platte Basin Current (2008) Annual Agricultural CU = 1,117,000 AF

Better Future Ag-Urban Cooperation Yield = 10,000 AF (< 1% of total CU)

Ag-Urban Cooperation

The Better Future Alternative assumes Ag-Urban cooperation supplies 10,000 AF. A Better Future relies on Ag-Urban cooperation, or alternative agricultural transfers, to provide water supplies to NISP participants. Nearly 90% of water used in NISP counties (Boulder, Larimer, Morgan, and Weld) is currently used for crop irrigation.* SWSI estimates that in 2008 there were 831,000 irrigated acres in the South Platte Basin, with an annual consumptive use of 1,117,000 AF.† A Better Future assumes that water from only a very small portion of this (less than 1%) will be necessary each year to provide a yield of 10,000 AF from Ag-Urban cooperation (Figure 8).

Given the large presence of agriculture and seniority of many rights, alternative agricultural transfers are feasible as a potential future supply for NISP participants. These agreements are between willing farmers and cities and provide farmers with reliable income and cities with reliable water supplies. Though hurdles remain to implementation, interest in such agreements has gained traction in recent years, and they are seen by many—especially irrigators and their communities—as preferable to “buy and dry” agricultural water transfers where the water is permanently severed from farmland.

* Ivahnenko T. and J. L. Flynn. 2005. *Estimated Withdrawals and Use of Water in Colorado, 2005*. Prepared in cooperation with the Colorado Water Conservation Board. Washington, D.C.: U.S. Geological Survey. Scientific Investigations Report 2010-5002.

† Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. *Colorado's Water Supply Future: Statewide Water Supply Initiative 2010, Final Report*. January.

Alternative agricultural transfers may include:

- Interruptible supply agreements
- Long-term rotational fallowing
- Water banks
- Deficit/partial irrigation practices
- Alternate cropping types[‡]

Ag-Urban cooperation is similar to a concept already integrated into NISP, which states that "...NISP will have the option of entering into contracts with agricultural water users to lease water that can be subsequently diverted and stored in NISP facilities"[§] when Glade inflows fall below a certain volume.

When discussing Ag-Urban cooperation, water providers frequently state that they are unwilling to depend on supplies from agreements where agriculture retains ownership of the water rights. However, two new pilot projects are working to address both agricultural and municipal concerns, the Arkansas Valley Super Ditch and the Lower South Platte Water Cooperative (LSP Co-op). These two projects are advancing the concept of umbrella organizations that facilitate the involvement of many irrigators, and which could guarantee supply volumes to municipalities and others while maintaining irrigator ownership of water rights. The LSP Co-op's mission statement, for example, is to "Create a member-based organization controlled by local water users to facilitate more efficient uses of water to better meet current and future water supply needs in both local and regional areas."[¶] The LSP Co-op is evaluating means to deliver firm yield and water needed on a periodic basis while maintaining member control of water supplies.

In the Arkansas Basin, farmers' interest in the Super Ditch is exceeding expectations. In a 2011 *Pueblo Chieftain* article, Peter Nichols, attorney for the Lower Arkansas Valley Water Conservancy District, is quoted as saying, "Water rights holders representing 67 percent of the land and 70-75 percent of the water under seven ditches proposed for inclusion in Super Ditch ... [indicated] they might be interested in selling water through a lease program."^{**} Similarly, a survey of South Platte Basin irrigators found that 63% of interviewed farmers would be willing to participate in a rotational land

‡ CDM. 2011. *Colorado's Water Supply Future: Alternative Agricultural Water Transfer Methods Grant Program Summary, Final Report*. May 2.

§ U.S. Army Corps of Engineers, Omaha District. 2008. *Northern Integrated Supply Project Draft Environmental Impact Statement*. Applicant: Northern Colorado Water Conservancy District. April.

¶ Lower South Platte Water Cooperative. 2012. Frequently asked questions presentation at update meeting on February 24.

** Woodka, C. 2011. "Most Farmers Interested in Super Ditch." *Pueblo Chieftain*. January 20. http://www.chieftain.com/news/local/most-farmers-interested-in-super-ditch/article_97faeaa-2463-11e0-a4d2-001cc4c03286.html.

fallowing program, if compensated adequately (the most common estimate of compensation was \$400 per AF).*

Additional storage may be needed to re-time a portion of deliveries from historical irrigation months to meet year-round municipal demands. Existing and improved storage, smaller off-channel reservoirs, local gravel pits, and other storage could be pursued for this purpose. Examples of potential storage locations from the DEIS[†] include the following:

- Erie, Lafayette, Left Hand Water District—gravel pits along Boulder Creek downstream of Longmont
- Eaton, Severance, Windsor—gravel pits along the Poudre River downstream of Fort Collins
- Fort Morgan, Morgan County Quality Water District—gravel pits along the South Platte River upstream of Fort Morgan
- Central Weld County Water District—gravel pits along the South Platte River to the east of Frederick, Firestone, and Dacono
- Evans—gravel pits on the South Platte River in the vicinity of Evans
- Fort Collins–Loveland Water District—gravel pits on the Poudre River and enlargement of a North Poudre Irrigation Company Reservoir
- Fort Lupton—gravel pit along the South Platte River in the vicinity of Fort Lupton

The Colorado-Big Thompson (CBT)[‡] system also provides for unique opportunities for Ag-Urban cooperation as all NISP participants receive CBT water. Water can—and is—moved around with relative ease among CBT participants.

Many details of Ag-Urban cooperation will need to be worked out, including overcoming technical issues, legal challenges, and existing reluctance on the part of municipalities and irrigators.[§] At the same time, a great deal of interest and political will exists to advance the concept, and significant resources are being invested by the state to this end. Because such supplies will not be needed by NISP participants for at least a decade,[¶] this provides time for

* Pritchett, J., J. Thorvaldson, N. Hansen, and A. Jha. 2008. "Water Leasing: Opportunities and Challenges for Colorado's South Platte Basin." Paper presented at Western Agricultural Economics Association annual meeting, Big Sky, Montana, June 26.

† U.S. Army Corps of Engineers, Omaha District. 2008. *Northern Integrated Supply Project Draft Environmental Impact Statement*. Applicant: Northern Colorado Water Conservancy District. April.

‡ The CBT Project is a U.S. Bureau of Reclamation project that diverts approximately 260,000 AF of water each year from West Slope Colorado River headwaters to the South Platte Basin on the east slope. Northern Water apportions the water amongst irrigators and communities that receive municipal and industrial water from the project.

§ *A Better Future* does not evaluate specific ditches and supplies because temporarily transferring agricultural water rights for municipal use can be extremely complex, requiring analysis for each specific situation, including NISP participant needs, potential supplies, timing, storage, delivery infrastructure, costs, water quality, and treatment, among other factors.

¶ *A Better Future* includes Ag-Urban supplies beginning in 2025, but these are supplies in excess of demands so they could be developed later.

specifics to be worked out and for the necessary administrative and market frameworks to develop.

As the framework for Ag-Urban cooperation is being developed in Colorado, two successful examples can be found in California. In 2005, a 35-year-long transfer program began in which land is fallowed in the Palo Verde Irrigation District to provide water to the Metropolitan Water District of Southern California (Metropolitan). Discussing the benefits of this agreement, Bart Fisher, a farmer and Palo Verde Irrigation District board member, said, “Being compensated by Metropolitan for fallowing serves both ends: It doesn’t diminish the bottom line and it allows farmers to make the land more productive.” Fisher added, “The community also is already seeing the benefits of the additional revenues that are flowing in.”** Another example is the Imperial Irrigation District, which is transferring water to the San Diego County Water Authority and Coachella Valley Water District under a 45-year agreement finalized in 2003.

The Harvey Report does not include any supplies resulting from Ag-Urban cooperation. The NISP No Action Alternative (NAA) evaluation conducted by MWH dismissed rotational fallowing and dry year leases from among viable NISP alternatives. This conclusion was based on assumptions that more than 40,000 AF of annual supply would be needed via this source alone and that land would be fallowed in 1 out of 10 years, necessitating the involvement of a large number of acres.††

The Better Future Alternative assumes Ag-Urban cooperation is one among several supplies contributing to meeting local water demands. Additionally, fields could be fallowed more frequently than 1 out of 10 years, thus requiring the participation of fewer acres. For example, a 1:4 ratio (land fallowed 1 out of every 4 years) is consistent with both the Super Ditch and Palo Verde Irrigation District/Metropolitan agreements. The NAA also dismissed dry year leases because the alternative assumed the water would be needed in all years. Because all Better Future supplies are firm yield supplies (water expected to be available in dry years), more water is available in average and wet years. As a result, NISP participants could choose to rely on Ag-Urban cooperation—such as interruptible supply agreements—in dry years only.

** Berman, M. 2006. “A Tale of Two Transfers: Palo Verde, Imperial Valley Farmers Take Different Roads.” *Aqueduct Magazine* 72(3):1 Summer.

†† MWH. 2010. *Northern Integrated Supply Project No Action Alternative*. Prepared for Northern Colorado Water Conservancy District. April.

Conditional Inclusion: Windy Gap Firming Project

The Windy Gap Firming Project is designed to improve the reliability of the existing Windy Gap Project, which has not delivered anticipated yields. A new reservoir, Chimney Hollow, would store water for the future needs of 13 WGFP participants, five of whom are also NISP participants (Central Weld County Water District, Erie, Evans, Fort Lupton, and Lafayette).

In November 2011, the U.S. Bureau of Reclamation released a Final Environmental Impact Statement for the project. A Record of Decision has not yet been released. This project would divert additional West Slope water to the Front Range, further impacting Colorado River headwaters. Because the WGFP has not yet been approved—and because of concerns about potential detrimental impacts to West Slope streams and rivers—the Better Future Alternative discusses WGFP water supplies both with and without the project. The inclusion of the WGFP in a Better Future should not be construed as support of the project. It is included, however, because it is in the final stages of approval and, as such, may be considered a reasonably foreseeable project.

A Better Future conditionally assumes 3,700 AF of WGFP firm yield for NISP participants beginning in 2020, as documented in the WGFP Final EIS.* WGFP reuse of 1,809 AF is also assumed, as discussed above in the “Planned and Additional Reuse” section. **Total conditional yield for NISP participants, both first-time use and reuse, from the WGFP is assumed to be 5,509 AF. Note that the Better Future Alternative meets NISP participant water demands with or without this project.**

The Harvey Report analysis does not include WGFP supplies.

