State of Utah
GARY R. HERBERT
Governor

GREG BELL
Lieutenant Governor

Department of
Environmental Quality

Amanda Smith
Executive Director

DIVISION OF DRINKING WATER
Kenneth H. Bousfield, P.E.
Director

July 17, 2013

Evan D. Miller
Powder Mountain Ski Resort
P.O. Box 270
Eden, UT 84310

Dear Mr. Miller:

Subject: **Status and Review Comments**, Summit at Powder Mountain PRUD
Well Drilling Summit Well (WS006), File #9225
Phase I Distribution System, File #9318
Earl's Peak Storage 400 K Gallons, File #9319,
System #29028

This is not plan approval.

The Division of Drinking Water (the Division) has been in discussions with the Summit Group which wants to develop property at Powder Mountain since early 2012. The early discussions reviewed the requirements for drinking water systems and waste water systems to provide adequate infrastructure for the development that was being proposed. The Division of Drinking Water stated its position that other infrastructure such as water lines and storage tanks would not be approved until first water sources had been developed and shown to be adequate. The water infrastructure being developed by the Summit Group would become part of the Powder Mountain Water and Sewer District.

Well Status

On January 29, 2013, the Division received the plans and specifications to drill the Summit Well (WS006) at Powder Mountain from George W. Condrat, P.E., P.G., of Loughlin Water Associates LLC, a consultant working for the Summit Group. The Division issued plan approval for the drilling of this well in a letter dated February 21, 2013. The Summit Group elected to first drill an exploration well at this site, which was started in May and drilled to a depth of 2800 feet. The exploration well, known as Exploration Well #1, was tested by air-lifting water out of the well starting on May 30, 2013, for 24 hours. The yield from the Exploration Well #1 averaged 79 gpm, which was disappointing since the desire yield was 500 gpm.

The Summit Group elected to drill a second exploration well at the Hidden Lake parking area.

The second exploration well, known as Exploration Well #2, was drilled to a depth of 2480 feet. The drilling of this well showed that there is one aquifer at approximately 1500 feet and a second aquifer at 2200 feet, which are not hydraulically connected as evidenced by the different static water levels in the well during the drilling process. Exploration Well #2, was tested by air-lifting water out of the well starting on June 22, 2013, for 24 hours from the 2200 feet depth. The yield from the Exploration Well #2 from the lower aquifer averaged 92 gpm. The driller then filled the bottom of the borehole of Exploration Well #2 with gravel and then a bentonite seal to 1510 feet. A second test by air-lifting water out of the well from the aquifer was conducted on June 30, 2013, for 24 hours from the 1480 depth. The yield from the Exploration Well #2 from the upper aquifer averaged 84 gpm. Based on the air pressure used during the air-lift tests and by measuring the static water level once the tests were completed and the well drill head could be removed, it indicates there was not significant drawdown and a rapid recovery in the well. The amount of water from an exploration well air-lift test is limited by the amount of air available and the depth of the well. In addition, the air supplied down the drill column increases the pressure in the borehole and may limit the amount of water from the formation that will enter the borehole.

Attached to this letter is a letter from William D. Loughlin, P.G., and George W. Condrat, P.E., P.G., from Loughlin Water Associates, LLC, with their opinion on the availability of "wet water" for the proposed Phase 1 of the Summit at Powder Mountain PRUD. The proposed Phase 1 consists of 154 connections to the water system. Based on the minimum sizing requirements of the Division of Drinking Water of 800 gallons per day of source capacity for each residential connection for **indoor use**, Phase 1 would require a safe yield of 85.6 gpm from a well. The safe yield of a well is defined in the Division's rules as 2/3 of the 24-hour constant rate pump test. Therefore, a well to supply water for Phase 1 for **indoor use only** would be required to have a 24-hour constant rate pump test of 128.3 gpm. Their professional opinion is that a single well into the upper aquifer at the Hidden Lake site would provide adequate water for the proposed Phase 1 for **indoor use only**, and could provide water at the required 24-hour constant rate pump test for the minimum required safe yield for **indoor use only**. **If any outdoor water is allowed in Phase 1, additional source capacity based on safe yield would be required at the rate of 3.39 gpm of source capacity per acre of outside irrigation.**

