The Future of Instream Flows in Snowmass Creek

Prepared for the
Snowmass/Capitol Creek Caucus

September 2012

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List of Attachments

A: Build-out Map

B: Build-out Map (zoomed in)

C: Build-Out Map Legend Description and Assumptions

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1 Executive Summary

The Snowmass Capitol Creek Caucus ("Caucus") commissioned this AMEC study in order to assess, and to mitigate in collaboration with the Snowmass Water and Sanitation District ("District"), the impacts of future water demands upon healthy and sustainable flows in Snowmass Creek. For over thirty years, the Caucus has maintained an active interest in protecting Snowmass Creek, especially during critical low-flow months when municipal demands are high in the adjacent Brush Creek Basin where the Town of Snowmass Village and the Snowmass Ski Area depend almost exclusively on East Snowmass and Snowmass Creek water.

The Caucus is committed to securing flows necessary to meet the Colorado Water Conservation Board's biologically-based minimum "stair step" instream flow right in the Middle Reach of Snowmass Creek year-round. To this end, the Caucus has actively supported the District's development of Zeigler Reservoir as well as the District's very significant achievements in water loss control and water conservation in recent years.[1]

The Caucus likewise is committed to working cooperatively with the District to insure that wise water management practices are implemented and monitored in both the Brush Creek and Snowmass Creek basins since the users in each basin rely on one creek, Snowmass Creek, for their water needs. AMEC's assumptions, analyses and recommendations are furnished to assist the Caucus and the District in adopting and employing water infrastructure and water management programs that protect and conserve adequate stream flows in Snowmass Creek.

WATER NEEDED TO PROTECT SNOWMASS CREEK

The CWCB's "stair step" instream flow right for the Middle Reach of Snowmass Creek represents a scientifically derived expression of the instream regime needed to protect the natural environment of the Middle Reach of Snowmass Creek. It is responsive to variations in natural flow patterns, and while it specifies lower flows in dry year, it also requires higher flows in wetter years and in years following extended multi-year dry periods in order to prevent degradation of the aquatic habitat and fish populations. The CWCB stair step right should be the standard of protection for the Middle Reach of Snowmass Creek.

The minimum flow needed to protect Snowmass Creek's aquatic ecosystems and trout populations has been the subject of much study. After extensive study and input from stakeholders, the Colorado Water Conservation Board (CWCB) modified its instream

[1] AMEC (then Hydrosphere) was engaged by the Caucus to first analyze the benefits of raw water storage in 2005 resulting in a report recommending at least 100 acre feet of storage (Hydrosphere Resource Consultants, Inc., Water Availability for Snowmass Base Village Development, June 20, 2005).

flow right for the Middle Reach of Snowmass Creek (hereafter the "CWCB stair step right") to include a fixed flow of 15 cfs during the spring and summer and a variable flow during the fall and winter based on the average stream flow during the preceding October 11 – October 15 that acts as a "trigger". The variable portion of the instream flow right is specified as one of four "stair step" flow schedules that correspond to a flow trigger that falls within the following statistical categories: 50th percentile or greater, between 25th and 50th percentile, between 10th and 25th percentile, or below 10th percentile. The CWCB stair step right provides additional protection after prolonged drought: following three consecutive "less than 10th percentile" years, the CWCB stair step right specifies a "recovery year" at the "50th percentile or greater" stair step flow schedule, regardless of the flow trigger.

INCREASING WATER DEMANDS

Water demands from Snowmass Creek will foreseeably increase. Additional development within the District's service area is expected to increase the number of customers within the District from 5,181 equivalent residential units (EQRs) to 6,107 EQRs. At current per EQR water use levels, the District's water demands are expected to increase from 1,480 acre-feet per year to 1,806 acre-feet per year at build-out, an increase of 22%, as shown in Table 4. In addition, snowmaking water demands for the Snowmass ski area could increase by 25% from a current average of 217 acre-feet per year to more than 270 acre-feet per year under terms of the ski area's U.S. Forest Service permit.

SCENARIO ANALYSIS

We evaluated the District's diversions from Snowmass Creek at existing and projected build-out demand levels using a 41-year period of hydrologic record (1970-2010). We included in our analysis an example climate change scenario. Climate change is expected to significantly alter the typical stream flow pattern in Snowmass Creek, resulting in earlier runoff and reduced stream flows in the late summer, fall and mid winter, as shown in Figure 25.