* U.S. Department of the Interior, Bureau of Reclamation, Great Plains Region, Eastern Colorado Area Office. 2011. *Windy Gap Firming Project Final Environmental Impact Statement*. Volume 1 FEIS 11-29. November.

Water Supply and Drought

Water supplies can vary greatly from year to year depending on hydrologic conditions, a community's specific water rights portfolio, and the amount of water remaining in storage from previous years. For this reason, "firm yield" supplies—water that is expected to be available even in dry years—typically are used in water supply planning, as opposed to planning around average or wet year supplies. This ensures that communities have sufficient water available to meet demands in most years. However, multi-year droughts can decrease the availability of supplies, albeit on a temporary basis. For example, with 100% of the state experiencing some level of drought during the summer of 2012, many communities did not implement drought measures because reservoirs were relatively full from a very wet 2011. If those supplies are drawn down and the drought continues, subsequent years will be more challenging and may require mandatory water use restrictions. Long-term drought and climate change increase the likelihood of more frequent and intense droughts in the future.

Many communities or water providers have drought response plans that can be put in place temporarily to ensure that critical water needs are met. Colorado has a statewide Drought Mitigation and Response Plan and encourages and financially supports water providers to develop drought mitigation plans specific to their service areas. Drought mitigation measures are temporary and are different from ongoing water conservation programs.

Examples of temporary drought mitigation activities include imposing more stringent limits on outdoor irrigation, setting tighter water budgets, serving water only upon request at restaurants, setting water savings goals for large water users, and implementing industry-specific water restriction programs.

To account for drought, all of the supplies in the Better Future Alternative are "firm yield" supplies. Additionally, the Better Future Alternative applies only 60% of active conservation savings to future demands. The remaining 40% is not included as a supply, but rather is assumed to be set aside to provide a buffer in times of drought and other uncertainties, and to improve system reliability. All NISP participants also have Colorado-Big Thompson shares that typically provide more water in dry years because the project was designed to provide supplemental supplies when other supplies are insufficient. A Better Future (and the Harvey Report) assumes that NISP participants' existing CBT supplies yield 0.60 AF/share, yet in past dry years the yield has typically been higher. For example, in 2002 the CBT quota was 0.70 AF/share and in 2012 it was 1.0 AF/share. Lastly, the Better Future Alternative relies on a variety of supplies that provide flexibility, rather than relying heavily on one project. For these reasons, and because the Better Future Alternative portfolio exceeds demands, our alternative provides secure water supplies, even in periods of drought.



The Smart Principles

Western Resource Advocates, in collaboration with Trout Unlimited and the Colorado Environmental Coalition, has developed a set of Smart Principles to guide future water supply management and development efforts:

- Make full and efficient use of existing water supplies and reusable return flows before developing new diversion projects.
- Improve use of existing water supply infrastructure by integrating systems and sharing resources among water users to avoid unnecessary new diversions and duplication of facilities.
- Recognize the fundamental political and economic inequities and the adverse environmental consequences of new transbasin diversions.
- Expand or enhance existing storage and delivery before building new facilities in presently undeveloped sites, and expand water supplies incrementally to better utilize existing diversion and storage capacities.
- Recognizing that market forces now drive water reallocation from agricultural to municipal uses, structure voluntary transfers, where possible, to maintain agriculture and in all cases to mitigate the adverse impacts to rural communities from these transfers.
- Involve all stakeholders in decision-making processes and fully address the inevitable environmental and socioeconomic impacts of increasing water supplies.
- 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 “multi-purpose projects” to spread project benefits as well as costs.

While NISP meets a few of the Smart Principles, like integrating systems and sharing resources, it is in stark contrast to others, such as leaving adequate flows in rivers to support healthy ecosystems. The Smart Principles are meant to be taken as a whole, and NISP does not meet that requirement. NISP’s major impacts on streamflow, combined with exaggerated populations and demands, and the lack of inclusion of water conservation (efficient use) and other reasonable supplies (reuse, water transferred as a result of growth onto irrigated lands, voluntary cooperation with agriculture) mean that NISP does not meet the Smart Principles.

While NISP meets a few of the Smart Principles, it is in stark contrast to others.

Cost Analysis

The Better Future Alternative allows participants to be more flexible with growth and investments in water supplies. In addition, it may cost significantly less than NISP. Below, we summarize our cost analysis and assumptions for the key components of the Better Future Alternative (growth-displaced agricultural water supplies, active conservation, additional reuse, and Ag-Urban cooperation).*

A Better Future increases water supplies and costs incrementally as cities grow, allowing participants to defer the capital construction costs to future years, and does not force cities to grow in order to repay project debts. To reflect the value of deferring such investments, we evaluate the Better Future Alternative in terms of a present value. The present value of the cost of providing 40,000 AF of water[†] through a Better Future, assuming a 5% discount rate, is approximately \$109 million. The present value cost of a Better Future through 2060 is moderately higher, at \$150 million. In addition to water supplies, the Better Future Alternative will undoubtedly require facilities to store and convey water to participants. The character of these facilities depends on a range of factors, such as individual cities' growth patterns (which determines what agricultural land and water is transferred to cities), capacity in cities' existing water conveyance systems, the seniority of agricultural water rights leased or transferred with land (which determines the size of storage facilities needed), and the location of reuse customers. In some cases, cities may be able to rely on existing infrastructure and avoid large additional costs. Estimating the cost of potentially needed facilities is beyond the scope of this analysis, but would be in addition to the \$109 million cost for 40,000 AF of water supplies.

WRA's cost analysis includes water supplies that are in excess of what utilities are already planning or have underway. For example, the City of Erie is already planning to develop 690 AF of reuse water by 2014 and a total of approximately 1,300 AF of reuse by build-out;^{‡,§} the cost of that water, therefore, is not included in this analysis. Assumptions are outlined below in each individual section.

* The cost analysis does not include the cost of Windy Gap Firming Project supplies because those are being developed independent of the purpose and need for NISP.

† 40,000 AF is the amount of water equivalent to the volume provided by NISP.

‡ CDM. 2008. *Town of Erie Water Conservation Plan*. January.

§ CDM. 2007. *Town of Erie Non-Potable Municipal Water System Master Plan*. September.

The Better Future Alternative is a strategy for meeting NISP participants' water needs *through the year 2060*, providing about 55,000 AF of new water (60,000 AF with the WGFP). In contrast, NISP proposes to meet participants' water needs through 2030, providing 40,000 AF of water. Under NISP, participants' total demands are projected to continue rising beyond 2030. WRA presents two cost comparisons:

1. The cost of a Better Future at the point when it provides 40,000 AF of new water (estimated to be around the year 2037)
2. The cost of a Better Future through the year 2060

Table 4 summarizes the data used to estimate the total cost of the Better Future Alternative; each element is described in greater detail below.

TABLE N° 4 SUMMARY OF UNIT COSTS OF KEY COMPONENTS OF THE BETTER FUTURE ALTERNATIVE.

Better Future Component ^a	Cost
Growth onto irrigated agricultural land	\$11,184/AF (one-time)
Active conservation	\$8,183/AF (one-time)
Reuse	\$13,500/AF (one-time)
Ag-Urban cooperation (leasing)	\$410/AF (annual)

^a Ag-Urban cooperation (leasing) would be a cost incurred during each year of the leasing period (regardless of whether or not the water is required each year); all other costs are a one-time, up-front cost.

Growth onto Irrigated Lands

As cities grow, their footprint also grows, often displacing agricultural land and altering associated water use. In this analysis, we include all costs of growth-displaced agricultural water, regardless of whether the city or developer pays for it.

To estimate the cost of purchasing water supplies, we rely on the recent cost of Colorado-Big Thompson water. CBT share prices fluctuate from year to year, depending on demands. The City of Longmont increased its fee for cash in lieu of water rights transfers from \$9,868/AF to \$11,184/AF in May 2012.* For this analysis, we assume water rights cost \$11,184/AF.

The question of “who pays” for water supplies does not affect the overall cost analysis of NISP as compared to the Better Future Alternative. Some cities require developers to provide water supplies to a city, others allow developers to pay a fee to cover the city’s cost for developing new water supplies, and others allow for a combination of the two. While these arrangements are important for a city’s financial planning, they do not affect the overall cost of a water supply. For example, presumably a city will ultimately pass the costs of NISP on to developers, even though the city will pay the up-front cost of developing the project. Likewise, a city could pay for the cost of CBT water, reuse water, or conservation, and then pass those costs on to developers. In

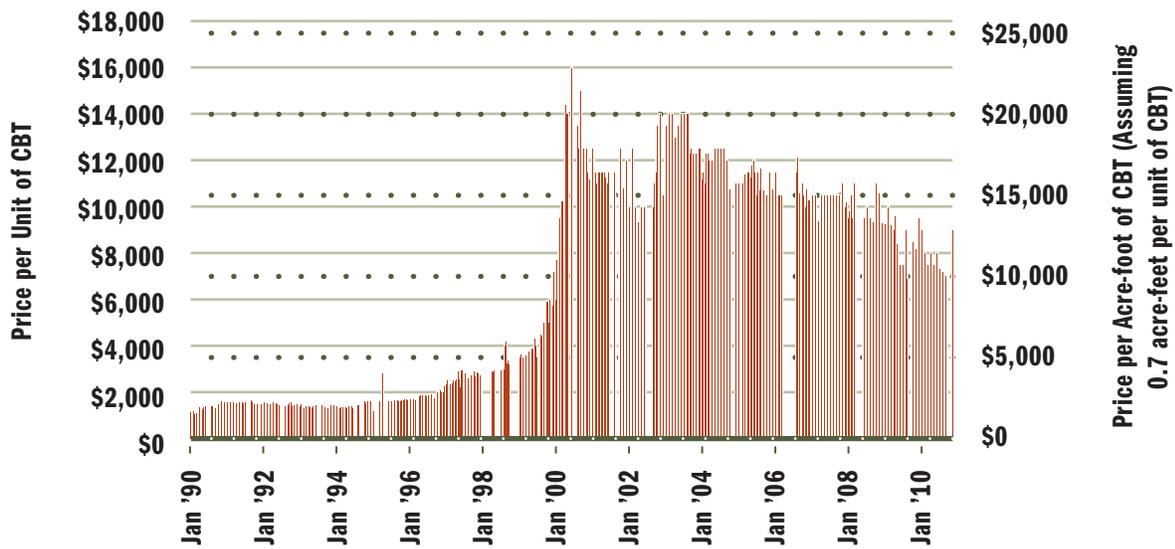
* City of Longmont, Colorado. 2012. “City Council Communication: Resolution Setting the Fee for Cash In Lieu of Water Rights Transfers at \$11,184.00 per Acre-Foot.” May 8. http://www.ci.longmont.co.us/city_council/agendas/2012/documents/050812_9E.pdf.

