Appendices

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June 18, 1999

Mr. Richard Flanders, Jr.
Water Supply and Pollution Control Division
Department of Environmental Services
64 North Main Street
Concord, New Hampshire 03301

**RE: Mt. Sunapee Base Area Well Yield Evaluation
Newbury, New Hampshire**

Dear Mr. Flanders:

Pioneer Environmental Associates, LLC. (Pioneer) of Middlebury, Vermont has completed testing associated with the re-evaluation of the yield of the Mt. Sunapee Base Area Well at the ski area at Mt. Sunapee State Park located in Newbury, New Hampshire (see site location map, page 1 of Attachment). In accordance with the June 1997 Design Standards for Small Public Drinking Water Systems (Section Env-Ws 372.14), we performed a 48-hour constant discharge test for this well from May 18 through 20, 1999. In addition to the required pumping test, we have also completed a step-drawdown test at the well on May 17, 1999, and a recovery test following the end of the constant discharge test on May 20, 1999. These additional tasks were performed to provide additional data on the hydraulics of the well and the bedrock aquifer in which the well is completed to help characterize the source capacity of this well. We also collected water samples prior to the end of the 48-hour test for analysis for the constituents listed in Table 372-4 of Env-Ws 372.

In summary, the aquifer testing indicates that, at a minimum, the Mt. Sunapee Base Area Well has a source capacity of 109.6 gallons per minute (gpm), or 157,824 gallons per day (gpd), based on our capacity analysis. As specified in Section Env-Ws 372.11(b), a minimum total source capacity of 1½ times the design flow rate is required for public non-community water systems such as this. A source capacity of 109.6 gpm is adequate to serve a design flow rate of 73.1 gpm, or 105,216 gpd. This exceeds the currently permitted source capacity of 70 gpm which is sufficient to serve a design flow rate of 67,200 gpd. A detailed description of the testing program follows.

INTRODUCTION

The ski area at Mt. Sunapee State Park has historically been operated by the New Hampshire Department of Resources and Economic Development (DRED). However, as of the 1998-99 ski season, the ski area is operated by Okemo Mountain Resort, as Mount Sunapee Resort, through a lease agreement with the State of New Hampshire. Because of improvement plans being implemented at the resort, primarily the construction of the new Sunapee Base Lodge, a re-evaluation of well capacity was requested by the Department of Environmental Services. The water system is a transient non-community system as it serves a transient, rather than residential, population.

The Base Area Well is located near the base of the Duckling chairlift at the Mt. Sunapee Resort (Attachment, page 1). The well is used to meet the water needs of the base area of the resort's facilities. Details of the well are as follows:

- Date Drilled: February 1980
- Drilled By: Gallagher and Philbrick, Concord, NH
- Drilling Method: Pounder/Percussion
- Depth of Well: 244 feet
- Depth to Bedrock: 47 feet
- Casing Length: 63 feet
- Static Level: 10 feet

According to a sanitary survey performed on November 1, 1993 by Mr. Jack Mollica of the Department of Environmental Services Water Supply Engineering Bureau, the Base Area Well has a permitted source capacity of 70 gpm, sufficient to serve a design flow rate of 67,200 gpd. During a previous pumping test performed for this well on June 4-6, 1980, the water level in the well was slowly rising while being pumped at a rate of 70 gpm. This suggests that the capacity of the well is greater than the currently approved 70 gpm. Therefore, this most recent testing was performed to determine the source capacity of the well to a greater degree of accuracy.

WELL TESTING

Testing of the Base Area Well occurred from May 17-20, 1999 and consisted of the following:

- Step-Drawdown Test
- 48-Hour Constant Discharge Test
- Observation Well Monitoring at Shop Well
- Recovery Test
- Collection of Water Quality Samples

The production well data (step-drawdown test, constant discharge test, and recovery test) are presented on pages 2 through 21 of the Attachment. The results and evaluation of the water quantity testing are discussed below.

<u>Step Drawdown Test</u>

A step-drawdown test was performed at the well on May 17, 1999. The purpose of this test was to determine a safe pumping rate for the 48-hour pumping test. Additionally, the step-drawdown test data allows for the development of a head loss equation for the well to determine the components of drawdown in the well attributable to formation (aquifer) drawdown and turbulent (in-well) drawdown.

The step-drawdown test consisted of six 60-minute step performed at mean discharges ranging from 11.5 gpm to 181.2 gpm. At the end of the sixth step, the pump was allowed to run for an additional 38 minutes at which time the water level was 75.62 feet, representing a drawdown of 64.99 feet. Step-drawdown test data are included on pages 2 through 14 of the Attachment.

From the step-drawdown test data, a head loss equation has been derived for the Base Area Well. The head loss equation is as follows:

$$s_w\ (60\text{-}minute) = 0.199Q + 0.000784Q^2$$

where:

s_w = drawdown in production well at a pumping duration of 60 minutes (feet)
Q = pumping rate (gpm)

This equation can be used in conjunction with the 48-hour test constant discharge test data to determine the source capacity of the well. The step-drawdown test analysis is presented on pages 24 through 25 of the Attachment.