We analyzed 16 supply/demand scenarios. The results of our analysis are summarized in Table 11 of this report. The frequency and magnitudes of shortages to the CWCB stair step right for each of these scenarios are portrayed in Tables 12 through 37. These scenarios were analyzed against the CWCB stair step right to ascertain when, how often, and how severely water supply would be insufficient to supply this protective minimum instream flow standard.

NATURAL FLOW CONDITIONS

These results indicate that shortages to the CWCB stair step right for the Middle Reach of Snowmass Creek will occasionally occur even under natural conditions. However,

shortages will occur infrequently (1.7% of the days) and will be relatively minor (averaging 10% of the specified minimum flow).

DISTRICT'S EXISTING DEMANDS, NO INSTREAM FLOW BUFFERING

At the District's current demand levels and if Ziegler Reservoir is not used to buffer instream flows, the District's diversions will significantly increase the frequency and magnitude of instream flow shortages compared to the natural flow condition, particularly during January through April in extended dry periods, although the District's water loss control and water conservation efforts have significantly reduced the District's depletive 'footprint' on Snowmass Creek.

DISTRICT'S BUILD OUT DEMANDS, NO INSTREAM FLOW BUFFERING

At projected build-out demand levels and if Ziegler Reservoir is not used to buffer instream flows, the District's diversions will further increase the frequency and magnitude of instream flow shortages compared to the natural flow condition. Even with the additional water conservation savings that are likely to result from the District's water conservation plan and full use of the District's Brush Creek supplies, the frequency and magnitude of instream flow shortages will increase significantly compared to existing demand conditions.

STRATEGIC MITIGATING ROLE OF ZIEGLER RESERVOIR

Ziegler Reservoir has the potential to greatly reduce the impacts of the District's diversions upon the CWCB stair step right. Given its multiple refill water right, the reservoir can be a very effective buffer for instream flows, supplying the District's needs and reducing the District's direct flow diversions during periods of inadequate stream flow, and refilling when stream flows are in excess of the CWCB stair step right.

The District's reservoir Operating Plan is well structured to allow the reservoir to operate in a manner that would provide nearly complete protection to the CWCB stair step right under both existing and build-out demand conditions while meeting the District's goals regarding water supply reliability and water quality, provided the reservoir is used to buffer the District's diversions from both East Snowmass Creek and Snowmass Creek. Buffering of diversions from East Snowmass Creek is necessary to achieve this benefit because the District typically satisfies most of its demands with its East Snowmass Creek diversions, and uses the Pump Station to meet its municipal demands relatively infrequently.

Under its Operating Plan, the District intends to partially draw down the reservoir during each non-irrigation season to maintain water quality in the reservoir. Using the reservoir to buffer stream flows when the District's diversions would otherwise reduce stream flows below the CWCB stair step right would be consistent with that purpose.

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Notably, the recent snowmaking agreement between the District and the Aspen Skiing Company provides significant additional access to water stored in Ziegler Resevoir for snowmaking, both before and after December 31st. This agreement could significantly diminish the effectiveness of Ziegler Reservoir to act as a buffer for instream flows in Snowmass Creek. The agreement appears to prohibit the District from withdrawing water from the reservoir to meet its municipal demands during the snowmaking season (October 15 through December 31) unless all of the District's other supplies are insufficient. This limitation would prohibit the District from withdrawing water from the reservoir to meet its municipal demands in order to satisfy the CWCB stair step right. There will be occasional times during the snowmaking season when flows in Snowmass Creek will be insufficient to supply the District's municipal demands on a direct flow basis without causing shortages to the CWCB stair step right. If the District can withdraw water from the reservoir to supply its municipal demands during such times, shortages to the CWCB stair step right would be significantly reduced without affecting the amount or reliability of snowmaking supply to the Skiing Company.

Another major concern regarding the Ziegler snowmaking agreement is the potential for snowmaking withdrawals from the reservoir during January 1 through March 15. This is the season when Ziegler reservoir is most needed to act as a buffer between the District's municipal diversions and the CWCB stair step right, particularly in dry years. While the Skiing Company has not historically taken snowmaking water after December, the Ziegler snowmaking agreement would allow snowmaking deliveries from Ziegler Reservoir from January 1 through March 15 under certain limitations. Any significant amount of snowmaking delivery from Ziegler Reservoir during January through March, particularly in dry years, would impair the District's ability to use Ziegler to buffer instream flows and is likely to result in additional shortages to instream flows because natural stream flows are generally at their lowest levels during these months.