Colorado-Big Thompson (CBT) Water Market

An element of the Colorado-Big Thompson project is an active water market. CBT water, which is imported from Colorado's West Slope, is unique in that it can be leased or sold throughout Northern Water's geographic service area with relative ease compared to other water rights. Units are purchased and sold by irrigators and municipalities on a regular basis. As a result, CBT prices impact other water right transaction prices in the area.

Northern Water changes the quota (the volume of water provided per CBT share) regularly to respond to conditions and the needs of CBT users. The delivery in any year is a Northern Water board decision that depends, among other things, on the amount of water that can be put to use. CBT water cannot be imported and then wasted in wet years when demand for supplemental water is low. The chart below shows the historical price per CBT unit or share (left axis) and the price per AF assuming a 0.70 AF/unit quota (right axis). Note that these are prices to purchase CBT units, not lease them.

HISTORICAL PRICE OF COLORADO BIG THOMPSON (CBT) UNITS*



* Leonard Rice Engineers. 2011. "Colorado Big Thompson Water Rights Price Trends." Accessed July 2, 2012. http://lrewater.com/sites/default/files/files/CBT_Water_Rights_Price_Trends.pdf.



order to provide an appropriate comparison, this cost analysis includes all of the new water supplies, regardless of whether the cost is directly borne by developers or the city.

Active Conservation

We include the cost of active conservation savings in excess of those that would result from the low conservation strategy (which we assume will occur whether or not the Better Future Alternative is adopted by NISP participant communities). We estimate the costs of saving 16,800 AF of water* through active, high conservation measures. The SWSI 2010 report estimates that water saved through measures employed under the high conservation strategy typically cost \$8,183/AF. While only 60% of the active conservation savings are applied toward meeting demands (40% is held for drought response and to improve system reliability), our analysis reflects the cost of saving the full volume of water (100%). Finally, we assume conservation savings are permanent.

Reuse

As noted above, several NISP participants have plans to develop or expand reuse supplies. Erie, for example, plans to develop 690 AF of reuse water by 2014 and 1,300 AF of reuse water by build-out. Similarly, Lafayette currently reuses almost 1,500 AF of water. We do not, therefore, include these volumes in our cost estimate. The remaining volume of reuse water developed by NISP participants under WRA projections amounts to 3,935 AF in 2060.†

The cost of developing reuse water depends on a host of factors, such as the quality of the wastewater (high dissolved solids, for example, may require reverse osmosis or other treatment), new or expanded transmission and conveyance facilities, the designated use (i.e., potable or nonpotable), and—if direct reuse—the proximity of the wastewater treatment plant to reuse customers.

The Colorado Water Conservation Board estimates the cost of reuse in its *Reconnaissance Level Cost Estimates Report*.‡ According to the report,

* Total Better Future 2060 active conservation savings, less savings attributed to decreased losses and water charges (which should not have conservation costs applied to them), are 29,578 AF. Of this, 14,749 AF can be attributed to savings resulting from the SWSI low conservation strategy, which we assume will occur regardless of NISP or the Better Future Alternative, so low strategy costs are not included. The cost to implement the remaining 16,800 AF of savings from high conservation measures ($29,578 - 14,749 = 16,798$ AF) is included as a Better Future cost.

† Some of this reuse volume may result from water provided through the Windy Gap Firming Project. While this project may not be built, for simplicity, our cost estimate includes WGFP reusable supplies.

‡ CDM. 2010. *Reconnaissance Level Cost Estimates for Agricultural and New Supply Strategy Concepts*. Prepared for Colorado Water Conservation Board. June 4. <http://cwcb.state.co.us/water-management/water-supply->

developing direct, nonpotable reuse has a capital cost of \$7,000/AF, whereas indirect potable reuse costs \$13,500/AF. The higher cost estimate is based on a hypothetical system similar to the proposed Water, Infrastructure, and Supply Efficiency (WISE) project, in which treated wastewater is discharged into a natural stream, withdrawn, and pumped to South Metro Water Supply Authority cities, where it is treated at a regional treatment facility (using advanced treatment, such as reverse osmosis or ultraviolet radiation). Of note, this treatment process would provide fully potable water. NISP provides high-quality raw water that would still require treatment at cities' treatment plants (or a regional treatment plant). Treatment to potable standards is not included in NISP or in the cost estimates of other elements of the Better Future Alternative. While this is likely more complex and expensive than the probable reuse system that would be developed in NISP participant cities, we use the higher cost estimate (\$13,500/AF), which likely represents an upper bound of actual costs.

Ag-Urban Cooperation

Flexible, voluntary transfers of water between agricultural and municipal users represent another component of the Better Future Alternative. These transfers could take many forms; however, in this analysis, we evaluate only the cost of rotational fallowing, using price estimates developed by economists at Colorado State University. Supplies could be relied on in all years or just in times of drought, depending on the structure of agreements. In either case, long-term agreements likely would need to be in place to provide security to both irrigators and municipal water users.

Surveys by researchers at Colorado State University show that a majority of farmers surveyed (75%) indicated a willingness to accept between \$225 and \$575 per acre fallowed.[§] Given the typical consumptive use of water in the region, the median price of leased water would amount to approximately \$410/AF. Recent short-term leases on the Front Range exhibit similar prices: Aurora paid farmers in the Rocky Ford-Highline Canal \$300/AF for a short-term lease; with revegetation and administrative costs, the total cost was \$500/AF.[¶] Of note, any fallowing program would have to incorporate the cost of managing the fallowed cropland, which would include revegetation, weed control, and other maintenance costs.

[planning/Documents/SWSI2010/Appendix%20N_Reconnaissance%20Level%20Cost%20Estimates%20for%20Strategy%20Concepts.pdf](#).

§ Pritchett, J., J. Thorvaldson, and M. Frasier. 2008. "Water as a Crop: Limited Irrigation and Water Leasing in Colorado." *Review of Agricultural Economics* 30(3):435-444.

¶ HDR Engineering, Inc. 2008. *Northern Integrated Supply Project Environmental Impact Statement, Water Resources Technical Report*. Prepared for the U.S. Army Corps of Engineers. February.

Better Future Present Value of Costs

Cities and water utilities finance the development of new water supplies in varying ways. Most fund projects through municipal bonds, which are then repaid through tap fees, water rates, and other mechanisms. On rare occasions, cities or utilities fund projects with cash or money that has already been collected through rates or other fees. It is critical that costs are evaluated in terms of the present value—that is, future costs are discounted into present terms. There is a “time value of money”—any money not spent on capital investments, for example, could be gaining interest or used for other needed capital improvements (e.g., highways, libraries, etc.).

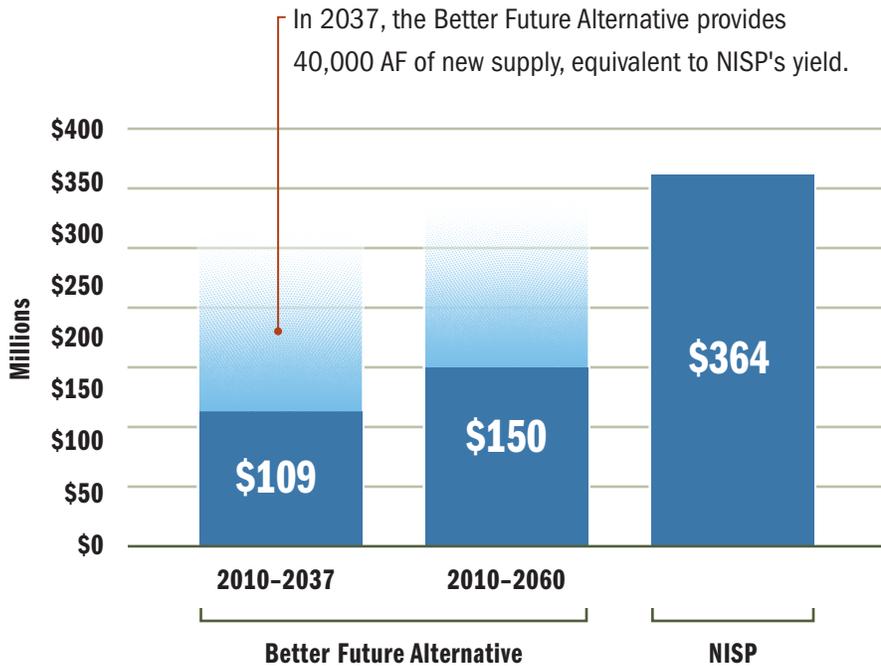
Both public agencies and private businesses evaluate investments in terms of the present value. The discount rate chosen has a substantial effect on the present value of the costs. For this analysis, we calculate the cost (Figure 9) assuming a discount rate of 5% (approximately equal to the current municipal bond rate), which represents the most likely discount rate under present conditions.

A phased approach to developing new supplies allows cities to postpone major investments and also helps cities hedge against the risk of overbuilding supplies and locking existing customers into paying off the debts. This is a particular risk if cities or utilities are counting on new growth (and tap fees) to pay municipal bonds. In Colorado Springs, for example, payments to construct the Southern Delivery System are being funded primarily by existing ratepayers, who have seen double-digit rate increases partially due to slower growth (and thus fewer tap fee sales).*

The present value of costs for Better Future water supplies (Figure 9) are evaluated over the time periods of 2010–2037 (2037 is the year in which the Better Future Alternative provides 40,000 AF of new supply, which is equivalent to the NISP yield) and 2010–2060. We also illustrate conceptually the timing of investments in the Better Future Alternative, broken down by water supply source, for the entire planning period of 2010–2060 (see Figure 10, which assumes that supplies are added incrementally every five years, with the exception of Ag-Urban cooperation, which has annual costs). Not shown in these figures is the cost of storage, pipelines, or other infrastructure that may be required to deliver water to participating cities. Because of these undefined costs, the costs of the Better Future Alternative cannot be directly compared to those of NISP. However, it is important to note that the majority

* Colorado Springs Utilities increased water rates by 41% in 2009, 6% in 2010, and was expected to increase rates by 12% per year for the next 6 years. Source: Zubeck, P. 2010. “Paying Through the Hose.” *Colorado Springs Independent*, July 8.

