HOMEWOOD MOUNTAIN RESORT

SNOWMAKING PLANNING

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1. Introduction

It is proposed that an upgraded snowmaking system be installed at Homewood Mountain Resort in order to ensure early and late season snowpack. It is generally accepted that a ski trail requires a minimum of approximately 12" of packed snow over a fine groomed summer surface in order to provide a quality surface for skiing and snowboarding. Any less than this depth will accelerate melting of the snow pack, as well as exposure of vegetation through the snow surface which can damage the vegetation and skiers' or snowboarders' equipment. Having adequate snow depth will provide a predictable and safe sliding surface. Ideally, ski trails require in excess of four feet of snow to ensure a long lasting quality surface for a full season with typical weather conditions. This is especially important at Homewood due to its southern exposure and proximity to the lake.

A general overview of the basics of snowmaking follows. When nature does not cooperate by providing natural snow, snowmaking takes over. With a properly designed and operated snow system, the variable of having cold conditions and precipitation occur simultaneously is removed. With snowmaking, only cold temperature conditions are needed to provide snow. Snowmaking requires large volumes of water, energy and temperature conditions below 28°F.

In summary, a snowmaking machine:

a) breaks water into smaller molecules
b) cools the water
c) removes the heat of fusion
d) nucleates the water
e) provides throw to reduce grooming costs

Most requirements for snow making involve certain quantities of water. For example, to cover one acre with one foot of snow requires approximately 200,000 gallons of water. In order to break the water droplets up into smaller particles, water pressures of at least 300 psi are advised.

A proper snowmaking plan includes providing adequate water supply and distribution, appropriate electrical supply and distribution along with the snowmaking technology to convert these resources into snow.

2. Existing Snowmaking System Summary

The existing snowmaking system is summarized as follows.

Trails	Length (ft)	Width (ft)	Area/Acres	Qty Hydrants	Pipe Size
North Side					
Lower Rainbow/Chute	2400	100	5.5	9	8”
Happy Platter	500	250	2.9	3	6”
Alpine Platter	500	300	3.4	5	6”
Lombard Street	2700	40	2.5	8	6”
The Face	1000	200	4.6	4	6”
Pump house	0	0	0	1	0
North Side Totals	**7100**		**18.9**	**30**	
South Side					
South Side Base Area	700	200	3.2	3	6”
Lower Homewood Bound	1500	50	1.7	3	6”
South Side Total	**2200**		**4.9**	**6**	
GRAND TOTALS	**9300**		**23.8**	**36**	

Existing snowmaking at Homewood covers 18.9 acres on the North side and 4.9 acres on the South side for a total of 23.8 acres across the ski area.

All water to snow conversions is calculated at 200,000 gallons of water which are required to make 1 acre, 1ft deep of useable machine-made snow. This is the most commonly used formula for this calculation.

Existing snowmaking on the North side requires approximately 11.3 million gallons of water per year. The existing snowmaking system on the South side requires approximately 2.9 million gallons of water per year. In summary, the current snowmaking system uses about 14.2 million gallons of water per year.

The existing pumping at Homewood includes:

500gpm North Side Base Area,
500gpm Water Cooling, North Side
300gpm South Side Base Area

Existing Snow Machine Summary:			
2	Kid Wizard	Carriage	Manual operation
1	Kid Wizard	Carriage	Auto operation
2	Kid Wizard	Tower	Auto operation
2	Super Polecat	Tower	Auto operation
3	Super Polecat	Tower	Auto operation
1	Super Wizard	Tower	Auto operation
1	Super Wizard	Carriage	Manual operation
5	Super Polecat	Carriage	Auto operation
3	Polecat	Carriage	Manual operation
1	Pole Kid	Carriage	Auto operation
21 Existing Snow guns			

3. Homewood Snowmaking Expansion Area Summary

A. North Side Snowmaking Expansion

The following Table 1 represents the snowmaking expansion on the **North Side**

Table 1. North Side Expansion Summary

Trail Name	Acres	Open Depth (in)	Open Water Gallons (M)	Season Depth (ft)	Season Water Gallons (M)
Northern Return	1.7	12	0.34	3	1.0
Homeward Bound	6.9	12	1.38	3	4.1
Lombard Completion	1	12	0.20	3	0.6
Tailings	4.2	12	0.84	3	2.5
The Shaft	1.8	12	0.36	3	1.0
Pot O Gold	3.3	12	0.66	3	1.9
Rainbow Ridge	6.8	12	1.36	3	4.0
Bonanza	5.5	12	1.1	3	3.3
Miners	9	12	1.8	3	5.4
Smooth Cruise	4	12	0.8	3	2.4
Ore car	3.7	12	0.74	3	2.2
Gilberts	3.7	12	1.1	3	2.2
Totals	**51.6**	**12**	**10.68**	**3**	**30.7**

B. North Area Opening Snowmaking Conditions

The primary objective is to open all trails by December 10 each year with primary trails first then secondary trails in order of priority. Maximum pump capacity and temperatures will regulate the total flow.

