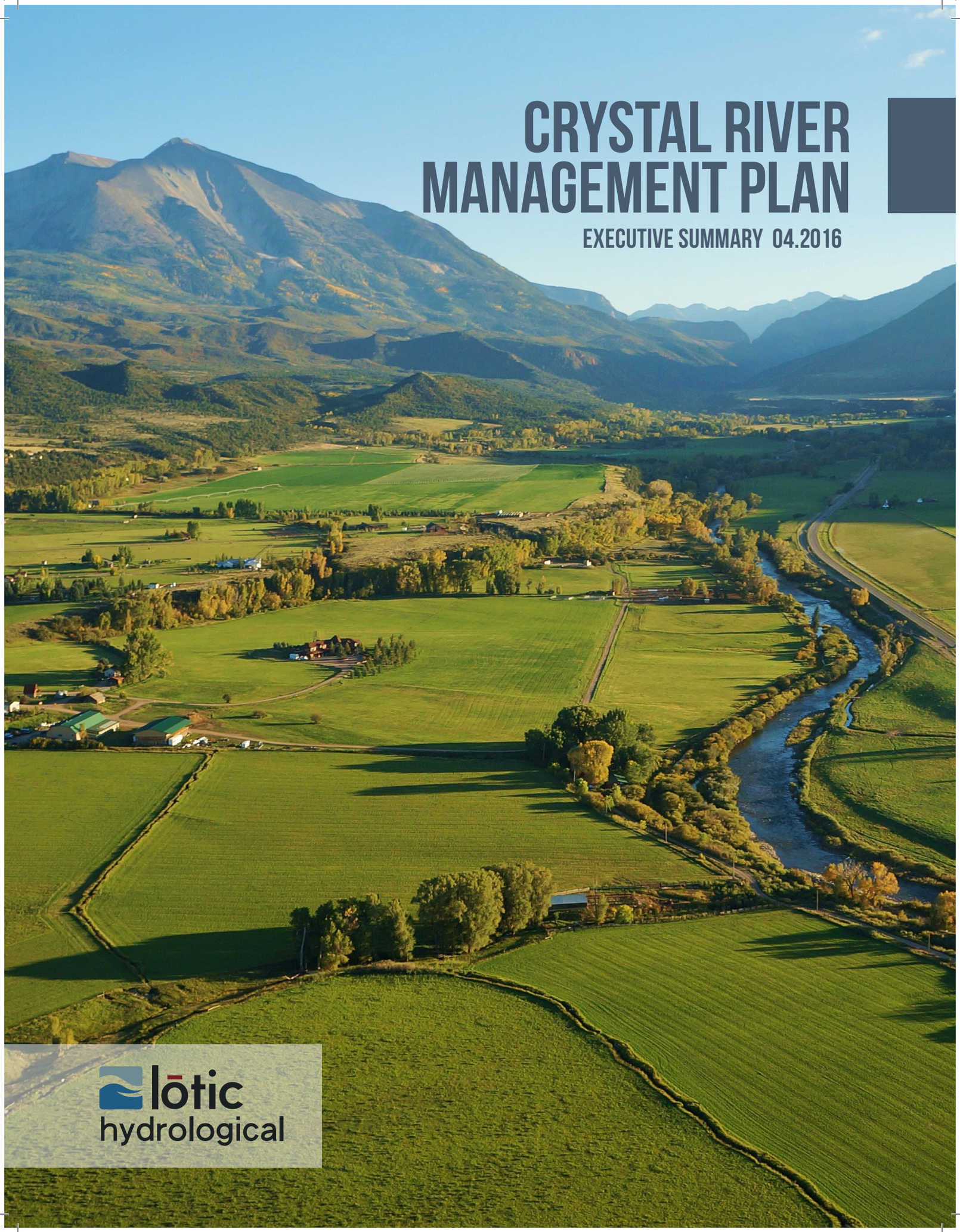

CRYSTAL RIVER MANAGEMENT PLAN

EXECUTIVE SUMMARY 04.2016

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CRYSTAL RIVER MANAGEMENT PLAN 2016

Identifying, prioritizing and guiding management actions that honor local agricultural production, preserve existing water uses, and enhance the ecological integrity of the river.

EXECUTIVE SUMMARY

Changing demographics and local economies place increasing value on the Crystal River's aesthetic, environmental and recreational attributes. At the same time, the community retains important cultural and economic ties to a strong agricultural heritage and ongoing agricultural production. Residents in the Town of Carbondale enjoy large shade trees, verdant gardens, and green parks and open spaces supported by a free raw-water supply sourced from the River. Agricultural producers, in turn, depend on use of the Crystal River to support their livelihoods and maintain vast open spaces terraced along the flanks of Mount Sopris and across the valley floor. The convergence of these diverse and sometimes competing demands with water scarcity on the Crystal River during periods of drought leads to demand shortages for some agricultural producers and impairment of various measures of ecosystem function.