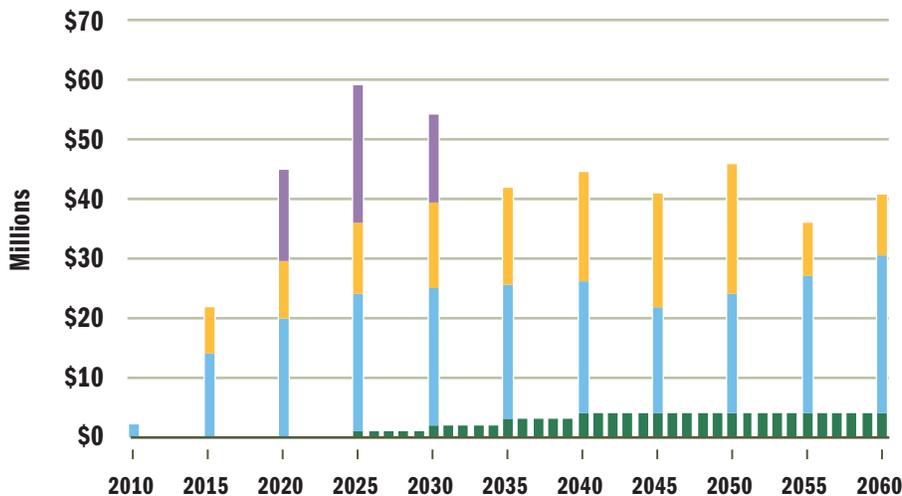
FIGURE Nº 9 ESTIMATED NET PRESENT VALUE OF COSTS FOR NISP AND THE BETTER FUTURE ALTERNATIVE.



■ Uncertain Costs
■ Firm Costs

“Uncertain costs” include various unidentified infrastructure needs, such as gravel pit storage and conveyance structures.

FIGURE Nº 10 ESTIMATED ANNUAL COSTS FOR THE BETTER FUTURE ALTERNATIVE*.



■ Reuse
■ Active Conservation
■ Growth onto Irrigated Lands
■ Ag-Urban Cooperation

* Five-year intervals are used for planning purposes in both the Harvey Report and the Better Future Alternative. As a result, the Better Future Alternative assumes costs to develop and/or expand reuse programs, active conservation, and growth onto irrigated lands are incurred at five-year intervals. Ag-Urban cooperation would require that irrigators are paid an annual fee whether or not water is being transferred that year, to incentivize them to participate, so Ag-Urban cooperation costs are assumed to be incurred every year.

of NISP capital costs, estimated at approximately \$479 million* total, or a present value of \$364 million (assuming a 5% discount rate), occur over the next 10 years.†‡§ NISP participants also will have additional demands beyond 2030 that are not met by NISP, which will require investment on the part of participants, resulting in costs also not shown.

In this analysis, we address only the capital costs of NISP and the key nonstructural elements of the Better Future Alternative. Both NISP and a Better Future would have annual operations and maintenance (O&M) costs. For NISP, those costs would include operating pumping stations and reservoirs; for a Better Future, those costs could include operating pumping stations and gravel pits. Because we do not include an assessment of infrastructure needs in the Better Future Alternative, it is not possible to estimate annual O&M costs, and not accurate to compare them to NISP's O&M costs.

Finally, the NISP costs do not include uncertain or unforeseen costs. For example, in its comments on the NISP Draft EIS, Fort Collins indicated it may have to upgrade its wastewater treatment facilities in order to meet discharge standards due to the Poudre River's decreased ability to dilute wastewater outflows. This cost may be high but it is uncertain, and, therefore, not included in our cost analysis.

* This amount is slightly lower than costs reported in the news media and on Northern Water's website (\$490 million) or through personal communication with Brian Werner, Northern Water (\$486.7 million), August 23, 2012. However, it reflects the most detailed cost breakdown WRA had available that sufficiently allowed us to identify the timing of investments in order to estimate a present value cost.

† Integra Engineering and GEI Consultants. 2010. "Northern Integrated Supply Project, South Platte Water Conservation Project Facilities Update and Cost Estimate." Technical Memorandum. January.

‡ Integra Engineering and GEI Consultants, 2010. "Northern Integrated Supply Project, Glade Complex Facilities Update and Cost Estimate." Technical Memorandum – Draft. January.

§ Cost of land acquisition for Glade Reservoir and realignment of Highway 287 only. Source: U.S. Army Corps of Engineers, Omaha District. 2008. *Northern Integrated Supply Project Draft Environmental Impact Statement*. Applicant: Northern Colorado Water Conservancy District. April.

Recommendations

Planning for and meeting the water needs of NISP participant communities is critical, as is ensuring the health of the Poudre River and the recreational, economic, and other benefits it provides. We believe that Northern Water and NISP participants can chart an innovative path forward, one that differs from the traditional approach of building very large reservoirs. The Better Future portfolio instead relies on a combination of supplies from conservation, reuse, water transferred as a result of growth onto irrigated agricultural lands, and voluntary agreements with agriculture.

We encourage the U.S. Army Corps of Engineers to incorporate elements of the Better Future Alternative into its No Action Alternative when completing the NISP Supplemental DEIS.

Western Resource Advocates offers the following key recommendations for Northern Water, NISP participants, and the U.S. Army Corps of Engineers to consider carefully in planning for the region's future water needs:

- ✓ Meet projected demands with balanced strategies that are the least environmentally damaging, in contrast to large traditional reservoir and pipeline projects.
- ✓ Protect Colorado's rivers and streams as an integral part of any future water development strategy. Nonconsumptive uses of water—for fishing, boating, and other uses—are extremely valuable to the local economy and are critical to our quality of life.
- ✓ Use reliable and up-to-date population data and projections from the State Demography Office.
- ✓ Implement more aggressive water conservation strategies. Conservation is often the cheapest, fastest, and smartest way to meet new demands, and NISP participants have significant opportunities to boost their existing water conservation efforts.
- ✓ Conservation savings—passive and active—must be integrated into water supply planning.
- ✓ Include all existing supplies, supplies from growth onto irrigated lands, and NISP participants' water dedication requirements in future supply projections
- ✓ Maximize the role of water reuse in meeting future needs. Include NISP participants' existing and planned reuse—as well as additional Better Future reuse supplies—in any analysis.
- ✓ Include increased cooperation between agriculture and local communities in the form of voluntary water sharing agreements that benefit both NISP participants and the agricultural community without permanently drying up irrigated acres. Alternatives to “buy and dry” transfers present excellent opportunities for meeting future municipal demands.

By following these recommendations, NISP communities can more than meet their future water needs while minimizing impacts to rivers and streams.

“ At New Belgium, the excellence of our beer and the livelihoods of over 450 people depend on reliable, high-quality water. So both our hearts and our minds demand that we protect the Poudre River. We cannot support a solution that further jeopardizes our environment when there is a portfolio of better options. ”

—Jenn Vervier, Sustainability Coordinator, New Belgium Brewery



Conclusions

The Better Future Alternative includes a diverse portfolio of water supplies to meet, and exceed, NISP participant demands through 2060. Relying on water from growth onto agricultural lands, conservation, reuse, and cooperative agreements with agriculture, a Better Future provides an alternative to NISP that meets water demands far into the future while maintaining Poudre River flows that are critical to the aquatic environment, recreation, and local economies. The Better Future Alternative includes:

- Total water requirements of 72,100 AF by 2030 and 109,100 AF by 2060 (which is 27,000 AF and 34,300 AF less than Harvey Report projections in 2030 and 2060, respectively)
- 60,550 AF of current firm yield supplies
- Annual firm yield from traditional agricultural transfers from urban growth onto previously irrigated lands of 7,360 AF by 2030 and 19,150 AF by 2060
- Active conservation savings of 6,401 AF by 2030 and 20,482 AF by 2060 applied toward NISP participant demands
- Reuse supplies of 4,900 AF by 2030
- Ag-Urban cooperation supplies of 5,000 AF by 2030 and 10,000 AF by 2060
- Conditional (NISP participant demands are met with or without this project) Windy Gap Firming Project yield (first-time use and reuse) of 5,500 AF by 2030
- Firm yield that exceeds projected demands by 12,100 AF by 2030 and 6,000 AF by 2060 without the WGFP; when the WGFP is included, Better Future supplies exceed demands by 17,700 AF by 2030 and 11,500 AF by 2060

We have been conservative in our analysis of Better Future water supplies, as documented throughout this report and in “Appendix A: Better Future Alternative Safety Factors.” As a result, we anticipate that the Better Future Alternative portfolio will yield supplies in excess of those described.

We anticipate that the Better Future Alternative portfolio will yield supplies in excess of those described.

NISP participants will also pursue other supply sources not included in the Better Future Alternative. For example, Erie’s water conservation plan says, “Erie anticipates the need to acquire additional water rights to meet future needs. These will likely consist of Windy Gap shares, CBT shares, and ditch water rights.”* A Better Future does not include an estimate of these or similar supplies being pursued by other NISP participants. Additionally, the supplies identified are firm yield (i.e., dry year) supplies. In average and wet years, additional water will be available. For example, the Harvey Report includes existing firm yield supplies of 59,400 AF and average year supplies of 82,076 AF. It may be possible to utilize small, incremental storage projects, such as improved gravel pits, to increase firm yields with additional carryover of average and wet year supplies.

The present value cost of the Better Future Alternative to yield 40,000 AF† (NISP’s yield) is \$109 million, though this doesn’t include some infrastructure costs. By relying on a phased approach (i.e., water supplies increase incrementally and do not require a large, up-front investment by participants), a Better Future provides water supply flexibility and financial risk management for communities. If population growth is not as rapid as predicted, communities can delay investment in reuse and water transfers. In contrast, NISP requires large up-front costs, meets demands only through 2030, and diverts critical peak flows from the Poudre River.

The Better Future Alternative is a realistic and reasonable alternative to NISP. The supplies identified in the Better Future portfolio do not require the development of large new reservoirs and river diversions. However, portfolio components may impact streamflows, as historical return flows are reused and if diversion points change as a result of growth on previously irrigated lands or Ag-Urban cooperation. Additionally, water conservation can result in decreased returns flows. New supply development, including the Better Future portfolio, should be undertaken with care to avoid or mitigate significant impacts to stream and ecosystem health.

Better Future Alternative portfolio components and projected water requirements are shown in Figure 11. Additional water supply details for the 2010 to 2060 planning period are provided in Table E-1 in Appendix E.

