HOMEWOOD MOUNTAIN RESORT

SNOWMAKING PLANNING

January 19, 2009

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1. Introduction

It is proposed that a vastly 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, we only need cold temperature conditions 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 involve very large quantities of water. For example, to cover one acre with one foot of snow requires around 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 System Highlights

Trails covered include:	NORTH SIDE				
	LENGTH	**WIDTH**	**PIPE**		**AREA**
Lower Rainbow/ Chute	2400ft	100ft	8”	9 Hydrants	5.5 Acres
Happy Platter	500ft	250ft	6”	3 Hydrants	2.9 Acres
Alpine Platter	500	300ft	6	5 Hydrants	3.4 Acres
Lombard Street	2700	40ft	6”	8 Hydrants	2.5
The Face	1000ft	200ft	6”	4 Hydrants	4.6
Pump House				1 Hydrants	
	SOUTH SIDE				
South Side Base Area	700ft	200ft	6”	3 Hydrants	3.2 Acres
Lower Homewood Bound	1500ft	50ft	6”	3 Hydrants	1.7 Acres

Existing snowmaking at Homewood covers 23.8 Acres
The current snowmaking at Homewood uses about 17,500,000 gallons of water per year.

The existing pumping at Homewood includes: 500gpm North Side Base Area,
500gpm Water Cooling
300gpm South Side Base Area

Existing Snowgun Summary:			
2	WizzKid	Carriage	Manual
1	WizzKid	Carriage	Auto
2	WizzKid	Tower	Auto
2	Super PoleCat	Tower	Manual/Auto Valve
3	Super PoleCat	Tower	Auto
1	Super Wizzard	Tower	Auto
1	Super Wizzard	Carriage	Manual
5	Super PoleCat	Carriage	Auto
3	PoleCat	Carriage	manual
1	Pole Kid	Carriage	Auto
21 Existing Snowguns			

3. Snowmaking Coverage Area Summary

A. Homewood Snowmaking Expansion Area Summary.

The following table represents the snowmaking expansion on the **North Side**

Trail Name	Acres	Open Depth (in)	Open Water Gallons (M)	Season Depth (ft)	Season Water Gallons (M)
Northern Return	1.7	12	0.34	4	1.36
Homeward Bound	6.9	12	1.38	4	5.5
Lombard Completion	1	12	0.20	4	0.8
Tailings	4.2	12	0.84	4	3.36
The Shaft	1.8	12	0.36	4	1.4
Pot O Gold	3.3	12	0.66	4	2.6
Rainbow Ridge	6.8	12	1.36	4	5.44
Bonanza	5.5	12	1.1	4	4.4
Miners	9	12	1.8	4	7.2
Totals	**40.2**	**12**	**8.04**	**4**	**32.06**

B. North Area Opening Snowmaking Conditions

The primary objective is to open by December 10 each year.

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.

So to open the proposed new snowmaking trails we need to convert 8,040,000 gallons into snow in 150 hours for average water to snow conversion rate of 900 gpm.

Plus we need to add the existing snowmaking areas @ 18.9 acres which require 3,780,000 gallons of water to cover trails 12" of snow in 150 hours for average water to snow conversion rate of 420 gpm

Total water required for 12" cover is 11,820,000 gallons

A typical snowgun converts 35 gpm at 25˚F Wet Bulb, so 38 snow guns are required to be operating.

We advise sizing the water capacity at 80 gpm/snowgun, for 18˚F x 38 snow guns which equals 3000 gpm for total future snowmaking expansion for the north side. However if Homewood would concentrate on opening trails in stages, 2000gpm on the north side would be sufficient to operate 25 machines @ 80gpm. Then open further trails in stages.

The North Side Pumping requirement is 2000gpm minimum. Total Build out 3000 gpm

The following table represents the snowmaking expansion on the **South Side**

Trail Name	Acres	Open Depth (in)	Open Water Gallons (M)	Season Depth (ft)	Season Water Gallons (M)
Mighty Mite	3	12	0.6	4	2.4
Short Cut	3.5	12	0.7	4	2.8
Mighty Fine	1.5	12	0.30	4	1.2
Martins Lane	4.6	12	0.92	4	3.6
Spill Way	1.7	12	0.34	4	1.36
Sunny Side	2.6	12	0.52	4	2.08
Prospector	1.8	12	0.36	4	1.44
El Capitan	3	12	0.60	4	2.4
Exhibition	4.5	12	0.90	4	3.6
Totals	**26.2**	**12**	**5.24**	**4**	**20.88**

D. South Area Opening Snowmaking Conditions

The primary objective is to open by December 10 each year.