The Summit Group is proposing to drill a single production well into the upper aquifer at the Hidden Lake site to provide drinking water for Phase 1 of the Summit at Powder Mountain PRUD. This well would be named "Hidden Lake PWS Well" and would be identified in the Division's data base as WS008. Based on its review of the data from the exploration wells, the Division believes that this proposed production well may be able to provide adequate safe yield of water for indoor use for Phase 1. The project manager of the Summit Group has agreed during a meeting with the Division that if this well does not provide an adequate safe yield of water for Phase 1, they would drill a second well at the Hidden Lake site into the lower aquifer to provide the additional water to meet the safe yield requirement. The Division agrees with this approach and is willing to move the project forward by providing review of the plans and specifications of the water lines and storage tank, and issuing conditional plan approval once the plans and specifications are verified to comply with the Drinking Water rules.

The consultants of the Summit Group need to provide to the Division revised plans and specifications for the well drilling of Hidden Lake PWS Well (WS008) and the revised Preliminary Evaluation Report (PER) to reflect the new location of the well at Hidden Lake site.

Storage Tank Status

On March 18, 2013, the Division received the preliminary engineer design plans and specifications for the Earl's Peak 400K gallon storage tank (ST004) and the well equipping of the Summit Well (WS006) from your consultant, Jeff Beckman, P.E., of Bowen Collins & Associates, Inc. The Division provided review comments on the preliminary design in a meeting on May 9, 2013. With the change in the well site to Hidden Lake, Summit group is proposing to move the storage tank to Hidden Lake and renamed it Hidden Lake 400K Gallon Tank. The Division's database identification would remain ST004.

The Division received the construction plans and specifications for the Hidden Lake 400K Gallon Tank (ST004) on July 1, 2013, from Jeff Beckman. Several minor issues of concern were discussed with Jeff Beckman in a phone call on July 15, 2015, and resolved. The Division anticipates having a final conditional approval letter for this tank by July 19, 2013. The only condition in the approval letter is that the Summit Group will be required to drill the second production well at the Hidden Lake site if the 24-hour constant rate pump test of the Hidden Lake PWS Well (WS008) does not confirm an adequate safe yield to provide water to Phase 1.

Waterlines Status

On March 18, 2013, the Division received the preliminary engineer design plans and draft Hydraulic Model Report for the distribution system waterlines (DS001) for Phase 1 of the Summit at Powder Mountain PRUD from your consultant, Ryan Cathey, P.E., NV5, Inc. The Division provided review comments on the preliminary design and hydraulic model in a meeting on May 9, 2013. At this point, the distribution system for Phase 1 will only be connected with the existing Powder Mountain water system with an emergency interconnection to the existing Hidden Lake Storage tank (80K gallons, ST001). Additional engineering and infrastructure will be required in order for the existing Powder Mountain water system and the proposed Phase 1 water system to be permanently connected.

The consultants of the Summit Group need to provide to the Division final construction plans and specifications for the distribution system waterlines (DS001) for Phase 1 so the Division can do the formal plan review and issue a conditional plan approval letter once the plans and specifications are verified to comply with the Drinking Water rules. The plans need to be revised to reflect the new location of the storage tank at Hidden Lake.

In addition, since this is an expansion of existing water system, the Drinking Water rules require that a hydraulic model report be submitted to the Division showing the propose water system expansion can provide adequate water quantity and pressure to the new connections. The draft Hydraulic Model Report that was submitted on March 18, 2013, covered the existing system, the

proposed system for Phase 1 of the PRUD, and future phases outlined in the Master Plan. Since the existing system and the proposed system for Phase 1 will not be hydraulically connected at this time, the Division recommends that the Hydraulic Model Report be limited to only Phase 1 of the PRUD. The Hydraulic Model Report can be amended and expanded in the future to cover the interconnection to the existing system when the time comes and future phases outlined in the Master Plan.