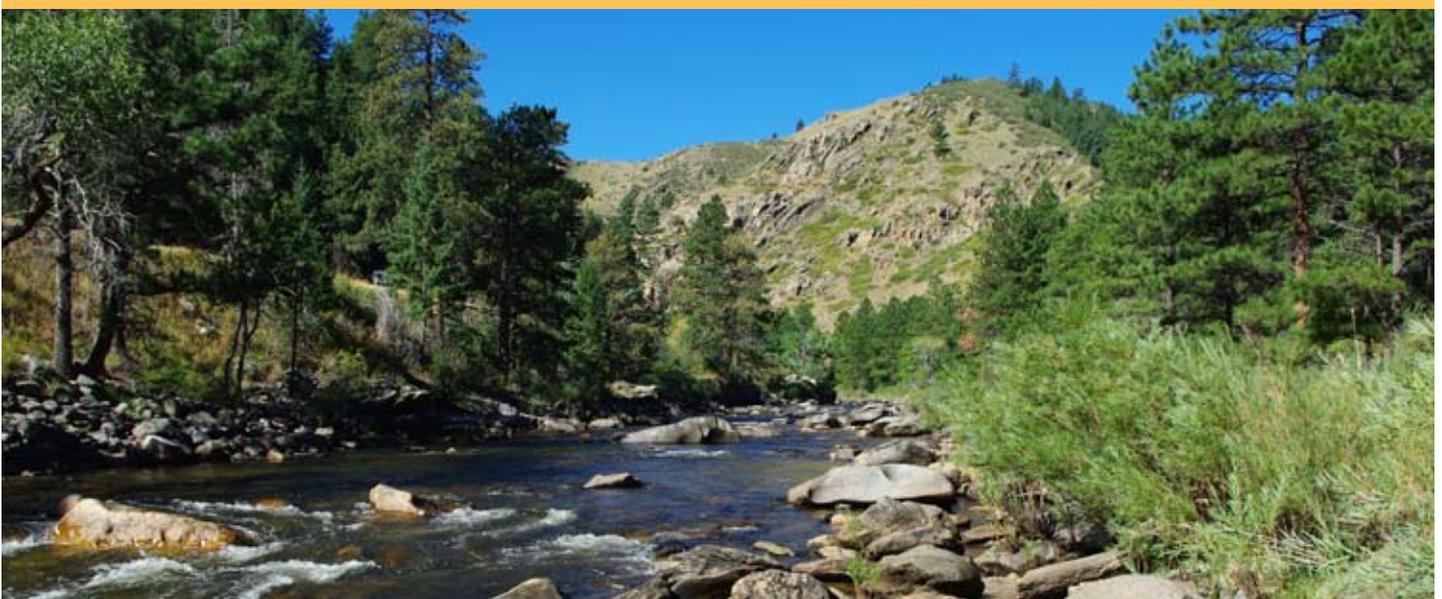
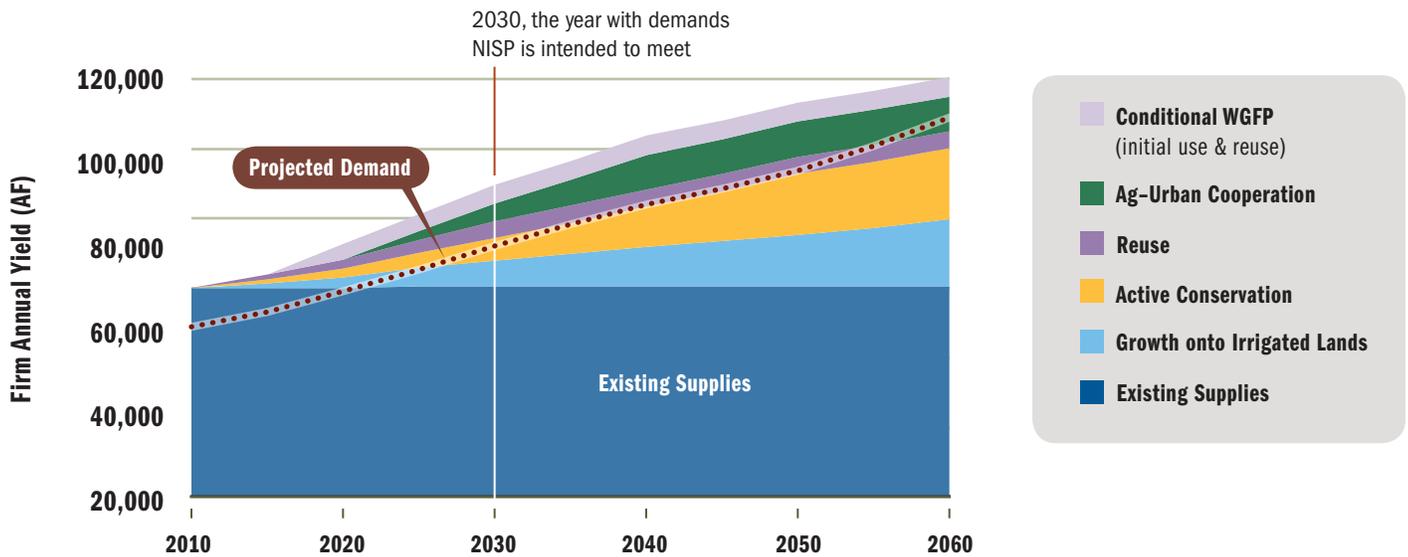
* CDM. 2008. *Town of Erie Water Conservation Plan*. January.

† The Better Future Alternative provides a total of more than 60,000 AF of new firm yield supplies (about 55,000 AF when the WGFP is not included), in addition to existing NISP participant supplies.

“ The Better Future Alternative is a common-sense path forward for NISP communities. It protects the Poudre River, safeguards Fort Collins’ interests, and provides water to these small towns. ”

—City of Fort Collins Mayor Pro Tem Kelly Ohlson

FIGURE Nº 11 BETTER FUTURE ALTERNATIVE SUPPLIES MEET AND EXCEED NISP PARTICIPANTS’ PROJECTED 2060 DEMANDS.



“ Commercial and private recreational boating opportunities depend on keeping existing flows in the river, and they both provide an important boost to the local economy. I encourage NISP participants to adopt the recommendations listed in the Better Future Alternative Report. ”

—Patrick Legel, Owner of A Wanderlust Adventure Rafting Company



Appendices

Appendix A describes the various safety factors incorporated throughout this report in order to be conservative in our analysis of Better Future water supplies.

Appendices B-E provide additional details regarding the data, assumptions, and calculations that are the basis of the Better Future Alternative. Data sources include the 2011 Harvey Report, Colorado State Demography Office, and Colorado's 2010 Statewide Water Supply Initiative, among others.

Appendices are not provided for Better Future water supplies that are fully explained in the main report body, e.g., reuse supplies.

- Appendix A: Safety Factors
- Appendix B: Population Projections and Baseline Demands
- Appendix C: Growth onto Irrigated Lands
- Appendix D: Active Conservation
- Appendix E: Summary of Supplies and Demands

Appendix A: Better Future Alternative Safety Factors

Numerous safety factors have been included in the Better Future Alternative to ensure that the alternative provides sufficient supplies to meet future demands. If demands decrease below Better Future projections and/or if additional supplies are realized, that will provide NISP participants with additional security or enable them to scale back and be even more flexible in the supplies they choose to develop. Specific Better Future safety factors are discussed below.

General

- The Harvey Report and the NISP DEIS state that NISP participants are pursuing other supplies in addition to NISP. While there is undoubtedly some overlap with Better Future Alternative supplies, additional supplies that were not included in this analysis will further increase the reliability of NISP participants' systems. For example, Fort Lupton's water conservation plan* states that the town has plans to purchase additional Fulton Ditch and Windy Gap shares, but these supplies are not included in the Better Future portfolio. Similarly, Erie's water conservation plan says, "Erie anticipates the need to acquire additional water rights to meet future needs. These will likely consist of Windy Gap shares, CBT shares, and ditch water rights."†

Baseline Demands

- To develop baseline demands, the Better Future Alternative applied the 2004–2009 average of 185 gpcd to projected populations. This is higher than the NISP participant average of 177 gpcd that Northern Water frequently refers to‡§ and is higher than the current usage rates provided in Table III-1 of the Harvey Report.¶ If NISP participants are actually using

* Clear Water Solutions, Inc. 2007. *City of Fort Lupton Water Conservation Plan*. August. http://www.fortlupton.org/DEPARTMENTS/FINANCE/water_conservation_plan/Water.pdf.

† CDM. 2008. *Town of Erie Water Conservation Plan*. January.

‡ Northern Water. 2012. *NISP Communities' Water Conservation Efforts: A Key Component to Meeting Future Water Needs*. http://www.northernwater.org/docs/Brochures/conserv_brochure_NISP_Feb2012.pdf.

§ Northern Water. "NISP Participants." Accessed September 6, 2012. <http://www.northernwater.org/WaterProjects/NISPParticipants.aspx>.

¶ Western Resource Advocates was unable to replicate the data provided in Harvey Report, Table III-1, using the data provided in the report's appendices. Our calculations resulted in higher historical use rates.

less than 185 gpcd currently, demands will be lower than those identified in this report.

- Several high water use customers—including dairies, food and milk processing plants, and power generation facilities—elevate existing per capita use. As populations grow, such large water users will likely account for a smaller percentage of total use, leading to lower total per capita use. No adjustments were made to the Better Future baseline to account for this.

Existing Supplies

- The Harvey Report documents 37,854 AF of existing Colorado-Big Thompson firm yield supplies. This assumes that CBT shares have a firm yield of 0.6 AF. In fact, these shares typically yield more in dry years. For example, in 2012—a very dry year—CBT shares yielded 1.0 AF. In 2002, CBT shares yielded 0.70 AF. Based on past practice, more CBT water will be available to NISP participants in dry years.
- Fort Lupton’s existing supplies decreased from 3,538 AF in the NISP DEIS to 1,864 AF in the 2011 Harvey Report with no explanation (a decrease of 1,674 AF). The Better Future Alternative used the lower 1,864 AF yield number, adjusting it up only by 270 AF to account for the city’s existing Fulton Ditch firm yield, which was not accounted for in Harvey Report supplies. If there were an error in the 2011 Harvey Report, Fort Lupton could have as much as 1,674 AF of additional supplies.
- In the Harvey Report, Fort Morgan supplies decreased by 500 AF from the supplies listed in the NISP DEIS with no explanation. A Better Future adjusted Fort Morgan existing supplies up by only 200 AF to account for a math error in Appendix P of the Harvey Report.
- In the Harvey Report, it is unclear if 336 AF of CBT water is accounted for in either Windsor’s or Fort Collins–Loveland Water District’s firm yield supplies. This existing supply should be included in one of these water provider’s supplies but may not be. No adjustments from the Harvey Report data were made in the Better Future Alternative, due to the lack of clarity on this matter.
- The supplies identified in our report are firm yield (i.e., dry year) supplies. In average and wet years, additional water will be available. For example, the Harvey Report states that NISP participants’ current firm yield supplies total 59,400 AF, but average year supplies total 82,076 AF. It may be possible to utilize small, incremental storage projects, such as improved gravel pits, to increase firm yields with additional carryover of average and wet year supplies.

