# *Integrated Water Resources Plan*

# *Recommendations of the Technical Advisory Committee to the Bozeman City Commission*

# *September 30, 2013*

**Executive Summary**

In 2012-2013 the City of Bozeman developed an *Integrated Water Resources Plan* to guide its water supply and water use policy and practices for the next 50 years. As part of the planning process a Technical Advisory Committee (TAC) of local water experts was engaged. The TAC participated in evaluating a broad range of possible water-supply and water-use alternatives. The TAC concurs with the recommendations set forth in the *Plan* and recommends additional measures. A vigorous water conservation program should be the cornerstone of Bozeman's water management. In this regard, the city should take the following steps: continue to make the distribution system more efficient, enact policies to encourage landscape irrigation using non-potable water, institute code revisions and otherwise encourage water-use efficiency in new development. Bozeman should work to acquire additional water rights in Hyalite Reservoir and senior rights in Hyalite and Sourdough Creeks. Over the next 5-10 years, the city should conduct detailed studies to define the costs, legal requirements, and engineering feasibility of optimizing the Lyman Creek water source, creating one or more impoundments in Sourdough Canyon, raising Hyalite Dam a second time, developing a new well field in the Gallatin Valley, and acquiring new water from the Salar Project near Gallatin Gateway. These new water supplies should be phased-in as needed, in the order established by a multiple-criteria screening exercise such as that conducted in this planning project. It is also essential that the city periodically review and update the water resources plan, and commit the funds necessary to better understand its water sources and to mitigate water-system operational difficulties.

**Background**

These recommendations are part of an integrated planning process for water resources that was undertaken in Spring, 2012. This process is the latest in a series of actions taken by our growing community to balance water supply and demand. Notably, in the past 15 years the city has substantially upgraded and enlarged both its water and wastewater handling facilities, examined water conservation as a way to harmonize supply and demand, initiated an aggressive program to repair leaks and replace old water-distribution lines, and studied the potential for constructing a new impoundment in the canyon of Sourdough Creek.

The planning process that was just completed is well-described in the *Integrated Water Resources Plan*, dated August 2013, prepared by the firms AE2S and CH2MHill under contract to the city. Its broad purpose has been to project the city's water demand decades into the future, examine an exhaustive array of means to meet the demand - both sources of supply and water-use practices - and recommend the most promising

measures for further study and potentially for implementation. The planning process has been carried out by city staff and contractors with expertise in hydrology, climate science, water-supply engineering and Montana water law (hereinafter referred to as "the consultants"). This "Technical Advisory Committee," chartered in April 2012 by the City Commission, has participated in every stage of the process. As described in the resolution creating it (Appendix A), the twofold role of the TAC has been to bring local expertise into the planning process and to incorporate interests of key stakeholder groups. To do this, the Commission named to the TAC local experts in water resources, water use, and water law, as well as key agency personnel (Appendix B).

The TAC convened in eight public meetings between June 2012 and August 2013, including six meetings with the city's consultants (see table below). There are two products of its work: specific measures and approaches that were incorporated into the technical analysis reported in the *Water Resources Plan,* and several additional recommendations to the Bozeman City Commission, described below.

| Technical Advisory Committee Meetings | |
|---|---|
| **Date** | **Major Topics** |
| June 6, 2012 | Procedural actions; review background information; review general types of alternatives and authorize alternatives screening approach |
| July 5, 2012 | Finalize TAC mission statement and process; define alternatives screening criteria and weights; discuss background assumptions |
| August 3, 2013 | Adoption of ranking criteria; discussion of water conservation |
| December 6, 2012 | Conservation planning; water rights management; alternatives refinement |
| January 11, 2013 | Contents and evaluation of conservation alternatives; integrated utilities alternatives situation |
| March 1, 2013 | Alternatives ranking and selection for portfolio analysis |
| May 23, 2013 | Consultant presentation and TAC discussion of portfolio results |
| August 16, 2013 | Review of city public-involvement plan; formulation of recommendations to Commission |

**TAC Perspective**

The TAC strongly commends the Bozeman City Commission and city staff for undertaking this comprehensive planning process before a crisis impends, taking stakeholder concerns into account. We are satisfied that a full range of potential water sources has been examined and the best available science has been applied. We have seen the TAC's input incorporated into the plan at every stage, including the shaping of the alternatives-analysis procedure. This long-term, large-scale planning exercise has set the stage for the detailed future examination of specific measures to secure the city's water. Should the *Water Resources Plan* and the TAC's supplementary recommendations be adopted, the Commission and the citizens of Bozeman can be confident that its water-management policies and practices will serve the city well for decades to come.