Despite the challenges involved in managing water for multiple uses when resources are limited, diverse stakeholders continue to recognize the importance of balancing agricultural production and ecosystem function on the Crystal River. However, without comprehensive quantitative and social frameworks for understanding the costs and benefits associated with any proposed management alternative, uncertainty prevails and stakeholders default to the status quo. Planning around water needs on the Crystal River required development of a scientifically rigorous and consensus-based framework for predicting the ecological and social consequences of proposed projects or management strategies. The Crystal River Management Plan (the "Plan") utilized a science-based and stakeholder-centered approach to consider complex interactions between the physical components driving watershed structure; the biological components of riverine ecosystems; the social context of competing perspectives, needs, and values; and the existing legal and administrative frameworks governing water use in an effort to identify and evaluate management and structural alternatives that honor local agricultural heritage, preserve existing water uses, and enhance the ecological integrity of the river. A series of stakeholder meetings held throughout the planning process served to clarify outstanding questions, summarize results from previous studies, refine planning goals and objectives, and evaluate the feasibility of various management alternatives.

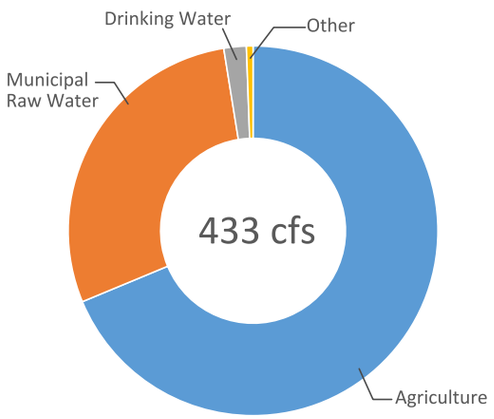
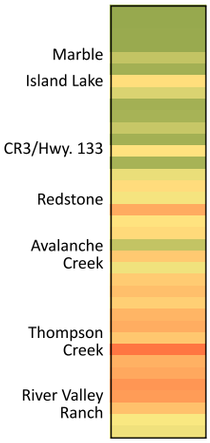


Figure ES-1: Agricultural and non-potable municipal water uses represent the dominant surface water diversions on the Crystal River

The functional assessments detailed in Section 2 conclude that few external stressors exist in the headwaters of the Crystal contributing to a generally healthy ecosystem above Redstone. Constraints on function increase in the downstream direction due to the cumulative effects of floodplain development and surface water diversions (Figure ES-1). The reaches of Crystal River between Thompson Creek and the confluence with the Roaring Fork exhibit the most degraded overall functional condition. This pattern most strongly reflects late summer modifications to the hydrological regime and cascading impacts on channel hydraulics, water temperature, habitat quality and availability, and biotic structure. The dominant nature of the impacts to streamflow and habitat suggest that management strategies that focus on these two variables will yield the greatest overall environmental benefit.

Characterizations of water management and use presented in Section 3 identified the prominent limiting circumstances for management of consumptive and non-consumptive use needs on the Crystal River. Legal and administrative frameworks governing the use of water on the Crystal River allocate water among multiple uses—agricultural production, municipal water use, operation of a fish hatchery, and a minimum instream flow right (Figure ES-2)—according to a seniority system that places the oldest existing uses ('senior rights') in priority over newer uses ('junior rights'). The convergence of water availability and water administration under the Prior Appropriation System creates both chronic and transient water shortages. Agricultural use shortages impact users on tributaries more significantly than on the mainstem of the Crystal River. The most persistent shortages on the Crystal River mainstem are the CWCB ISF right, and the junior water rights on the East Mesa Ditch, Sweet Jessup Canal, Helms Ditch, and Kaiser & Sievers Ditch. The presence of agricultural shortages highlights the difficulties associated with managing water to satisfy ecosystem needs without burdening existing water users.

The alternative management strategies detailed in Section 4 respond to the overlapping themes and management prospects that emerged from reviews of water use patterns, legal and administrative considerations, and evaluations of ecosystem function. The Plan considered the relative effectiveness of a wide array of market-based programs, efficiency measures, water supply projects, and channel modifications for meeting planning goals and



Grade	Score	Level of Impairment
A	90-100	Negligable
B	80-90	Mild
C	70-80	Significant
D	60-70	Severe
F	50-60	Profound/Unsustainable

Figure ES-2: Constraints on ecosystem function are greatest on the lower Crystal River where surface water diversions modify the hydrological regime and limit the quality and availability of aquatic habitat

objectives. Unfortunately, no single management option represented a panacea for meeting existing needs and addressing observed ecosystem impairments. Rather, each alternative was associated with a unique set of environmental, capital, and social costs and benefits. Section 5 presents the results of consideration of these factors by local stakeholders and a prioritization of management actions over the short and long-term. Stakeholders groups involved in the cost-benefit analysis process included: agricultural producers, State water administrators, local municipalities, natural resource agencies, local and national environmental organizations, recreational advocates, and other water rights holders.