Supplies from Growth onto Irrigated Lands

- Better Future calculations of irrigated acreage that will be developed utilize Better Future population projections that are lower than Harvey population estimates. The resulting smaller growth footprint means less water is transferred (from growth onto irrigated lands) than would occur for larger populations.
- Current NISP participant population density is much lower than the 5 people per acre assumed in Better Future calculations. Less dense development would result in a larger growth footprint and more water transferred.
- The Better Future Alternative assumes 1 AF/acre of firm yield from growth on surface-water-irrigated lands and then assumes that water is transferred from only 75% of this land (to account for uncertainty and the complexities associated with changing irrigation water to municipal use), in effect resulting in a low 0.75 AF/acre of firm yield.
- Additional opportunities exist if water used historically for irrigation continues to be used for outdoor irrigation on the same parcel. The full historic yield, rather than just the consumptive use portion, potentially could be utilized. These opportunities were not evaluated in the Better Future Alternative.
- No parcels irrigated by groundwater or a combination of groundwater and surface water were included in our geographical information system (GIS) analysis of the percentage of irrigated acreage in the growth area, though some of this water may be transferred.
- By using the water-supply-limited, non-CBT portion of consumptive use, a Better Future assumes that little or no CBT water is transferred or acquired.
- Many NISP participants have requirements that developers provide sufficient water supplies for new development, including dedication of CBT water in some cases (see sidebar on page 25). The Better Future Alternative includes only the consumptive use portion of water that would be transferred directly from parcels where growth occurs that were previously irrigated by surface water. Additional water dedications required by towns were not included in Better Future supplies.
- The consumptive use portion of transferred agricultural water would be reusable. No reuse of these supplies is included in Better Future calculations.

Conservation

- Only 60% of active high conservation strategy savings were applied to meet future demands, while 40% is retained (not included in the Better Future Alternative portfolio) for assumed use to improve system reliability and provide for drought response.
- Conservation savings were applied to current baseline per capita use rates, though these are skewed higher by several very large water users, including dairies, food processors, and power generation facilities. As residential populations grow, these customers will account for a smaller percentage of total water use, decreasing per capita use rates. A Better Future did not adjust for this and instead worked off the higher rates. (Note this safety factor was also discussed under “Baseline Demands.” Here we discuss the relationship to active savings.)
- Conservation savings were based on the SWSI South Platte Basin assumed percentage reduction in per capita use (38.3%) by 2050 rather than SWSI’s high conservation scenario per capita use rate of 116 gpcd for 2050, which would result in lower demands. Table D-1 in Appendix D shows that when losses are added in to be comparable to SWSI data, the Better Future Alternative results in 2050 use of 122 gpcd, which is higher than SWSI’s 116 gpcd.
- Projected water charge percentages from the Harvey Report (applied to water deliveries) were maintained, though these could decrease over time as treating utilities charge a smaller percentage as volumes increase. Also, as their use increases, NISP participants, who currently pay water charges, may find that it is more cost-effective to treat their own water, which would eliminate water charges.
- The Harvey Report water loss percentage of 7% (applied to water deliveries) was maintained, though utilities will likely—and should—decrease water losses (as a percentage of deliveries) over the next 50 years.

Reuse

- The Better Future Alternative calculated reuse only for participants with 2,000 AF or more of existing reusable supplies yield. An additional 4,900 AF of existing reusable supplies (including WGFP) were not included in Better Future calculations for participants with supplies below the 2,000 AF threshold.
- Most reusable supplies can be used to extinction. A Better Future evaluated only first-time reuse.
- Though many new supplies acquired will be reusable, a Better Future does not include reuse from those supplies here. For example, agricultural water

transferred as a result of growth or via Ag-Urban cooperation will provide additional reuse opportunities not accounted for in the Better Future Alternative. Using the reuse assumptions discussed above, the 19,150 AF yield from growth onto irrigated lands has the potential for over 8,600 AF of first-time reuse.

- A Better Future includes 1,300 AF of Erie reuse per Erie's nonpotable master plan. The state's Water Supply Future Portfolio and Trade-off Tool* includes much more reuse by Erie, ranging from 3,700 to 4,300 AF. A Better Future relies on the lower estimates from Erie's planning documents rather than the higher state estimate.

Cost Analysis

- NISP participants will have additional demands beyond 2030 that are not met by NISP, which will require investment on the part of participants. These costs are not included in our analysis but are critical to consider when comparing NISP and the Better Future Alternative.
- Only the Better Future includes costs associated with water transferred from growth onto irrigated lands, though this water will most likely be transferred to NISP participants under both NISP and Better Future scenarios.
- Reuse unit cost assumptions are based on an expensive indirect use project with many miles of pipelines, pumping, and water treatment to provide for potable use. NISP participant reuse would likely be much less expensive, being more localized and possibly being used primarily to meet nonpotable demands.
- The Better Future Alternative incurs all active conservation costs between the SWSI low and high conservation strategies even though NISP participant water conservation plans may already exceed low strategy programs and measures.

* Colorado Department of Natural Resources, Colorado Water Conservation Board. 2010. "Colorado's Water Supply Future Portfolio and Trade-off Tool." Available at <http://cwb.state.co.us/technical-resources/portfolio-tool/Pages/main.aspx>.

Appendix B: Better Future Alternative Population Projections and Baseline Demands

Population Projections

The Better Future Alternative is based on Colorado State Demography Office (SDO) county population estimates[†] through 2040 (the last year for which state projections are available) and Harvey Report growth rates from 2041 through 2060.

[†] Population forecasts **are not** available for municipalities. Forecasts are available for counties and sub-state regions only.

TABLE B-1 ANNUAL GROWTH RATES FOR NISP PARTICIPANTS CALCULATED FROM FIVE-YEAR DATA.

Year	Better Future	Harvey Report		State Demography Office Annual Growth Rate for Period ^a				
	Growth Rate (annual % increase)	Population	Growth Rate (annual % increase)	Boulder County	Larimer County	Morgan County	Weld County	Weighted NISP SDO Growth Rate
A	B	C	D	E	F	G	H	I
Est. % 2009 Population	—	—	—	22%	14%	9%	55%	—
2009	—	204,285	—	—	—	—	—	—
2010	1.51	211,404	3.48	0.6	1.1	0.6	2.1	1.51
2015	1.85	244,445	2.95	1.1	1.6	1.1	2.3	1.85
2020	2.36	281,746	2.88	1.2	2.0	1.6	3.0	2.36
2025	2.43	322,743	2.75	1.1	1.9	1.8	3.2	2.43
2030	2.17	365,661	2.53	0.9	1.6	1.7	2.9	2.17
2035	1.92	404,864	2.06	0.7	1.4	1.7	2.6	1.92
2040	1.71	435,559	1.47	0.6	1.2	1.6	2.3	1.71
2045	1.28	464,078	1.28	—	—	—	—	—
2050	1.35	496,296	1.35	—	—	—	—	—
2055	1.45	533,285	1.45	—	—	—	—	—
2060	1.54	575,639	1.54	—	—	—	—	—

^a Source for county data: Colorado Department of Local Affairs, State Demography Office. 2011. "Population Totals for Colorado Counties." Updated September. <http://www.colorado.gov/cs/Satellite?c=Page&childpagename=DOLA-Main%2FCBONLayout&cid=1251593346867&pagename=CBONWrapper>.

TABLE B-2 NISP PARTICIPANT POPULATION PROJECTIONS.

Year	Harvey Report Population	Better Future Population	Change in Population From Harvey Report
A	B	C	D
2009	204,285	204,285	0
2010	211,404	207,363	-4,041
2015	244,445	227,255	-17,190
2020	281,746	255,379	-26,367
2025	322,743	287,958	-34,785
2030	365,661	320,576	-45,085
2035	404,864	352,483	-52,381
2040	435,559	383,648	-51,911
2045	464,078	408,768	-55,310
2050	496,296	437,147	-59,149
2055	533,285	469,727	-63,558
2060	575,639	507,033	-68,606

Table B-1 compares the average annual assumed growth rate for NISP participants in the Harvey Report (column D) with State Demography Office projected growth rates for NISP participant counties (columns E, F, G, and H). Harvey Report growth rates (column D) were calculated by WRA based on population data for individual NISP participants provided in Harvey Report appendices. WRA summed these data to total annual NISP population projections (column C) and calculated the annual growth rate (column D). Better Future growth rates (column B) are weighted SDO rates (column I) through 2040 and Harvey Report rates after that. Weighted NISP SDO growth rates (column I) were developed by multiplying SDO county projections (columns E through H) by the estimated percentage of 2009 NISP population in each county from the “Est. % 2009 Population” row (when a NISP participant serves more than one county, the population was assumed to be evenly distributed among those counties).

Table B-2 shows the Better Future Alternative population projections as compared to Harvey Report projections.

Baseline Demands

Table B-3 shows NISP historical populations, water deliveries, and average per capita usage calculated by WRA using data provided in the Harvey Report appendices. Harvey Report demand projections are based on unsupported rates that are higher than recent historical usage (Table B-4, column B). Recent average (2004–2009) use was 185 gpcd. This is the assumed baseline used in the Better Future Alternative. A Better Future then adjusts baseline demands to incorporate passive water conservation from 2010 through 2050 according to SWSI percentage saving (10.2% savings) estimates. The per capita usage rate (Table B-4, column F) was then held constant from 2050 to 2060 since no additional savings are estimated by SWSI for this period.