Early in the planning process the consultants, in consultation with the TAC, developed twenty-five potential measures ("alternatives") that could be applied to reconcile Bozeman's water supply and demand (see Table 5-1 of the *Water Resources Plan*). The alternatives ranged from aggressive water conservation by residents, to re-use of reclaimed wastewater, to importing water from distant locations. A vital role of the TAC

was to rank the alternatives with regard to their priority for further analysis (and hence, potential implementation). We did this by elaborating a set of evaluation criteria first developed by the consultants. The 30 criteria and the relative weights assigned to them by the TAC are attached as Appendix C; the criteria descriptors comprise Appendix D.

| CATEGORIES OF EVALUATION CRITERIA | WEIGHT (%) |
|---|---|
| Technical criteria | 18 |
| Environmental criteria | 28 |
| Social criteria | 13 |
| Economic criteria | 19 |
| Water supply criteria | 22 |
| **TOTAL** | **100** |

The ranking criteria and their relative weights were the lens that focused this planning process according to our community's values. Among the five types of criteria, environmental factors collectively were scored highest by the TAC. These included factors like energy use (conveying water to the treatment plant via gravity vs pumping using fossil fuels), disruption to aquatic environments, and resilience to climate change. Water-supply factors - the reliability and proximity of the source, its vulnerability to contamination, its quality - were judged next-most-important by the TAC. Alternatives were evaluated on the basis of five economic criteria and six social criteria such as quality-of-life impacts, maintenance of irrigated agriculture, and likely customer satisfaction. Alternatives were also assessed according to technical criteria such as compatibility with existing infrastructure and ability to meet water-supply targets. "Redundancy" was judged an important consideration. A redundant water supply has multiple sources, such that it is resilient to catastrophe. For example, an earthquake that renders Bozeman's Hyalite water source unusable would also likely deprive the city of its Sourdough Creek supply - but possibly not the Lyman Creek supply, which thus provides some degree of redundancy. The criteria are in conflict, to a degree. The same measure cannot both "maximize use of existing infrastructure" and bolster water supply redundancy. This shows how each alternative has both advantages and drawbacks.

**Recommendations**

To meet its 50-year water needs, the TAC recommends that the Bozeman City Commission formally adopt the *Integrated Water Resources Plan*. In particular, the TAC favors the plan's "Portfolio 14," augmented with additional measures. Beginning this year, the city should take the following actions:

- Initiate a water-conservation program, as specified in the FY 2014 budget recently adopted by the Commission. This should include conventional measures such as a consumer-education program and incentives for change-out of water-wasting fixtures, but also plans for piloting and monitoring less-conventional water-saving measures. Water conservation and water-use efficiency should be the bedrock of the city's water-resource management. These measures are cost-effective relative to developing new sources of supply, and hold important ancillary benefits such as environmental preservation and securing water for agriculture in the Gallatin Valley.

- Implement an ongoing effort to acquire additional shares in the Hyalite Reservoir from willing-seller shareholders. As they become available, the city should also seek to acquire flow rights in Hyalite and Sourdough Creeks with older priority dates. This water can be conveyed by gravity to the new water treatment plant, optimizing the city's very substantial investment there.

- Continue to take the legal actions needed to define, consolidate and make the best use of currently-held water rights.

- Continue and intensify current work to cut unaccounted-for water in the distribution system. The TAC recommends adopting an aggressive goal: less than 10% of produced water. Re-visiting past decisions regarding distribution-system pressure, which is very high by national standards, is recommended. This high pressure exacerbates all leaks, from the largest water mains to the smallest customer tap. Both the "moderate" and "high" conservation alternatives described in the *Water Resources Plan* rely on further cutting water losses from the distribution system.

In the intermediate term, the city should:

- Conduct a cost/engineering/legal feasibility study to define how it can optimize water production from the Lyman Creek source. The city holds a much larger water right there than it is currently able to use. This source could not, alone, make up the water shortfalls projected for the 30- and 50-year planning horizons.

- Work with developers to implement non-potable irrigation in new developments, as possible and appropriate. When lands annexed to the city come with appurtenant irrigation rights, those rights should be accepted and the water used for landscape irrigation, sparing capacity at Bozeman's advanced water treatment plant.

- Expand the conservation program to include the commercial and institutional sectors. The program should emphasize water-use efficiency in new developments, where significant savings may be realized. It should deploy an array of tools, ranging from educational campaigns, to incentive programs, to municipal-code updates.

