**COMMENT ON THE KEYSTONE BERGMAN BOWL PROJECT**

*FOLLOWING REVIEW OF: NOTICE OF PROPOSED ACTION, KEYSTONE BERGMAN BOWL PROJECTS, & KEYSTONE BERGMAN BOWL ENHANCEMENT PROJECTS (Sno-E & USDA Forest Service, April 2020)*

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**SUMMARY**

Extensive analysis by Sno-E of Bergman Bowl at Keystone Resort offers assurance that the project will be implemented with minimal adverse environmental and human factor impact however additional adjustment to lift and trail alignments will both enhance the user experience and further mitigate impacts.

Without the need to compromise the voluminous work done to date, overstrike on the attached plan outlines that swinging the lift top terminal some 350 to 400 feet to the south improves fall-line access to 85% of available slope (to 350 of 410 available acres) and could cap the need for high elevation earthwork solely to the ski patrol building and lift top terminal offload sites (Proposed Action Figure PDF 1094).

Of serious concern, run trajectories as shown by green and blue dashed lines, i.e. 16-04U, 16-13, 16-06U, 16-08, etc., often fail to adhere to natural fall line, this in contradiction to Forest Service Directive W18 that states that “*Trails should be routed directly down the fall line*…” (White River National Forest Mountain Sports Program/ Project Planning- Ski Area Design Criteria, Nov. 2018, *Trail Layout*). It also contradicts one of the most attractive general features of the Keystone ski experience that is that much of its terrain maintains natural fall line with few runs involving catwalks, traverses, or descent at some cross-slope angle (double fall line).

Another concern is the large travel distance ratio between such short main trails as 16-03, 16-07 and particularly snow-made 16-08, against the long Bergman ridges and collector trail 16-01. The result is a degraded rider experience because of the need to repeat ridge and collector run segments to access these trails, contrasted i.e. to the longer 16-15-MW or 16-14-MW to 16-04U trails. Less favorable conditions can be anticipated when lower quality slope-forms such as *Trans-Parallel*\* are lift serviced.

Partial remedy might be to temporarily forego development of trail 16-08 to instead focus on improving the fall-line trajectory of 16-07 plus switch snowmaking to it.

Overall, the Bergman Bowl project represents a breakthrough for Keystone Mountain by providing riders lift access for the first time well into the treeless alpine setting. The general configuration of the Bergman slope however presents a drawback that, as much as possible, needs to be mitigated by more optimal alignment of trails and lift.

**BACKGROUND**

Keystone Mountain has been of special interest to the author since arriving to teach there in the mid-1990’s. Formerly a ski area planner in western Canada (sample projects- Lake Louise Ski Area, SnowDance, Northpoint), upon arriving in Colorado he practiced landscape architecture in the metro Denver area and later in Summit County. Ski area planning continued as a hobby culminating in the preparation of long-range sketch plans for both the Keystone and Breckenridge ski areas. These were presented to the Vail Associates Planning Department at about that time and, perhaps not coincidently, Vail moved to acquire both mountain operations the following year.

The Keystone plan was also presented to Keystone management along with field surveys of what the following season were to become the Ranger Beginner Chair and slope, and a new section of Schoolmarm above Dercum’s Dash (formerly Camp Creek).

The Bergman lift and slope are listed as an early priority on the Keystone plan. In addition to consultations with Max Dercum, ski area founder, at that time the author conducted over-snow field surveys of Bergman Bowl. Though he continued to work and now has over two decades experience at Vail and Beaver Creek, he continues to ski and perhaps be somewhat protective of the goings-on at Keystone.

Over the past six years he has also been planning a new Colorado-based ski area to be called Headwaters. The 150-page pilot report titled, “*Introduction to the Headwaters Projects*” and now archived at the National Copyright Office, integrates initial day use ski area development with village, four-season operation, a new parkway and Winter Olympics prospects.

**BERGMAN BOWL *SKIABILITY* ANALYSIS**

Though the environmental and human factors analysis evident in the reports listed above can be termed exemplary, perhaps more could have been done by way of *skiability* analysis.

The **separation of terrain categories into green and blue** rated trails is too coarse. Years ago Sno-E published a six category differentiation of skiable gradients that today the author would posit as seven: ‘Never-ever’ skiers and snowboarders 7 –15%, Beginners 15 –25%, Easy Intermediate 25 –35%, Mid Intermediate 35 –45%, Advanced 45 –60%, Expert 60 –75%, and Extreme at over 75%. Also from what is discerned, the reports are almost devoid of **ski school consideration**- what are the opportunities and constraints here to ski school operations?

**Slope aspect** not only affects snow *retention* with steeper southwest facing trails such as 16-20L potentially subject to accelerated snow loss, but also snow *quality* (with the slope aspects of 16-05 through -08 promising better quality). The high elevation of Bergman Bowl can hopefully help mitigate snow loss tendencies caused by some unfavorable slope aspects, two of which might be the outruns of Erickson Bowl trails 16-16L and 16-24-MW.