If you have any questions regarding this letter, you can contact me either by phone at (801) 536-0054 or e-mail bhart@utah.gov.

Sincerely,

Bob Hart

Bob Hart, P.E.
Environmental Engineer III

Enclosure – Loughlin Opinion

cc: Louis Cooper, Env. Director, Weber-Morgan Health Department, lcooper@co.weber.ut.us
George W. Condrat, P.E., P.G., 3100 W. Pinebrook Road, Suite 1100, Park City, UT 84098
John Reeve, Reeve and Associates Inc., 920 Chambers St, Suite 14, Ogden, UT 84403
Sean Wilkinson, Weber County Planner, 2380 Washington Blvd.,Suite 240, Ogden, UT 84401
Jared Andersen, P.E., Weber County Engineer, 2380 Washington Blvd.,Suite 240, Ogden, UT 84401
Russ Watts, Summit Group, 5200 South Highland Drive, Salt Lake City, UT 84117
Jeff Beckman, P.E., Bowen Collins & Associates, Inc., 154 East 14000 South, Draper, UT 84020
Ryan Cathey, P.E., NV5, Inc., 5217 South State Street, Suite 300, Murray, UT 84107
Ying-Ying Macauley, Division of Drinking Water, ymaculey@utah.gov
Kate Johnson, Division of Drinking Water, katej@utah.gov
Bob Hart, Division of Drinking Water, bhart@utah.gov
John Mackey, Division of Water Quality, jkmackey@utah.gov

DDW-2013-007047

LOUGHLIN
WATER ASSOCIATES ▲ LLC

June 28, 2013

Division of Drinking Water
Attention: Robert E. Hart, P.E.
P.O. Box 144830
Salt Lake City, UT 84114-4830

Subject: **Opinion of Water Availability for Phase 1**
Results of Groundwater Exploration Program
Powder Mountain Water & Sewer Improvement District
Public Water System (PWS) # 09225, Weber County, Utah
For Summit Mountain Holding Group

Dear Bob:

This letter presents our opinion concerning the availability of wet water for the proposed Phase 1 development at Powder Mountain Resort (Powder Mountain) in Weber County, Utah, for Summit Mountain Holding Group (the Summit Group).

SUMMARY OF OUR OPINION

According to NV5, Inc. (NV5, 2013), Phase 1 of the proposed expansion of Powder Mountain will have an average annual demand of 65.25 ac-ft and peak-day demand of about 81 gallons per minute (gpm). The Utah Division of Drinking Water (DDW) requires that a new public water system (PWS) well or wells be tested at 1.5 times the peak-day demand of 81 gpm (about 122 gpm) for a minimum of 24 hours to approve Phase 1.

The Summit Group recently completed a groundwater exploration program at Powder Mountain that consisted of two exploration wells (Exploration Well 1 and Exploration Well 2) that were drilled and tested. The exploration program helped to identify an upper aquifer and a lower aquifer that (1) are separated by low-permeability shale and (2) have a difference in hydraulic head (water level) of approximately 300 feet.

The well driller (National EWP) conducted air-lift tests at relatively constant rates of (1) 79 gpm from the lower aquifer of Exploration Well 1, (2) 84 gpm in the upper aquifer of Exploration Well 2, and (3) 92 gpm in the lower aquifer of Exploration Well 2. We (Loughlin Water Associates, LLC) reviewed the yields, drawdowns, and field water quality data from the tests, and conclude that a single well completed in the upper aquifer at Exploration Well 2 will be capable of (1) supplying the 81-gpm peak-day demand of Phase 1 and (2) being pump-tested at a minimum of 122 gpm (1.5 times the peak-day demand of 81 gpm) for at least 24 hours. The discussions that follow provide details and supporting information for our conclusion.

