



onsulting Engineers

184 South Winooski Avenue • Burlington • VT 05401 • 802 860 1331 • Fax 802 850 6499 • www.hoyletanner.com

March 12, 2003

Mr. Jay Gamble, General Manager
Mount Sunapee Ski Resort
P.O. Box 2021
Route 103
Newbury, New Hampshire 03255

RE: Wastewater Facilities Evaluation Report

Dear Mr. Gamble

The following letter report constitutes our evaluation of the existing wastewater treatment facilities at the Mount Sunapee Ski Area and its capacity to adequately handle the projected increase in skier visits for the future.

1.0 PROJECT DESCRIPTION

In the summer of 1998, the Mount Sunapee Ski Area was leased to a private ski industry firm, Okemo Mountain Resort. Under the new management, the ski area has incorporated many upgrades to the ski area and to the wastewater treatment system. Based on previous engineering recommendations, they have installed a v-notch weir and ultrasonic meter in the distribution box to measure and record influent lagoon flows. This has allowed for accurate records of flow data during the past five years. Drainage around the lagoons has been improved to reduce the amount of surface run-off that enters the lagoons each year during the spring. This has been accomplished by construction of a berm around the up gradient side of the lagoon and providing a drainage swale to direct run-off from the forested slope around the lagoons. Also, the ski area has made many other improvements to the wastewater systems such as replacing leaky manhole covers with water-tight covers, disconnecting sump pumps from the collection system, and also locating and correcting sources of extraneous inflow and/or infiltration. These changes have improved the operating conditions of the wastewater treatment system considerably since previous evaluations.

Hoyle, Tanner & Associates, Inc. (HTA) has been retained to complete an evaluation of the wastewater treatment and disposal system to determine if the system is capable of handling an increase in skier volumes. Our evaluation includes the review and analysis of the past five years of operating data, including monthly average wastewater influent data, spray application data, skier visits and other data associated with the wastewater facilities. One goal of this study is to evaluate the impact that the various improvements made at the ski area have had on the operations of the wastewater treatment facilities.

Our evaluations include analysis of the lagoons and spray areas. The lagoon evaluation included analysis of meteorological impacts, free board levels and other design factors. Our evaluation focused on the conditions for the last five years. Projected future trends have been evaluated for expected skier visit levels of 275,000, 300,000 and 325,000. The existing wastewater facilities were analyzed to determine their ability to satisfy these anticipated needs. HTA has also reviewed groundwater monitoring reports, and evaluated the overall operation condition of the lagoons and spray areas.

2.0 SKI AREA ATTENDANCE

Ski area attendance is defined as the number of ski tickets sold, ski season pass visits, and employees attending the park during the ski season. Attendance was determined for ski seasons 1998/1999 thru 2001/2002 based on actual recorded data. The current season, 2002/2003, represents accurate data from the ski season opening in November 2002 thru February 2003, and projected data from February 2003 through the end of the season based on historical data. The following table shows the attendance for the past five seasons:

	1998/1999	1999/2000	2000/2001	2001/2002	2002/2003*
Ticketed Skier Visits	109,803	131,511	195,237	159,646	194,990
Season Pass Visits	55,516	58,150	62,599	70,542	66,571
Employees	17,200	23,095	30,375	25,625	28,025
Total	182,519	212,756	288,211	255,813	289,586

*The season 2002/2003 represents actual data (Nov. thru Feb.) and projected data through the end of the season which is based on historical data.

Skier Attendance

Historical records of skier attendance during the ski season are maintained through both the sale of daily lift tickets and season passes. The daily sale of lift tickets was used to determine the daily skier visits at the ski area, and then totalized for the annual skier visits for each of the last five ski seasons. Figures for season pass visits are estimated based on the number of season passes sold and total skier visits. The table above summarizes attendance for the past five ski seasons.

Employees

Employee figures were obtained from the ski area's payroll records. The amount of skiers varies from year to year and also with the length of the ski season. As

attendance increases, so have the employee numbers. Earlier seasons used original figures of 125-225 employees.