So to open we need to convert 5,200,000 gallons into snow in 150 hours for average water to snow conversion rate of 600 gpm.

Plus we need to add the existing snowmaking areas @ 4.9 acres which require 980,000 gallons of water to cover trails 12” of snow in 150 hours for average water to snow conversion rate of 110gpm

Total water required for 12” cover is 6,180,000 gallons.

A typical snowgun converts 35 gpm at 25˚F Wet Bulb, so 17 snow guns are required to be operating.

We advise sizing the water capacity at 80 gpm/ snowgun for 18˚F x 17 snow guns which equals 1360 gpm. If Homewood opens these trails in stages, 1000gpm would be sufficient to operate 13 machines @ 80gpm. Then open further trails in stages.

The South Side Pumping requirement is 1000 gpm minimum. Total Buildout 1400 gpm.

4. Water Supply and Distribution

Suggested water supply pumping capacity totals follow:
North side base well 700gpm
McKinney well 1000gpm
Supply total 1700gpm
Reservoir on mountain

A. Water Supply

The Homewood snowmaking water requirements can be summarized as follows:

To open the totals are 11.82M and 5.28M gallons per side of the mountain. The snowmaking trails require around 17.1 million gallons to open.
Per season, it could be 35.46M and 15.84M per side of the mountain for a 3 to 4 foot depth
Anticipated total water usage per season would be 51.3 to 68.4 million gallons

The actual operating water consumptions would average between 1900 gpm and 3400 gpm.

The existing water supplies available for Homewood snowmaking are:

1. McKinney well – This well has been flow tested has potential for 1000 gpm

2. South Base Area - Domestic water 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 - Domestic water of 300 gpm available from 6 p.m. to 6 a.m. Plus the existing well in the gravel parking lot which will flow up to 800gpm. At the moment this 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. A new pumphouse with another pump is suggested.

The water delivery system could also be utilized for fire protection in the forests and buildings on the mountain.

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. 700- 1000gpm pumping from existing north base
C. 300gpm pumping from existing south side base

Total 2300gpm

Pumping Requirements as follows:

South base pump station to the top of the gondola will require (2) 300hp pumps rated at 500gpm to provide 250psi at 7300feet (top of the Gondola). Water cooling will be (2) 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 side base area will need to be moved to a new location. This location is still to be determined. 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 side pump station will remain in the existing location, but will need to be upgraded to house more equipment. The piping and power supply mounted also need to be rerouted.

C. 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	2
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
Miners Delights	0	2400	0	0	13
Mighty Mite	750	0	0	0	1
Short Cut	0	0	0	1600	7
Bonanza	0	2400	0	0	9
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
Mckinney well-south base pump station				2700	
Grand Totals	**3650’**	**17300’**	**4500’**	**16600’**	**127**

Piping to be buried with 4' of cover.
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 system.

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

5. ELECTRICAL SUPPLY AND DISTRIBUTION

The snowmaking system at Homewood power requirements can be summarized as follows:

A. Estimated Loads

South base	Item	HP	Qty	Total
	Main Pumps	300	2	500
	Cooling Towers	25	2	50
	Snow guns	25	17	425
South base Total				**975 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				**3175 HP**

B. Secondary Mountain Power Distribution

The snow guns require electrical to be distributed along the trails. Next to each water hydrant will be an electrical outlet of 60 Amp capacities to plug the snowguns into. 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).

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.

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

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

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

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

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

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

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

6. Pumphouse Building

Consideration should be given to a larger pumphouse building to house snowguns for maintenance, hose drying and storage and for crew meetings and offices.

Once these decisions are concluded, more detailed space layouts can be developed.

7. Further Engineering

After this general concept plan is approved, more detailed engineering is required for all aspects of the project including pumping stations and buildings, water cooling towers, primary and secondary electrical supply and distribution and snow gun layouts

10. Assumptions

1. No Permits
2. No Taxes
3. No Blasting
4. No High Voltage Improvements
5. No Revegetation, Fencing, Signage or Hydrant Covers
6. No water supply improvements included