SWSI projects South Platte Basin municipal and industrial passive savings ranging from 6.0% to 10.2% in the South Platte Basin by 2050.* The Better Future Alternative applies passive conservation savings of 10.2%,† which results in a 2050 through 2060 per capita use rate of 166 gpcd (Table B-4). Better Future annual deliveries were calculated by applying baseline per capita use rates to Better Future population projections. The projected percentage water charges and losses in the Harvey Report analysis (Table B-4, column E) ranged from 13% to 15%. The Better Future Alternative assumes the same annual rates for charges and losses. Better Future total water requirements (Column I) were calculated by applying Harvey Report loss and water charge percentages to annual deliveries.

TABLE B-3 HISTORICAL WATER USE AND POPULATIONS FOR NISP PARTICIPANTS FROM HARVEY REPORT DATA.^A

Year	Population	Water Deliveries (AF)	Average Per Person Use (gpcd)
A	B	C	D
1999	121,362	27,411	202
2000	130,332	33,612	230
2001	141,407	35,236	222
2002	150,211	34,522	205
2003	159,542	31,930	179
2004	170,558	34,458	180
2005	184,394	37,424	181
2006	192,344	43,156	200
2007	195,723	43,198	197
2008	200,213	42,108	188
2009	204,285	37,852	165
2004–2009 Average			185

^a Annual totals and per capita data calculated by Western Resource Advocates using individual NISP participant data provided in Harvey Report, Appendices A through O.

* Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. "Appendix L: SWSI 2010 Municipal and Industrial Water Conservation Strategies," prepared by Aquacraft, Inc. and Headwaters Corporation, January 2011. In *Colorado's Water Supply Future, Statewide Water Supply Initiative 2010, Final Report*. January.

† The higher end of the SWSI passive savings range was used because the Better Future Alternative projects that NISP participant populations will increase by nearly 150% from 2009 to 2060. As a result, the majority of homes and businesses will be new and so will use less water as a result of passive conservation. Additionally, because of the long 50-year Better Future planning period, many existing home will have to replace less efficient fixtures and appliances.

TABLE B-4 BETTER FUTURE ALTERNATIVE BASELINE PER CAPITA USE, WATER DELIVERIES, AND TOTAL WATER REQUIREMENTS COMPARED TO THOSE FROM THE HARVEY REPORT.

Year	Harvey Report ^a				Better Future Alternative			
	Per Capita Use (gpcd)	Water Deliveries (AF)	Total Water Requirements (AF)	Annual Loss and Water Charges ^b (% of Water Deliveries)	Baseline Per Capita Use (gpcd)	Population	Water Deliveries ^c (AF)	Total Water Requirements ^d (AF)
A	B	C	D	E	F	G	H	I
2009	165	37,852	42,786	13%	NA	204,285	–	–
2010	193	45,820	51,900	13%	185	207,363	43,051	48,764
2015	203	55,480	63,300	14%	183	227,255	46,579	53,145
2020	208	65,490	74,800	14%	181	255,379	51,668	59,013
2025	211	76,310	86,800	14%	178	287,958	57,497	65,401
2030	212	86,770	99,000	14%	176	320,576	63,161	72,064
2035	209	94,640	108,300	14%	174	352,483	68,515	78,404
2040	205	100,260	114,700	14%	171	383,648	73,557	84,151
2045	202	105,180	120,400	14%	169	408,768	77,291	88,475
2050	199	110,880	127,400	15%	166	437,147	81,500	93,642
2055	196	117,160	134,800	15%	166	469,727	87,574	100,759
2060	193	124,250	143,400	15%	166	507,033	94,529	109,098
2010 to 2060 % change	0.4%				-10.2%	–	–	–

a WRA calculations based on data in Harvey Report, Appendices A through O.

b Calculated as the difference between total water requirements (column D) and water deliveries (column C) divided by water deliveries (column C).

c Water deliveries calculated by applying Better Future baseline per capita use (column F) by Better Future population projections (column G).

d Total water requirements calculated by multiplying Better Future water deliveries (column H) by Harvey Report annual loss and water charge percentage for that year (column E) and adding that to water deliveries (column H).

Appendix C: Better Future Alternative Growth onto Irrigated Lands

The Better Future Alternative includes supplies transferred from direct growth by NISP communities onto lands that were previously irrigated. This differs from the Harvey Report, which didn't include any water from this source, though such transfers frequently occur. A Better Future projects the total NISP population to increase, from 2009, by approximately 116,300 by 2030 and 302,750 people by 2060. Assuming new development will be relatively dense at 5 people per acre, which is higher than current population densities for the NISP participants (see Table 1, main report body), results in an estimated 60,550 acres being developed. This is a significantly smaller footprint than what would result if current densities were used in estimates.

The volume of water available to be transferred is site- and situation-specific. The Better Future Alternative relies, in part, on data presented in the NISP No Action Alternative* (NAA) and SWSI. The NAA documents the average supply-limited consumptive use (CU) per acre for the several South Platte River sub-basins. The average supply-limited CU for all basins was 1.12 AF/acre (NAA, Table 5). For the NAA, supply-limited consumptive use for specific ditches selected for the alternative was then further adjusted to remove CU resulting from Colorado-Big Thompson deliveries (NAA, Table 6). This was done because CBT water isn't tied to specific parcels as other water rights are so can be moved around. As a result, CBT water is very desirable and may or may not be available for transfer to NISP participants. For the Poudre Basin, the NAA assumed the average transferable CU was 0.70 AF/acre. For the South Platte Basin, the NAA assumed the average transferable CU was 1.13 AF/acre.† SWSI 2010 data shows an average South Platte Basin water supply limited CU of 1.34 AF/acre.‡ Based upon the NAA and SWSI data, a Better Future assumes an average water supply limited transferable CU of 1.0 AF/acre.

Using irrigated crop data layers (2005) from Colorado's Decision Support System, WRA estimates that, on average, 42% of land surrounding NISP communities where growth would occur is currently agricultural land that is irrigated by surface water. This results in growth by NISP communities onto

* MWH. 2010. *Northern Integrated Supply Project No Action Alternative*. Prepared for Northern Colorado Water Conservancy District. April.

† Note that the NAA Table 6 incorrectly lists the South Platte average as 0.77 AF/acre. Calculations erroneously did not include Farmers Independent Ditch. When this ditch is included, the South Platte average is 1.13 AF/acre.

‡ Calculated by WRA using data provided in SWSI 2010 (Table 4-12): 1,117,000 AF water supply limited CU divided by 831,000 acres.

25,534 surface water irrigated acres (42% of 60,550 developed acres is 25,534 acres). WRA's analysis did not include parcels irrigated by groundwater or parcels where both groundwater and surface water are applied. Additionally, the Better Future Alternative further limits water from this source by assuming that only 75% of the water historically used for agriculture is transferred, resulting in 7,356 AF in 2030 and 19,150 AF by 2060 (Table C-1).

TABLE C-1 WATER SUPPLIES FROM NISP PARTICIPANT GROWTH ONTO IRRIGATED LANDS.

Year	Better Future Cumulative Increase in Population	Cumulative Developed Land ^a (acres)	Traditional Ag Transfers from Developed Lands ^b (AF)
A	B	C	D
2009	–	–	–
2010	3,078	616	195
2015	22,970	4,594	1,453
2020	51,094	10,219	3,232
2025	83,673	16,735	5,293
2030	116,291	23,258	7,356
2035	148,198	29,640	9,374
2040	179,363	35,873	11,345
2045	204,483	40,897	12,934
2050	232,862	46,572	14,729
2055	265,442	53,088	16,790
2060	302,748	60,550	19,150

a Calculated by dividing cumulative change in population (column B) by the assumed density of 5 people per acre.

b Calculated by multiplying developed acreage (column C) by average surface-water-irrigated percentage of 42.2%, and then applying 1.0 AF for each acre and multiplying that by the 75% assumed transfer rate.

Appendix D: Better Future Alternative Active Conservation

Better Future passive conservation savings are accounted for in baseline demand projections. Active conservation will result in additional savings. SWSI* includes high, medium, and low conservation strategies, which include both passive and active conservation savings (Table D-2). The Better Future Alternative assumes high conservation savings will be achieved by 2050, over a 40-year period. A Better Future applies 60% of active conservation savings to future demands and reserves the remaining 40% for drought response and system reliability.

SWSI's high conservation strategy is projected to decrease water use from 188 gpcd to 116 gpcd in 2050 in the South Platte Basin, a savings of 38.3% (Table D-1). Because the 38.3% savings also includes passive savings of 10.2% (already accounted for in Better Future baseline demands), a Better Future assumes active conservation savings equalling 28.1%. Applying passive and active conservation to Better Future historical use of 185 gpcd results in 2050 per capita use of 114 gpcd. SWSI estimates include system losses of 7%, which are comparable to the 7% system loss assumed in the Harvey Report, Table II-3, and the Better Future Alternative.

To compare Better Future per capita use rates with the SWSI data, losses must be included. When 7% system loss is added to the Better Future Alternative, recent average historical use increases from 185 gpcd (based on water deliveries) to 198 gpcd (water deliveries plus system losses), and 2050 use—with passive and active conservation—increases from 114 to 122 gpcd. Resulting Better Future rates are higher than SWSI high conservation strategy use rates.

TABLE D-1 SWSI AND BETTER FUTURE ALTERNATIVE PER PERSON WATER USE ASSUMPTIONS.

	SWSI	Better Future
Historical use including system loss	188 gpcd ^a	198 gpcd
Historical use without system loss	---	185 gpcd
2050 use with conservation and system loss	116 gpcd ^a	122 gpcd
Percent conservation savings	38.3% ^b	38.3%
2050 use not including system loss	108 gpcd ^b	114 gpcd
System loss	7% ^a	7%

^a Data from Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. Tables 8 and 16 of "Appendix L: SWSI 2010 Municipal and Industrial Water Conservation Strategies," prepared by Aquacraft, Inc. and Headwaters Corporation, January 2011. In *Colorado's Water Supply Future, Statewide Water Supply Initiative 2010, Final Report*. January.

^b Data calculated by WRA based on data from the same tables in the source listed above.

* Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. "Appendix L: SWSI 2010 Municipal and Industrial Water Conservation Strategies," prepared by Aquacraft, Inc. and Headwaters Corporation, January 2011. In *Colorado's Water Supply Future, Statewide Water Supply Initiative 2010, Final Report*. January.