3.0 EXISTING WASTEWATER FLOWS

Wastewater inputs to the ski area's treatment and disposal facilities come from several sources, including skiers, summer visitors, and employees. There are also sources that are directly influenced by the local weather conditions, such as infiltration and inflow into the sewage collection system as well as direct precipitation into the lagoons.

Ski-Season Wastewater Flows

To correlate wastewater flows to the attendance at the mountain, wastewater flows to the lagoons during the last five ski seasons were analyzed. Influent flows to the lagoons are measured and recorded by a v-notch weir and ultrasonic meter located in the distribution box. Daily wastewater flows were totalized for each of the past five ski seasons and correlated with the ski season attendance for each ski season to determine a per person wastewater flow rate.

A summary of the total influent wastewater flows per season, the total number of attendance per season, and the corresponding wastewater flow rate in gallons per person are presented in the following table:

Table 3-1 Ski Season Wastewater Data			
Ski Season Year	Wastewater Influent (gallons) ¹	Attendance	Wastewater Flowrates (gal/person)
1998-1999	970,417	182,519	5.32
1999-2000	856,522	212,756	4.03
2000-2001	1,010,728	288,211	3.51
2001-2002	765,739	255,813	2.99
2002-2003 ²	651,973	194,598	3.35

Notes:

¹ Wastewater Influent is the total gallons during the ski season year based on the opening and closing dates of each ski season.

² Ski season 2002-2003 data is not complete.

From the last five years of operating data, one can see that the corresponding wastewater flow rate per person has decreased. This is very likely due in part to the implementation of several flow saving measures, such as low flow fixtures, improvements to the collection system, and other improvements aimed at reducing wastewater flows. Based on the available data, Hoyle, Tanner and Associates, Inc.

feels that a 4 gallon per person wastewater flow rate for estimating future ski season wastewater flows is reasonable.

Off-Season Wastewater Flows

For the above wastewater correlation, we did not include summer visitors, summer-time employees, nor summer wastewater flows. However, wastewater flows into the lagoons that occur during the remainder of the year, or "off-season," need to be considered when evaluating the total capacity of the lagoons. For the purpose of determining the off-season wastewater flows into the lagoons, we subtracted the total ski season wastewater flows from the total annual wastewater flows for each of the last five years. The resulting off-season flows are summarized in the following table:

Season Year ¹	Annual Wastewater Influent (gallons)	Ski-Season Wastewater Influent (gallons) ²	Off-Season Wastewater Influent (gallons)
1998-1999	1,494,670	970,417	524,253
1999-2000	1,226,590	856,522	370,068
2000-2001	1,261,832	1,010,728	251,104
2001-2002	1,048,150	765,739	282,411
2002-2003 ³	N/A	651,973	N/A

Notes:

1. The season year is from November thru October.
2. Ski-Season Wastewater Influent is the total gallons during the ski season year based on the opening and closing dates of each ski season.
3. Season 2002-2003 data is not complete.

Infiltration/Inflow

Total inputs into the storage lagoons include inflow and infiltration (I/I) into the sewer collection system. Inflow is defined as extraneous water that enters into a sewer collection system from sources that are directly connected, such as sump pumps, catch basins, manhole covers, and other direct inlets. Infiltration is defined as extraneous water that enters into the sewer system from the ground through sources such as defective pipes, pipe joints, connections and manhole walls. Infiltration is directly influenced by groundwater levels.

In our analysis, I/I is included as a part of the total influent flow measured and summarized in Table 3-1. We have seen from previous studies, that while the system does not appear to have excessive I/I, the collection system does experience a steady nighttime flow, which can be associated with infiltration and/or inflow. For the purpose

of our evaluation, I/I is considered as part of the total wastewater influent amounts on both an annual basis and ski season basis, and is therefore accounted for in the per person wastewater flow rate correlation.