3100 W. Pinebrook Road, Ste. 1100 ▲ Park City, Utah 84098
Phone: 435.649.4005 ▲ Fax: 435.649.4085 ▲ Mobile: 435.659.1752 ▲ www.LoughlinWater.com

PURPOSE OF GROUNDWATER EXPLORATION PROGRAM

The groundwater exploration program consisted of two exploration wells (Exploration Well 1 and Exploration Well 2) that were drilled and tested at Powder Mountain. Figure 1 shows the location of Powder Mountain and Figure 2 shows the locations of the two exploration wells. The objectives of the exploration well program were to assess the presence, character, and potential yield of the aquifers and provide information for the final design and permitting of PWS production wells. The purposes of this letter are to briefly summarize the results of air-lift testing of the exploration wells and to provide our opinion concerning the capability of production wells to be constructed nearby to provide the sufficient water for the Phase 1 development at Powder Mountain.

The Summit Group proposes to construct one or two PWS wells near the location of Exploration Well 2, and although it is unlikely that it would be necessary, would construct a well near Exploration Well 1.

National EWP, under Utah Water Well Driller License No. 805, drilled, set and grouted conductor casing to a depth of 50 feet and then drilled 6-inch diameter borehole to a depth of 2800 feet in Exploration Well 1. National EWP conducted air-lift tests during various stages of the drilling and testing program.

National EWP drilled, set and grouted conductor to 125 feet and surface casing to a depth of 430 feet; then drilled 6-inch diameter borehole to a depth of 2480 feet in Exploration Well 2. National EWP conducted air-lift tests during various stages of the drilling and testing program.

Loughlin Water Associates, LLC (Loughlin Water) observed well drilling, described drill cuttings, performed field water quality tests (specific conductance, temperature and pH), collected water samples for water quality analyses by Chemtech Laboratories of Salt Lake City, summarized air-lift test data and recovery measurements, and interpreted the geophysical logs.

AQUIFERS

The geology at the two exploration wells is relatively similar. Two aquifers occur at each location: an upper aquifer in the Nounan Formation and a lower aquifer in the Middle Member of the Bloomington Formation. The aquifers are separated by shale in the Calls Fort Member of the Bloomington Formation.

AIR-LIFT TESTS

END-OF-ROD AIR-LIFT MEASUREMENTS

During the drilling program, National EWP measured the air-lift rate upon finishing each drill rod (about every 20 feet in depth). These were short-term tests with the discharge measured by recording the time to fill a small container (5 to 20 gallons capacity). During drilling, end-of-rod air-lift rates generally increased with depth in each aquifer and submergence of drill rods.

During the drilling process, grab samples of groundwater were usually collected after cuttings had been blown from the borehole upon finishing each drill rod. Samples were analyzed in the field for specific conductance, pH, and temperature.

End-of-rod air-lift rates and field water quality results are summarized as follows:

Exploration Well	Aquifer	Range of Rates (gpm)	Average Specific Conductance (µS)	Average pH (units)	Water Temperature
1	Upper	5 – 50	364	8.0	44 °F
1	Lower	58 – 95	433	7.9	44 °F
2	Upper	50 – 110	408	7.7	44 °F
2	Lower	80 – 150	415	8.0	42 °F

24-HOUR AIR-LIFT TESTS

National EWP performed three 24-hour long air-lift tests: (1) a test in the lower part of the Exploration Well 1 (the Middle Member of the Bloomington Formation or lower aquifer), (2) a test in the lower part of the Exploration Well 2 (the Middle Member of the Bloomington Formation or lower aquifer), and (3) a test in the upper part of Exploration Well 2 (the Nounan Formation or upper aquifer).

National EWP conducted the tests by directing the discharge from the borehole to an 8000-gallon tank and recording the time to fill the tank in 0.1-foot (138-gallon) increments. Results of the 24-hour air-lift tests are summarized below.

Date Started	Exploration Well	Aquifer	Test Duration	Borehole Depth (feet)	Bottom of Drill Rods (feet)	Average Discharge Rate (gpm)	
5/30/2013	1	Lower	24 hours	2800	2400	79	*
6/22/2013	2	Lower	24 hours	2480	2200	92	*
6/25/2013	2	Upper	24 hours	1510**	1480	84	*

* Water sample collected for laboratory analysis.