Based on an analysis of the weather and general experience in the Tahoe area, we can assume 150 hours at minimum 25˚F Wet Bulb between November 1 and December 25 each year in approximately 17 out of 20 years.

25˚F Wet Bulb is equivalent to 27˚F/80% RH, 26˚F/90% RH and 29˚F/60% RH. However, colder conditions down to 15˚F can occur. Under these colder conditions, snowmaking efficiencies are greatly improved. Therefore, we suggest sizing the water capacity for 18˚F Wet Bulb. In simple terms, if the temperatures are colder, the snowmaking equipment using the same energy can convert double or triple the water volumes into snow, although total water flow is regulated by water supply and pumping capacity.

For the North side expansion of 51.6 acres, the conversion of 10.68 million gallons of water into snow in 150 hours for average water to snow conversion rate of 1186 gpm would be necessary to meet opening conditions. This quantity is added to the existing snowmaking demand for 18.9 acres, which requires the conversion of 3.7 million gallons of water to cover trails with 12" of snow in 150 hours for an average water to snow conversion rate of 420 gpm, for a total of 14.4 million gallons. **In summary, 14.4 million gallons of water will be necessary to meet opening snowmaking conditions on the North side.**

A typical snow machine converts 35 gpm at 25˚F Wet Bulb, so 45 snow guns are required to be operating.

If Homewood would concentrate on opening trails in stages, 2000gpm on the North side would be sufficient to operate 25 machines @ 80gpm. Additional trails could be opened in stages.

The North side pumping requirement is 2000gpm

C. North Side Annual Snowmaking Demand

As detailed in Table 1, the snowmaking expansion to cover 51.6 acres will require up to 30.7 million gallons of water per year to maintain a 3 foot base of snow coverage on the North side trails. When added to the existing demand of 11.3 million gallons per year to cover 18.9 acres, the total annual demand equals 42 million gallons of water per year to cover 70.5 acres on the North side.

D. South Side Snowmaking Expansion

The following Table 2 represents the snowmaking expansion on the **South Side.**

Table 2. South Side Expansion Summary

Trail Name	Acres	Open Depth (in)	Open Water Gallons (M)	Season Depth (ft)	Season Water Gallons (M)
Mighty Mite	3	12	0.6	3	1.8
Short Cut	3.5	12	0.7	3	2.1
Mighty Fine	1.5	12	0.30	3	0.9
Martins Lane	4.6	12	0.92	3	2.7
Spill Way	1.7	12	0.34	3	1.0
Sunny Side	2.6	12	0.52	3	1.5
Prospector	1.8	12	0.36	3	1.0
El Capitan	3	12	0.60	3	1.8
Exhibition	4.5	12	0.90	3	2.7
Overload	.7	12	0.14	3	0.4
Totals	**26.9**	**12**	**5.38**	**3**	**15.9**

E. South Area Opening Snowmaking Demand

Again, the primary objective is to open by December 10 each year.

For the South side expansion of 26.9 acres, the conversion of 5.3 million gallons into snow in 150 hours for average water to snow conversion rate of 600 gpm will be necessary to meet opening conditions. This quantity is added to the existing snowmaking demand for 4.9 acres, which requires the conversion of 980,000 gallons of water to cover trails 12" of snow in 150 hours for average water to snow conversion rate of 110 gpm, for a total of 6.36 million gallons.

In summary 6.36 million gallons of water will be necessary to meet opening snowmaking conditions for the South side trails.

A typical snow machine converts 35 gpm at 25°F Wet Bulb, so 17 snow machines are required to be operating. Sizing the water capacity at 80 gpm/snow machine for 18°F x 17 snow guns, which equals 1360 gpm, is recommended. If Homewood opens these trails in stages as would typically be the case, 1000gpm would be sufficient to operate 13 machines @ 80gpm. Additional trails could be opened in stages.

The South side main pump station would also so feed the North side via the Homewood Bound trail main pipe, therefore, pumping needs to be sized accordingly to maximize all of the South side water.

The South side pumping requirement is 1300 gpm

F. South Side Annual Snowmaking Demand

As detailed in Table 2, the snowmaking expansion to cover 26.9 acres will require up to 15.9 million gallons of water per year to maintain a 3 foot base of snow coverage on the South side. When added to the existing demand of 2.9 million gallons per year to cover 4.9 acres, the total annual demand equals 18.8 million gallons per year to cover 31.8 acres on the South side.