Meteorological Inputs

The meteorological inputs have been examined a number of ways. In our 1999 *Wastewater Lagoon and Spray Irrigation System Phase II Report*, an empirical analysis of using the Thornthwaite method to calculate the evaporation losses from the lagoons and run-of areas was used. This previous report estimated a net total of 2.4 million gallons per year could be expected from meteorological factors.

Another method for estimating the meteorological inputs is to look at historical operating data. The difference between the annual wastewater sprayed (effluent) in the irrigation field and the annual wastewater that flows into the lagoons (influent) can be considered as net annual meteorological inputs to the lagoons. This accounts for precipitation, evaporation losses, and direct run-off into the lagoons. The following table shows the annual meteorological inputs for the seasons of 1998/99 thru 2001/02:

Season Year ¹	Annual Influent (gallons)	Annual Effluent (Spray) (gallons)	Meteorological Inputs (gallons)
1998-1999	1,494,670	2,896,971	1,402,301
1999-2000	1,226,590	3,587,830	2,361,240
2000-2001	1,261,832	3,894,900	2,633,068
2001-2002	1,048,150	2,534,200	1,486,050
Average	1,257,811	3,228,475	1,970,665

¹The season year is from November thru October.

By examining the last four years of operating data, one can see that the two methodologies result in similar estimates of meteorological input into the lagoons. The 2000/2001 season was an unusually very wet year, whereas, 2001-2002 season was a very dry year. Previously recommended improvements have been made to reduce the runoff that flows into the lagoons from the adjacent hillside. These improvements, together with the historical average of less than 2.0 million gallons, lead us to recommend an allowance of 2.4 million gallons for future meteorological inputs.

Lagoon Capacity

In our *Wastewater Lagoon and Spray Irrigation System Phase II Report, 1999*, the active storage capacity of the lagoons had been estimated to be approximately 5.48 million gallons. This was based on the past operating conditions of maintaining 1' of freeboard and a 1' minimum operating depth. Operator reports have shown that no sludge accumulation occurs in Lagoon #3 nor in Lagoon #2, and little if any in Lagoon #1. Taking this into consideration, it is acceptable to conclude that the active storage space is approximately 5.48 million gallons.

Water level measurements in the lagoons were analyzed for the past four operating years to determine the reasonable operating capacity of the lagoons. Historically, the maximum depths seen in the lagoons occur just before spraying starts. The ski area spray season begins on May 1 which makes this a critical time, and represents the maximum water level depth in the lagoons per year. The maximum water level measured over the past four years occurred on April 27, 2000. This was 65.5 inches, which correlates to a lagoon freeboard of approximately 2.5 feet. This is within the operating parameters of the lagoons.

Groundwater Monitoring Data

Groundwater data from monitoring wells installed down gradient of the lagoon were reviewed and show that there appears to be no evidence of groundwater degradation in the vicinity of the lagoon or spray area.

Spray Season Capacity

The Ski Area is permitted to spray 250,000 gallons per week of lagoon effluent on its spray disposal fields, which consists of approximately 5 acres. Spray application is permitted from May to October or until leaf drop. Spraying is also limited during this period and is not allowed during rain events or when ground water levels are high. Theoretically, there are approximately 24 weeks of available spray season. However, wet weather and high groundwater conditions reduce this by as much as 25 to 30 percent. Based on historical spray data, we would estimate that the annual capacity of the spray area is between 4.2 and 4.5 million gallons per season.

4.0 FUTURE CONDITIONS

This section of the report will focus on projecting wastewater flows for future conditions. Future wastewater flows will be based on projected future trends for expected skier visit levels during the ski season, employee figures, off-season wastewater flows, and meteorological inputs into the lagoons.

Future Skier Attendance

Projections were made for the following three levels of skier visits:

Current:	275,000 skiers
Future:	300,000 skiers
Future:	325,000 skiers

It is assumed that these expected levels of skier attendance include season pass holders.