Of great concern on plans is the **failure of run trajectories to adhere to natural fall line**. Besides being stressed as vital in the above-mentioned Forest Service guideline, fall-line analysis is standard practice by such mountain planning firms as Ecosign. Moreover, fall line plotting can be a semi-automatic function in AutoCAD (with Osnap set to ‘perp’, run ‘3DPoly’ to successive contours). By whatever means, run trajectories in fall-line are essential to providing a quality alpine ski experience.

What is likely to happen post-development at Bergman is that, above timberline, snowcat grooming will be adjusted to correctly follow natural fall line; however, if trails such as Lower 16-01, 16-15-MW, 16-04L, 16-05L, 16-06, and 16-08 are cut through timber as indicated, a severely compromised rider experience will result. As is, the Bergman layout runs completely against established trail quality standards at Keystone (look at the illustrated North Peak/ Santiago trail system- except for Prospector below the Outpost Gondola, it is near to perfect!) There is strong argument that **run trajectories in Bergman’s wooded areas need extensive correction** before further Forest Service approvals can be justified.

Consideration should also be given to **shifting the top terminal of the Bergman lift south** 350 to 400 feet. With a fall line ‘separator’ drawn up from the presumably un-skiable V-notched gully above the proposed skier bridge, the slope naturally separates into two- 1/ the mostly northwest-facing 150-acre sector and 2/ the predominately west-facing 60-acre sector. **Lift access should prioritize the 150-acre sector**- it has better slope aspects, more available wooded terrain, and 2-½ times *more* terrain than the 60-acre sector. Rider access into Erickson Bowl is also expedited with the apex of the alignment as shown. With enough southerly shift, the terminal will provide **direct fall line access to 16-10 South Bergman Ridge**- this trail likely to become a classic at Keystone.

Having the alignment as shown may also eliminate the need for corrective side-slope grading at the highest point of the project- an environmental benefit. It is conceivable that the only earthwork needed would be foundation ‘cut’ for the patrol building to be transferred as ‘fill’ for the lift offload ramp.

Of last concern is **trail 16-01**, marked as a traverse leading to a skier bridge to be built. Regarding skiability, a constructed catwalk here would be far better than the shown traverse. A road in could bypass the wetland due east of the lift base by skirting above it starting out from the last bend in the road above it. Alternatively, a dozer could carefully tread across the wetland as fall frost takes hold to then prepare the catwalk. As another alternative, a snow road could be built by snowcats each winter however, without snowmaking, trail 16-01 would likely experience opening delay at the onset of the season. Regardless of method, the proposal should address whether the skier bridge is to be built with the help of tracked machinery or solely by hand. 16-01 also likely needs to be assigned as the exit route for logging skidders or trucks, unless helicopter logging is scheduled as the sole means to clear trails in the area.

The 200-acre **Erickson Bowl** sector is shown to have two main trails plus extensive areas of timber glading. It is not directly lift serviced but must rely for access on sequential rider use of the Wayback and Bergman chairs. As configured, Erickson Bowl can be defined as an *Elevation-Gain Inter-lift Trail Network*. In total, three slopes- 1. Wayback with the Spillway and Anticipation trails, 2. Bergman with its 16-01 to 16-15-MW (x 2) trails, and 3. Erickson Bowl and trails become accessible from only two lifts.

(Any trend towards inter-lift trail networks has ramifications for the rider experience plus ski area operational capacities and costs. Layouts offering four or more slopes per lift pair are also possible and comprise a key element of the Headwaters project.)

If Erickson Bowl becomes popular with advanced-level riders, the current **Wayback** chair as a painfully slow fixed-grip becomes an impediment to rapid return to the slope. As indeed indicated, as soon as feasible, the lift **should be converted to an express chair**. Side-glading to improve fall-line for the show-off trail under the lift should be included along with snowmaking.

**CONCLUSION**

We can anticipate that the Bergman Bowl project will be a game-changer for Keystone. With lift service now into true open alpine terrain, Keystone will become more an equal to its ski area neighbors- all of which currently offer a true treeless alpine experience. Some would argue that, being that Bergman Bowl has been at Keystone’s doorstep for decades, the development is long overdue.

Besides adding a novel recreation experience, the operation of Bergman should also improve rider usage of the Wayback Chair and Outpost Gondola- two lifts currently with often less-than-optimal rider utilization. The Bergman Chair will also reduce the need for low-capacity diesel-belching snowcat transit within the area- another environmental plus.

**The Bergman layout can hopefully undergo refinement that adjusts for the limitations of *Trans-Parallel* slope thus bringing it closer to par with the other great slopes at Keystone.**

(\*) Generic slope-forms from best to worse are Meridonal, Multi-Pinnate Meridonal, Parallel (Planar), Par-Axial, Para-Radial, Axial, Radial, Endo-Pinnate, Exo-Pinnate, then lastly Trans-Parallel. In ski area evaluation, slopes must “*not only be evaluated as to their vertical rise, aspect, steepness, and gradient consistency, but as to their form, since ropeways as point-to-point transport in great part define alpine ski resort operation*”. (Introduction to the Headwaters Projects, 2019, pg 49, par. 7, available through the National Copyright Office). Consult with the author for additional detail.