TABLE

D-2

ASSUMED IMPLEMENTATION AND PENETRATION LEVELS (BY 2050) FOR THE THREE SWSI CONSERVATION STRATEGIES.*

Measure	Implementation or Penetration Level by 2050		
	Low Strategy	Medium Strategy	High Strategy
System-wide conservation measures with potential to impact all customers			
• Public information and education	~100%	~100%	~100%
• Integrated resources planning	~100%	~100%	~100%
• Conservation-oriented water rates	~100%	~100%	~100%
• Water budget-based water rates	<=10% of utilities implement	<=30% of utilities implement	<=50% of utilities implement
• Conservation-oriented tap fees	0-5% of utilities implement	5-10% of utilities implement	<=50% of utilities implement
• Smart metering with leak detection	<=10% of pop.	<=50% of pop.	50-100% of pop.
Residential indoor savings and measures			
Reduction in Residential Per Capita Indoor Use	Res. Indoor gpcd = 40	Res. Indoor gpcd = 35	Res. Indoor gpcd = 30
• Conservation-oriented plumbing and building codes, green building, rules for new residential construction	30-50% of state impacted	50-70% of state impacted	70-100% of state impacted
• High efficiency toilets, clothes washers, faucets, and showers	Passive ~100%	Passive ~100%	Passive ~100%
• Submetering of new multi-family housing	0%	~50%	~100%
• Reduction in customer side leakage	33% savings - passive from toilet replacement	37% savings - passive from toilet replacement and active repairs	43% savings - passive from toilet replacement and active repairs
Non-residential indoor savings and measures			
Reduction in Non-Residential Per Capita Indoor Use	15% reduction	25% reduction	30% reduction
• High efficiency toilets, urinals, clothes washers, faucets, and CII equipment	Passive ~100%	Passive ~100%	Passive ~100%
• Conservation-oriented plumbing and building codes, green building, rules for new non-residential construction	30-50% of state impacted	50-70% of state impacted	70-100% of state impacted
• Specialized non-residential surveys, audits, and equipment efficiency improvements	0-10% of utilities implement	10-50% of utilities implement	50-80% of utilities implement
Landscape conservation savings and measures†			
Landscape water use reductions (residential and non-residential)	15% reduction	22-25% reduction	27-35% reduction
• Targeted audits for high demand landscape customers	0-30% of utilities implement	30-50% of utilities implement	50-80% of utilities implement
• Landscape transformation of some high water requirement turf to low water requirement plantings	<=20% of landscapes	20-40% of landscapes	>50% of landscapes
• Irrigation efficiency improvements	<=10% of landscapes	<=50% of landscapes	50-100% of landscapes
Utility water loss control			
• Improved utility water loss control measures	<=7% real losses	<=6% real losses	<6% real losses

* Colorado Department of Natural Resources, Colorado Water Conservation Board. 2011. "Appendix L: SWSI 2010 Municipal and Industrial Water Conservation Strategies," prepared by Aquacraft, Inc. and Headwaters Corporation, January 2011. In *Colorado's Water Supply Future, Statewide Water Supply Initiative 2010, Final Report*. January.

† Landscape water demand reductions include the anticipated impact of urban densification.

The Better Future Alternative assumes that only 60% of active conservation savings are applied to meet future demands. Active conservation, phased in over time, results in applied (60% of total) savings of 6,401 AF in 2030 and 20,482 AF in 2060 (Table D-3). These savings include decreases in water charges.

TABLE D-3 PASSIVE AND ACTIVE CONSERVATION SAVINGS AND RESULTING DECREASES IN WATER CHARGES.

Year	Better Future Population	Per Capita Use with Passive and Active Conservation ^a (gpcd)	Water Deliveries ^b (AF)	Annual Loss and Water Charges ^c	Water Requirements ^d (AF)	Baseline Water Requirements ^e (AF)	Active Savings ^f (AF)	60% Active Savings Applied ^g (AF)
A	B	C	D	E	F	G	H	I
2010	207,363	185	43,051	13%	48,764	48,764	0	0
2015	227,255	176	44,922	14%	51,254	53,145	1,891	1,134
2020	255,379	168	47,943	14%	54,759	59,013	4,254	2,552
2025	287,958	159	51,198	14%	58,236	65,401	7,165	4,299
2030	320,576	150	53,811	14%	61,395	72,064	10,668	6,401
2035	352,483	141	55,663	14%	63,698	78,404	14,706	8,824
2040	383,648	132	56,772	14%	64,948	84,151	19,202	11,521
2045	408,768	123	56,426	14%	64,592	88,475	23,884	14,330
2050	437,147	114	55,999	15%	64,342	93,642	29,300	17,580
2055	469,727	114	60,173	15%	69,232	100,759	31,527	18,916
2060	507,033	114	64,952	15%	74,962	109,098	34,136	20,482

a Applies SWSI 38.3% savings by 2050 to historical use rate of 185 gpcd for NISP participants.

b Deliveries were calculated by applying per capita use rate (column C) to Better Future population (column B).

c Harvey Report annual percentage loss and water charges were calculated by WRA using data in Harvey Report, Appendices A through O.

d Calculated by applying loss and water charge percentage (column E) to deliveries (column D). These are water requirements with passive and active conservation savings applied.

e From Table B-4, column I. These are water requirements with only passive conservation savings applied.

f Difference between baseline water requirements (column G) and requirements after active conservation savings (column F).

g 60% of savings from active conservation applied to the Better Future Alternative to meet future demands; 40% retained as a buffer (not included in Better Future supplies) for drought protection and to improve system reliability.

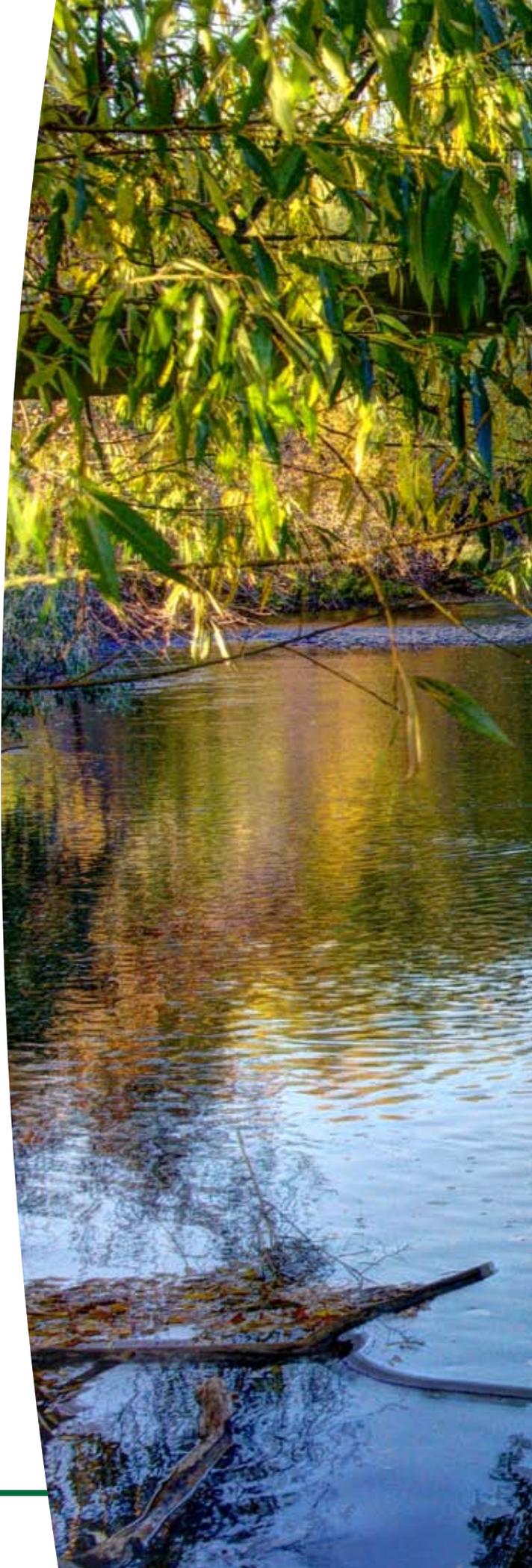
Appendix E: Better Future Alternative Summary of Supplies and Demands

Table E-1 summarizes all Better Future demands and supplies for the 2010 to 2060 planning period. A supply surplus exists in every year, without (column H) and with (column J) the Windy Gap Firming Project.

TABLE E-1 SUMMARY OF BETTER FUTURE SUPPLIES AND DEMANDS.

Year	Better Future Alternative (AF)									Additional Supplies Not Included in Better Future Yields (AF)	
	Total Water Requirements	Existing Supplies	Growth onto Irrigated Lands	Active Conservation (60% applied)	Reuse	Ag-Urban Cooperation	Supply Surplus without WGFP (AF)	Conditional WGFP (Initial Use and Reuse)	Supply Surplus with WGFP (AF)	Average Year Existing Supplies in Excess of Firm Yield ^a	Reserved (40%) Active Conservation Savings
A	B	C	D	E	F	G	H	I	J	K	L
2010	48,764	59,870	195	0	0	0	11,301	0	11,301	22,469	0
2015	53,145	59,870	1,453	1,134	1,479	0	10,792	0	10,792	22,469	756
2020	59,013	59,870	3,232	2,552	2,621	0	9,262	4,390	13,652	22,469	1,702
2025	65,401	60,550	5,293	4,299	3,763	2,500	11,004	4,949	15,953	22,469	2,866
2030	72,064	60,550	7,356	6,401	4,905	5,000	12,148	5,509	17,657	22,469	4,267
2035	78,404	60,550	9,374	8,824	4,905	7,500	12,749	5,509	18,258	22,469	5,882
2040	84,151	60,550	11,345	11,521	4,905	10,000	14,171	5,509	19,680	22,469	7,681
2045	88,475	60,550	12,934	14,330	4,905	10,000	14,244	5,509	19,753	22,469	9,554
2050	93,642	60,550	14,729	17,580	4,905	10,000	14,122	5,509	19,631	22,469	11,720
2055	100,759	60,550	16,790	18,916	4,905	10,000	10,402	5,509	15,911	22,469	12,611
2060	109,098	60,550	19,150	20,482	4,905	10,000	5,988	5,509	11,497	22,469	13,654

^a Additional supplies identified in the Harvey Report that are available in average and wet years.





“ This report needs to be read by every decision maker interested in Northern Colorado water supply planning. The report examines basic population and water use assumptions and demonstrates how those assumptions affect future projected firm water supply needs. Better Future alternatives are presented and analyzed. The report is a must read. ”

—Gerry Horak, Fort Collins City Councilmember



WESTERN RESOURCE
ADVOCATES