4. Water Supply and Distribution

Suggested water supply pumping capacity totals as follows:

- North side base well 800gpm
- McKinney well (Tahoe City PUD owned non potable source) 1000gpm
- Existing South base supply@ 300gpm (supplied by Tahoe City PUD)
- Supply total 2100gpm
- If required, North side available supplemental water - Madden Creek water company- 300gpm

A. Water Supply

The Homewood snowmaking water requirements can be summarized as follows:

To open with snowmaking only the totals are 14.4 million gallons and 6.36 million gallons for the North and South sides of the mountain, respectively. The snowmaking trails require a total of around 20.76 million gallons to open.

Per season depending on natural snowfall and conditions, the snowmaking system is anticipated to require up to an additional 30.7 million gallons/year on the North side and up to an additional 15.9 million gallons/year on the South side of the mountain. The total water supply for snowmaking equates approximately up to 60.8 million gallons/year or 186.6 acre-feet/year.

The actual operating water consumptions would average about 2000gpm

The existing water supplies available for Homewood snowmaking are:

1. McKinney well, South side – This well has been flow tested with a potential for 1000 gpm

2. South Base Area – Existing snowmaking water from the Tahoe City PUD of 300 gpm available from 6 p.m. to 6 a.m. only and the water is around 44°F which needs a cooling tower installed to be more effective.

3. North Base Area – Potential supplemental water available from the Madden Creek Water Company of 300 gpm available from 6 p.m. to 6 a.m.

4. North Base existing well in the gravel parking lot which will flow at approximately 800gpm. Currently, the well needs to be rehabilitated and is restricted to 500gpm by the size of the pipe on the discharge side of the well pump and the tank in the pump house and the existing pump size. A new pump house with another pump and cooling tower is required.

The water delivery system could also be utilized for fire protection purposes at the resort.

B. Pumping Alternatives

Snowmaking should have minimum 300 psi water pressures at top of system and to all snowmaking machines.

The basic methods for supplying water for snowmaking are summarized as follows:

A. 1000 gpm pumping at McKinney Well
B. 800 gpm pumping from existing North Base (with potential supplemental water of 300 gpm from Madden Creek Water Co.)
C. 300 gpm pumping from existing South Base (Tahoe City PUD)

All water will be combined into the same piping system and used throughout the entire resort

Total potential water supply equates to 2100- 2400gpm
Pumping Requirements are as follows:

South Base pump station to the top of the gondola will require (3) 300Hp pumps rated at 500gpm to provide 250psi at 7300 feet (top of the Gondola). Water cooling would be (3) 500gpm water cooling towers for the McKinney well water located at the south base pump house.

Top of the gondola pump station location to the top of the mountain is 600 vertical feet with friction and vertical pressure loss this comes to 700' total dynamic head. To maintain 300psi at the top of the mountain will require (1) 250HP pump in the Top of the gondola pump station.

The existing pump station at the North Base area will need to be moved to a new location. This location will most likely be in an underground vault near the existing well site (at the proposed gondola terminal location). One more 300HP pump will need to be added to this station to move 1000gpm to the top of the Gondola with sufficient pressures. There is already one existing 500gpm cooling tower so one more will need to be added to cool 1000gpm effectively.

The South Base area pump station would remain in approximately the existing location and be used as a supply pump to the new main McKinney pump station @ 300gpm. The new McKinney pump station will be located on Homewood property near the Sunnyside trail and be supplied from both the McKinney well and the south side existing snowmaking pump.

C. Piping and Hydrant Summary

Table 3 summaries the piping and hydrant needs for the snowmaking expansion.

Table 3. Piping and Hydrant Summary

Trail Name	Pipe				Pedestals & Hydrants
	4”	6”	8”	10”	
Northern Return	0	1800	0	0	7
Homeward Bound	0	0	0	8000	24
Lombard	800	1000	0	0	1
Tailings	0	0	0	2800	4
Shaft	0	2000	0	0	4
Pot O Gold	0	0	2000	0	5
Rainbow Ridge	0	0	2500	1500	16
Smooth Cruise	0	2400	0	0	6
Ore Car	0	4000	0	0	10
Mighty Mite	750	0	0	0	1
Short Cut	0	0	0	1600	7
Overload	1000	0	0	0	4
Martins Lane	0	1700	0	0	8
Spillway	0	1000	0	0	4
Sunny Side	0	2300	0	0	9
Prospector	1000	0	0	0	3
El Capitan	0	1600	0	0	4
Exhibition	0	1100	0	0	4
Mighty Fine	1100	0	0	0	3
Bonanza	0	2400	0	0	9
Gilberts	0	1700	0	0	7
Last Resort	0	900	0	0	5
Miners Delight	0	2400	0	0	13
Grand Totals	**4650’**	**36250’**	**4500’**	**13900’**	**186**

Piping and electrical are to be buried with 4 ft of cover at existing trails. All trails should be final graded and excavated to final grade prior to placing piping on trails. The existing systems would be tied into the new pipe system.