Future Ski Season Employee Attendance

Employee attendance during the ski season must be included in the wastewater flow projection as well. The average employee attendance per ski season from seasons 00-01 thru 01-02 used in this report was approximately 28,000 employees. The current 2002/2003 season was not included in this average, since the season is not completed. This amount of employees will be added to the projected number of skiers for total ski season attendance figures.

Projected Ski Season Wastewater Flows

To project ski season wastewater flows, we applied a wastewater flow estimate of 4 gallon per person to the total ski season attendance for the different targeted skier visit levels. The resulting ski season wastewater flows are shown in Table 4-1.

Projected Off-Season Wastewater Flows

For the purpose of determining projected off-season wastewater flows, we assumed that current attendance levels and wastewater flows generated during the summer months are going to remain fairly consistent from year to year. Taking the average of these flows from the past three years results in a projected off-season wastewater flow of approximately 300,000 gallons. The past three years are more representative of the actual conditions seen at the treatment facility due to system improvements made after the 1998/1999 season.

Projected Meteorological Inputs

A future projected meteorological input amount of 2,400,000 gallons was used for each targeted skier visit level.

Total Projected Wastewater Flows

The following table shows the total amount of projected wastewater flows for each of the targeted skier visit levels:

Skier Visits	275,000	300,000	325,000
Ski Season Employees	28,000	28,000	28,000
Total Ski Season Attendance	303,000	328,000	353,000
Ski Season Wastewater Flows @ 4 gal/person (gallons)	1,212,000	1,312,000	1,412,000
Off-Season Wastewater Flows (gallons)	300,000	300,000	300,000
Meteorological Inputs (gallons)	2,400,000	2,400,000	2,400,000
Total Wastewater Flows (gallons)	3,912,000	4,012,000	4,112,000

5.0 ABILITY OF EXISTING WASTEWATER FACILITIES TO MEET FUTURE NEEDS

The existing wastewater treatment system was evaluated to determine its ability to satisfy the projected capacity needs for the projected skier visits.

As discussed previously, review of the lagoon capacity indicates a total usable volume of 5.48 million gallons. In addition, the last several years of operating data indicate that ski seasons ended with an average freeboard condition at the lagoons of approximately 2.5 feet. Therefore, the projected flows should be able to be accommodated in the lagoons. While the capacity requirement of the lagoons is very weather dependent, it appears that there will be adequate storage capacity for the projected wastewater flows associated with the targeted levels of skier visits.

The Ski Area is permitted to spray 250,000 gallons per week of lagoon effluent on its spray disposal fields, which consists of approximately 5 acres. Spray application is permitted from May to October or until leaf drop. Spraying is however, restricted and is not allowed when groundwater levels are high and is further limited by precipitation. Earlier in this report we estimated that the spray area will have an effective spray capacity of between 4.2 and 4.5 million gallons depending on the weather and groundwater conditions.

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6.0 CONCLUSIONS


The future projections of skier visits will result in an increase in wastewater flows to the Mount Sunapee Ski Resort's wastewater treatment facilities. Based on the operating data of the past five years, an estimate of 4 gallons per person is appropriate for projecting wastewater flows. The total capacity requirements also include other flow inputs, some of which are very-weather dependent. The available data of actual operating conditions support the estimates of future wastewater storage and disposal capacity needs for the future projection levels.

Both the storage and disposal requirements of the Mount Sunapee Ski Resort's wastewater treatment facilities are greatly influenced by the weather. Based on our flow projections, it appears that the existing system will be adequate to handle the increase in capacity associated with the future projected skier visits. While our flow projections take into account meteorological inputs, there is no way of guaranteeing the weather conditions for upcoming years. There is a significant margin of safety in the available storage volume of the lagoons and a smaller, but adequate, margin of safety in the available spray area.

We appreciate the opportunity to provide you with this evaluation. If you have any questions or comments on this report please don't hesitate to call.

Very truly yours,

HOYLE, TANNER & ASSOCIATES, INC.



Eugene J. Forbes, P.E.
Vice President