In the longer term, the city should conduct the appropriate studies and then phase in, as needed, the measures below:

- Construct one or more impoundments on Sourdough Creek above the treatment plant. This would take advantage of the city's water rights and water reservation there, and conveyance to the treatment plant would be by gravity. Alternatively, it may be possible to slightly raise Hyalite Dam, or to raise the maximum-pool elevation behind the existing dam by changes to the intake structure. The city should explore these latter possibilities with water-project engineers and water-rights specialists from the Montana Department of Natural Resources & Conservation.

- Site and develop a new well field to supply the city. The Gallatin Valley has abundant groundwater (the use of which would have to be mitigated with existing

water rights). Groundwater has major advantages: it is resilient to drought and impervious to wildfire, and requires less treatment than surface water.

- Work with the owners of the "Salar Project" to develop, on their property near Gallatin Gateway, either a well field or an impoundment drawing from two irrigation canals that originate in the West Gallatin River. These waters would principally be used untreated, for landscape irrigation within the western part of the city.

The TAC recommends against importing water from outside the Gallatin watershed, or far downstream, unless extraordinary circumstances render the approaches above inadequate. Cost, legal hurdles and environmental drawbacks would all be high for such long-range water transport. The only circumstance we can envision that might make this approach worth Bozeman's consideration would be high population growth throughout the Gallatin Valley, sustained for a long period (>5% for more than 10 years).

An important question arising from the development of the *Water Resources Plan* is the implementation schedule for the various recommended water-supply alternatives. An essential aspect of the recently-completed work was comprehensiveness: all measures that were even remotely feasible were screened. Consequently, the cost and engineering data developed for the many alternatives were necessarily very rough. Selecting which measures to undertake, when and in what order, hinges on developing much more detailed information. Therefore, the TAC urges the city to adopt the following practices:

- For the next 5-10 years, as needed, program into the city's capital budget funds for detailed definition of the costs, legal requirements and engineering feasibility of the major water-supply alternatives listed above: Lyman, Sourdough impoundment(s), Hyalite dam raise, a new well field, and the Salar project.

- When these alternatives are well-understood, devise the implementation schedule using the screening matrix developed for the *Water Resources Plan*, or update it with the assistance of a new TAC. This is a comprehensive and robust tool that applies the community's values to capital planning. Among the possible capital-construction projects, the TAC looks most favorably on optimizing the Lyman Creek water source.

While the City is pursuing the above measures, it also needs to conduct several ancillary activities:

- Engage the public in active review and comment on this process and the water-resource possibilities open to Bozeman.

- Develop a plan to address the "shrink factor" or "conveyance loss" of Hyalite Reservoir water. More water may be available to the city than is currently assumed.

- Instrument and monitor Lyman and Sourdough Creeks so that their hydrographs - and the reliable water yields of the watersheds - are better understood.

- Continue to work to mitigate operational difficulties, which were outside the scope of this exercise. TAC members have come to appreciate that having an adequate water supply on paper does not mean it is straightforward for operations staff to get that water into the water plant and the distribution network. If the challenges are clearly defined, Bozeman ratepayers will accept modest added water fees to, for example, update the cumbersome and wasteful operational protocol for the Hyalite dam.

- Assist MSU in its continuing work to optimize water-use efficiency on campus. For example, it may be possible for the city to convey unused water rights to MSU's Family & Graduate Housing, allowing it to cease irrigating its grounds with treated city water.

- Re-visit and update the *Water Resources Plan* every five years. This is especially critical in light of the extreme sensitivity of its analysis to the population growth rate. If growth turns out to be slower than the "moderate-growth" scenario from the plan, the city can delay some actions and save money. On the other hand, rapid growth must be accommodated by accelerating the acquisition of new water and intensifying conservation efforts. An effective conservation program will steadily bring down per-capita water demand over time, allowing the city to postpone major expenditures on new water supplies.

**Concluding Observations**

This initial effort has been comprehensive and robust, but water-resource activities must be ongoing. Assuring water security into the future will require sustained commitment from future commissions. This must involve not just directing city staff to re-visit plans and assumptions periodically, but committing adequate funds to engage technical consultants and to initiate new demand-side or supply-side water projects. Only a serious level of commitment over a long term will allow the *Water Resources Plan* to be brought to fruition.

Collectively and individually, the members of the TAC thank the Bozeman City Commission for the opportunity to participate in this interesting and vital process. We look forward to following the city's water-resource management in coming years. We are confident it can take place in a manner that provides adequate water for a vigorously-growing city while protecting resident quality of life and the wonderful natural environment we so cherish here.

Appendices

A. City Commission resolution creating the TAC
B. List of TAC members and affiliations
C. TAC criteria scoring matrix
D. Criteria descriptors