A detailed plan for the piping and hydrants has been developed and is attached in Appendix B.

5. ELECTRICAL SUPPLY AND DISTRIBUTION

A. Annual Power Supply Demand

The power supply requirements for the snowmaking expansion are summarized in Table 4 (combined summary includes existing system with new requirements):

Table 4. Power Supply Requirements

South Base	Item	HP	Qty	Total
	Main Pumps	300	3	900
	Cooling Towers	25	3	75
	Snow guns	25	17	425
South Base Total				**1400 HP**
Top of Gondola	Pumps	250	1	250
	Snow guns	25	28	700
Top of Gondola Total				**950 HP**
North Base	Pump	250,300	2	550
	Cooling tower	25	2	50
	Snow guns	25	28	700
North Base Total				**1250 HP**
GRAND TOTAL				**3475 HP**

B. Secondary Mountain Power Distribution

The snow guns require electrical to be distributed along the trails. In addition to each water hydrant, there will be an electrical outlet of 60 Amp capacity in which to plug the snow machines. Typical circuits are 1000' to 3000' long with 5-10 pedestal outlets per circuit with 300Amp or 400Amp disconnects.

Transformers

The following are the known details and proposed upgrades of the existing electrical infrastructure, as it pertains to the chair lifts and snowmaking systems. Transformer numbers are referenced from either the transformer or SPPCO map provided by SPPCO, North Tahoe Office, dated 3-28-07. Project site map was created and provided by Snow Machines, Inc. (SMI).

Transformers

1. Transformer #1 North Lodge snowmaking, 750kva
   Existing Load; 400amp VFD, 3 fan circuits, 250 amps.
   Proposed load addition; 1 fan circuit, 300 amps
   Additional breaker to be used in existing switchgear.

2. Location; Bottom Terminal Quad chairlift
   Existing transformer SPPCO # 81-3141-78789, 25kva
   Ref #2 on SMI site map
   Proposed upgrade; 500kva transformer
   Proposed load addition; 2 fan-gun lines, 450 amps/373kva

3. Location; Top terminal Madden chairlift
   Existing transformer SPPCO # 13333, 300kva
   Ref #3 on SMI site map
   Existing load; 250kva.
   Proposed load addition; 4 fan-gun lines, 885amps/700 kva

4. Location; Bottom terminal Ellis chairlift
   Existing transformer SPPCO # TS-267, 515539, 300kva
   Ref #4 on SMI site map
   Proposed load addition; new high speed chair lift 700 kva (motor and associated loads)
   2 fan gun lines, 450kva
   New load total 1150 kva

5. Location; Vehicle shop
   Existing transformer SPPCO #, 750kva
   Ref #5 on SMI site map
   Proposed upgrade; 1000kva transformer
   Proposed load addition; 7 Fan circuits, 400amps each
   New 1000 amp switchgear w/breakers
   New load total 1000 kva

6. Location; top of Quad
   Existing transformer SPPCO #
   Ref # 6 on SMI site map
   This transformer has been upgraded to 1000 kva
   Proposed are new 600amp switchgear w/breakers

7. Proposed transformer location "miners" ski run, no existing service
   Ref #8 on SMI site map
   Proposed install; 300kva transformer
   Proposed load addition; 2 fan-gun lines, 375 kva

8. Location; McKinney well and pump station
   Existing transformer SPPCO # 80-3271, (3 pole mounted transformers, #103592, 93, and 94)
   Ref #9 on SMI site map
   Proposed install; 1500kva transformer

9. Proposed load; Pump station- 5, 250 HP (1175kva) VFD and soft starters,
   Misc. heaters and lights, 50kva
   Need to add some space for cooling towers for well water.

A detailed plan for the secondary electrical cabling and circuit has been developed and is attached.

6. Pump house Building

Plans are for the larger pump house building to house snow machines for maintenance, hose drying and storage and for crew meetings and offices to be located at the mid-mountain maintenance facility as an integral part of that building.

7. Further Engineering

The snow making master plan will require more detailed final engineering for the pumping stations and buildings, water cooling towers, primary and secondary electrical supply and distribution and snow gun layouts.

8. Snowmaking Expansion Phasing

The main trunk snowmaking must be installed during phase 1 of implementation of the snow making plan as it is a primary concern, and water pipe and power cable infrastructure needs to be placed under roads and to be compatible with other resort planning. Generally snowmaking needs to be installed before anything else as it requires to be buried under the ground. The phasing for the secondary trails snowmaking installation will be developed as required.

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