** Borehole filled and sealed below this depth.

WATER LEVELS

Approximate water level depths in Exploration Well 1 representing non-pumping (non-air-lifting) conditions are estimated at about 900 feet in the upper aquifer and about 1070 feet in depth in the lower aquifer. Approximate water level depths in Exploration Well 2 representing non-pumping (non-air-lifting) conditions are estimated at about 750 feet in depth in the upper aquifer and 1100 feet in the lower aquifer. Note that because the drilling method (reverse-circulation air drilling) produced water while drilling, water levels had only short periods of time to recover during the drilling program; therefore the water level depths estimated above are approximate.

WATER QUALITY

During the 24-hour air-lift tests, water samples were collected every 10 minutes during the first hour and every two hours thereafter for analysis of field parameters (specific conductance, pH, and temperature, and some cases for turbidity). Results are summarized below:

Exploration Well	Aquifer	Average Specific Conductance (µS)	Average pH (units)	Water Temperature	Final Turbidity (NTU)
1	Lower	425	8.0	°F	
2	Upper	368	8.5	°F	9
2	Lower	362	8.4	°F	24

During the two air-lift tests of Exploration Well 2, samples were analyzed in the field for turbidity using a portable field instrument. During the tests of Exploration Well 2, the water discharge was initially turbid but gradually cleared. The final turbidity of the test of the upper aquifer in Exploration Well 2 had a turbidity of 9 NTU; the final turbidity of the test of the lower aquifer in Exploration Well 2 was 24 NTU. Discharge from Exploration Well 1 during the 24-hour tests was relatively turbid because of sloughing of Wasatch Formation exposed in the borehole. Of course, turbidity of water pumped from future production wells will be lower because the Wasatch Formation will be cased and grouted, the production zones will be stabilized, and the wells will be properly developed.

Water samples were collected for analysis of primary, secondary and additional parameters that are a standard suite for new source samples. Analyses by Chemtech-Ford Laboratory are in progress.

CONCLUSIONS

Phase 1 of the proposed expansion of Powder Mountain will have an average annual demand of 65.25 ac-ft and peak-day demand of about 81 gallons per minute (gpm). The DDW requires that a new public water system (PWS) well or wells be tested at 1.5 times the peak-day demand of 81 gpm (about 122 gpm) for a minimum of 24 hours to approve Phase 1.

The well driller conducted air-lift tests at relatively constant rates of (1) 79 gpm from the lower aquifer of Exploration Well 1, (2) 84 gpm in the upper aquifer of Exploration Well 2, and (3) 92 gpm in the lower aquifer of Exploration Well 2. We reviewed the yields, drawdowns, and field water quality data from the tests, and conclude that a single well completed in the upper aquifer at Exploration Well 2 will be capable of (1) supplying the 81-gpm peak-day demand of Phase 1 and (2) being pump-tested at a minimum of 122 gpm (1.5 times the peak-day demand of 81 gpm) for at least 24 hours.

The Summit Group proposes to construct one or two PWS wells near the location of Exploration Well 2, and although it is unlikely that it would be necessary, would construct a well near Exploration Well 1.

If you have any questions or need more information, please do not hesitate to call us at (435) 649-4005 (office).

Very truly yours,

Loughlin Water Associates, LLC

William D. Loughlin, P.G.
Manager, Principal Hydrogeologist

George W. Condrat, P.G., P.E.
Senior Engineer

Figure 1 – Location Map
Figure 2 – Vicinity Map

LICENSED PROFESSIONAL GEOLOGIST
WILLIAM D. LOUGHLIN
5205683-2250
STATE OF UTAH

REGISTERED PROFESSIONAL ENGINEER
6-28-13
NO. 4922
GEORGE W. CONDRAT
State of Utah

Cc: Mr. Russ Watts, P.E. – Watts Enterprises, Inc.
Mr. Rick Everson, P.E. – Watts Enterprises, Inc.

REFERENCES CITED

NV5, Inc., 2013, *Powder Mountain Resort, Water Distribution System Master Plan:* Consultant report prepared for Powder Mountain Resort by NV5, Inc. of Murray, Utah, dated March 2013.