CLIMATE CHANGE IMPACTS

Assuming climate change-driven natural flow hydrology, instream flow shortages will occur more frequently in the Middle Reach of Snowmass Creek even without the depletive effects of diversions. These "natural" shortages would occur more than twice as often as would occur under historical natural flow hydrology. With climate change, the CWCB stair step right for Snowmass Creek would be set to the lowest two levels of the stair step methodology in approximately 75% of the years. As a result, even small shortages to the CWCB stair step right would have serious consequences.

Even with climate change, Ziegler Reservoir has the potential to greatly reduce the impacts of the District's diversions upon the CWCB stair step right. Use of the reservoir to buffer instream flows would provide effective protection to instream flows except in occasional very dry years, when the reservoir would be drawn down to the reserve storage pool. Additional water conservation savings that are likely to result from the District's water conservation plan, along with the District's use of its Brush Creek

supplies (subject to raw water supply blending requirements), would further reduce the District's impacts to the CWCB stair step right.

MAINTENANCE OF THE CWCB STAIRSTEP RIGHT

As the District grows to build-out within its service area, the combination of using Ziegler Reservoir to buffer instream flows, continued efforts by the District to minimize water losses, full use of available supplies from Brush Creek, and increased water savings from the District's water conservation plan should allow the District to meet its build-out water demands without significantly impacting the CWCB stair step right. The key to this positive outcome would be the active use of Ziegler Reservoir to buffer instream flows during low flow periods. Even in the face of climate change, these four elements would greatly mitigate the District's effects on minimum stream flows in Snowmass Creek.

Greater concern exists regarding the potential effects of irrigation diversions under climate change conditions. The combination of increased per-acre irrigation demand and reduced stream flows in the summer months is likely to result in chronic and severe instream flow shortages in the lower portion of the Middle Reach of Snowmass Creek during July through September.

A coordinated effort by all irrigators diverting from Snowmass Creek to improve their irrigation efficiencies, coordinate their irrigation scheduling and practice rotational fallowing or deficit irrigation may be necessary to avoid major impacts to Snowmass Creek during dry years, assuming climate change.

RECOMMENDATIONS

In light of these conclusions, we recommend the following.

1. The District should adopt the CWCB stair step right as its stewardship goal for protection of Snowmass Creek.

2. The District should refine its Ziegler Reservoir operation plan to maximize the use of the reservoir to protect the CWCB stair step right on Snowmass Creek, consistent with the District's reserve storage requirement, snowmaking delivery obligations and reservoir water quality management goals. Specific suggestions for refining the Operating Plan are discussed in Section 8 of this report.

3. The District should work with the Skiing Company to eliminate any uncertainties regarding the District's ability to withdraw water from Ziegler reservoir during the snowmaking season to meet the District's municipal demands to the extent needed to satisfy the CWCB stair step right.

4. Regarding the use of Ziegler Reservoir from January 1 through March 15 of each year, the District should develop operating rules that give priority to the protection of the CWCB stair step right over snowmaking deliveries in years with below-average winter season flows.

5. The District should maintain its exemplary efforts in water loss control and should actively pursue the full implementation of its water conservation plan.

6. The District should divert and use available supplies from the West Fork of Brush Creek, subject to its 50%/50% source water blend requirement[2].

7. Given the likely effects of climate change, the Caucus should work with all irrigators who divert from Snowmass Creek to improve irrigation efficiencies, coordinate diversion scheduling, and develop a contingency plan that may involve rotational fallowing, deficit irrigation and wastewater reuse to ensure that shortages to the CWCB stair step right are avoided during July through September of critical dry periods.

We recommend that the Caucus engage the District, the Skiing Company and irrigators that divert from Snowmass Creek with these recommendations in mind. There are several forums and initiatives active in and around the County that may be relevant vehicles for involvement, including the Roaring Fork Conservancy, the Pitkin County Healthy Rivers and Streams Board, the Western Rivers institute and the Colorado River Basin Roundtable. Funds may be available from the State of Colorado or from Pitkin County Healthy Rivers and Streams to defray the costs for additional study of these alternatives and/or construction of any needed facilities.

[2] According to information provided by the District, raw water diverted from the West Fork of Brush Creek must be blended at least a 50%/50 ratio with raw water from Snowmass Creek or East Snowmass Creek to address water quality concerns.