The findings and recommendations presented in the various sections of the Plan are summarized below:

- Few external stressors exist in the headwaters of the Crystal contributing to a generally healthy ecosystem above Redstone.
- Constraints on ecosystem function slowly increase in the downstream direction due to the cumulative effects of floodplain development and surface water diversions.
- The reaches of the Crystal River between Thompson Creek and the confluence with the Roaring Fork exhibit the most degraded overall functional condition.
- Reductions in late summer baseflows produce cascading impacts on channel hydraulics, water temperature, and physical habitat quality and availability.
- Supply shortages on water-limited tributaries are common. Demand shortages on the Crystal River exist for the junior rights on the East Mesa Ditch, Sweet Jessup Canal, Helms Ditch, and Kaiser & Sievers Ditch. The CWCB ISF right is frequently short in late summer.
- Water efficiency upgrades (e.g. sprinkler irrigation and ditch lining) can significantly reduce the frequency and magnitude of demand shortages experienced by agricultural producers.
- The most feasible and effective management options for meeting planning goals include 1) Non-Diversion Agreements between the Sweet Jessup Canal and Carbondale Ditch, and 2) ditch lining and short term water leasing by the Town of Carbondale on the Carbondale Ditch and Weaver and Leonhardy Ditch.
- Non-Diversion Agreements of approximately 25 cfs in severe drought and 10-15 cfs during moderate drought will meet management goals for maintaining moderate risk to ecosystem function. Current conditions place the ecosystem at high risk for unfavorable change.
- Reaching management targets will require diversion reductions between 5-18% (depending on drought severity) between the Sweet Jessup Canal and the Carbondale Ditch.
- Stakeholders should continue to investigate the feasibility of stand-alone water efficiency infrastructure projects, off-channel reservoir development, and channel modifications to simultaneously promote ecosystem function and the long-term sustainability of local agricultural production.

Population growth trends indicate that the Town of Carbondale will experience a doubling in size in the coming decades. Projections from climate data indicate that climbing temperatures will shift the timing of snowmelt runoff and increase the frequency and severity of hot and dry summer conditions. These changes will place increasing strain on the riverine environment at the same time that demand shortages for existing uses become more common. Without tools and structured plans for responding to these challenges, tensions between stakeholders in the Crystal River watershed will continue to mount. This Plan recommends several high-priority actions for balancing water use needs. Implementation of these actions will equip the community with flexible tools to deal with shifting community values, economic diversification, and climate change in a manner that minimizes conflict between user groups and achieves high levels of environmental resiliency.

ACKNOWLEDGEMENTS

The Crystal River Management Plan (CRMP) evolved from years of planning, studies and assessments that underscored the need for further investigation into water use patterns, ecological health and associated impacts in order to justify and produce on-the-ground improvements. In 2013, equipped with knowledge of successes and shortcomings of prior efforts, Roaring Fork Conservancy, Public Counsel of the Rockies, and Lotic Hydrological, LLC (the "Project Team") met with water rights holders and water users, listening to concerns and soliciting ideas to enhance riparian and instream conditions in and along the Crystal River. Combining prior knowledge with community input created a strong foundation for the CRMP and brought together river science and community values. The long-term efficacy of the CRMP depends on continued participation and input by stakeholders whose knowledge and values inform the options for water management and river stewardship now and in the future.

The CRMP benefitted from the expertise and guidance of a diverse and passionate group of experts, stakeholders, and community members. CDR Associates worked closely with the team through the final stages of planning and stakeholder engagement. Colorado Water Trust provided invaluable expertise, thoughtful insights and creative water management ideas. A long list of individuals and organizations informed and advised the Project Team throughout the planning process:

Crystal River water rights holders and agricultural producers, including representatives from the Sweet Jessup Canal, East Mesa Ditch, Lowline Ditch, Ella Ditch, Helms Ditch, Pioneer Ditch, Bowles and Holland Ditch, Rockford Ditch, Carbondale Ditch, Weaver and Leonhardy Ditch, Kaiser and Sievers Ditch, and Southard and Cavanaugh Ditch; the Town of Carbondale; Trout Unlimited; Western Resource Advocates; Crystal Valley Environmental Protection Association; Pitkin County Open Space and Trails; American Rivers; United States Forest Services, Natural Resources Conservation Service, Colorado Parks and Wildlife, Jake DeWolfe and Kevin Rein (Colorado Division of Water Resources); Kara Steeland (University of Michigan); Sandra Ryan-Burkett (Rocky Mountain Research Station); Chris Treese (Colorado River District); Peter Nichols (Berg Hill Greenleaf & Ruscitti LLP); Mark Beardsley (EcoMetrics); Karin Boyd (Applied Geomorphology, Inc.); Scott Gillilan (Gillilan Associates); and the outstanding engineering staff at RiverRestoraton. Any omissions are regretted.

Finally, we appreciate the interest and investment of the following supporters who recognized the potential of this ambitious project and without whom none of this work would have been accomplished: Colorado Water Conservation Board and the Colorado Basin Roundtable, Gates Family Foundation, Dornick Foundation, and Environment Foundation of the Aspen Ski Company.

ROARING FORK WATERSHED PLAN at work

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