<u>Constant Discharge and Recovery Tests</u>

A 48-hour constant discharge test was performed at a mean discharge of 134.4 gpm from May 18-20, 1999 (Attachment, pages 15 through 19). At the conclusion of the 48-hour test, the production well water level was 115.21 feet below top of casing, representing a drawdown of 105.59 feet. A generally linear drawdown curve (on semi-logarithmic data plot) was maintained during the initial 1,000 minutes (16.7 hours) of the test at which time it appears that a discharging boundary within the bedrock aquifer was encountered. The discharging boundary resulted in the steepening of the drawdown curve, which remained linear on the semi-logarithmic data plot at the steeper slope for the remainder of the test (Attachment, page 17).

Section Env-Ws 372.14(a) indicates that the 48-hour pumping test shall demonstrate stabilized drawdown (less than one inch of drawdown in two hours) for at least the last 12-hours of the test. This criterion was not met during the final 12 hours of the test as the water level was declining at an average rate of approximately 1.9 feet every two hours during this time period. However, the test was shut off at 48 hours for two primary reasons:

1) The testing performed for this well exceeds the requirements of Env-Ws 372 as a step-drawdown test and recovery test were performed to provide additional data concerning the source capacity of the well.

2) This is the main water source for Mt. Sunapee Resort, and it had been disconnected since May 14, 1999 when the temporary test pump was installed to allow for the well testing. A large event (the Mt. Sunapee Bike Race) was scheduled for May 22, 1999 and the permanent pump needed to be reinstalled and the reservoir filled prior to this event to accommodate the anticipated demand.

The testing performed for the Base Area Well provides adequate data to characterize the yield of the well.

Following the constant discharge test, recovery measurements were made at the production well and the maintenance building observation well (Attachment, pages 20 through 23). At the conclusion of 257 minutes of recovery measurements, the water level in the production well was 45.8 feet (drawdown = 36.2 feet) representing a recovery of 66 percent. At this time, the process of removing the temporary test pump and reinstallation of the permanent pump needed to begin to ensure its timely completion.

<u>Observation Well Monitoring</u>

Water level measurements were collected during the testing procedures at the Mt. Sunapee Shop Well located approximately 1,500 feet northeast of the Base Area Well to determine if there were any interference effects between the two wells. Well details for the Shop Well are as follows:

- Date Drilled: May 1985
- Depth of Well: 360 feet
- Depth to Bedrock: 185 feet

- Casing Length: 200 feet
- Static Level: Overflowing (at time of drilling)
- Driller's Yield: 5 gpm

As can be noted on the data plot for the water level data collected at this well (Attachment, pages 22 through 23), the pumping of the Base Area Well does not affect the water level at the Shop Well.

Water Quality Sampling

Water quality samples were collected just prior to the end of the 48-hour constant discharge test to be analyzed for the constituents listed in Table 372-4 of Env-Ws 372. The pH was measured in the field to be 6.98, and the temperature of the discharge water was 9.1ºC. Complete analytical results are included on pages 29 through 30 of the Attachment. The concentrations of all analytes tested for are below the Environmental Protection Agency's Maximum Contaminant Levels. Total Coliform tested as being present; however, the water samples collected represent the raw water quality from the well, and not after treatment prior to distribution. In addition, *E. Coli* was absent in the sample.

CAPACITY ANALYSIS

Section Env-Ws 372.13(c) indicates that the permitted production volume shall not be greater than the source capacity based on a 24-hour period, as defined by the 48-hour constant discharge test. For the purposes of this analysis, the total available head (TAH) in the well is 105.6 feet, as this is the maximum drawdown obtained during the testing.

To determine the source capacity of this well at steady-state conditions, which is what is essentially required by Env-Ws 372 given the stabilization requirement for the pumping test, the capacity analysis for the Base Area Well was performed by modeling the noted discharging boundary using the method developed by Stallman (Ground-Water Hydraulics, 1972). The aquifer coefficients of transmissivity (T) and storativity (S) were calculated from data collected during the 48-hour constant discharge test and recovery test (Attachment, pages 17 through 21). The calculated values are summarized in Table 1.

Table 1: Calculated Aquifer Coefficients from Pumping Well Data		
Test	**T (ft^2/day)**	**S (dimensionless)†**
48-hr. pumping	215.26	6.41
48-hr. recovery	197.32	---

Table 1: Calculated Aquifer Coefficients from Pumping Well Data		
Test	T (ft^2/day)	S (dimensionless)†
† S value used in equations to predict long-term drawdown, does not reflect actual aquifer S value		

To accurately model the aquifer behavior during pumping conditions, an aquifer T of 215.26 ft^2/day is used in the calculations to determine the source capacity of the well. As footnoted in Table 1, the calculated S values are not indicative of the actual storativity of the bedrock aquifer. However, the values can be used in the long-term capacity analysis equations to predict the drawdown in the pumping well over long periods of time. Essentially, the aquifer equations define the drawdown curve of the production well and, thus, can be used to predict the long-term drawdown.

The Stallman method is an analysis that models boundaries, either discharging or recharging, that are noted during aquifer tests. The boundary is modeled via a curve matching technique to determine the Stallman constant of proportionality (K). This is illustrated for the Base Area Well on page 18 of the Attachment. A K value of 10 was determined for the Base Area Well. This K value, and the values of T and S determined for the aquifer are used in the equations developed by Stallman to model the behavior of the aquifer under extended pumping conditions. The Stallman equations are presented on pages 27 and 28 of the Attachment.

The well capacity has been evaluated based on a seven day peak demand, to account for the one-week holiday periods during the winter season when the demand will be the greatest. Using the Stallman equations, the calculated source yield using a total available head of 105.9 feet is 109.6 gpm (157,824 gpd) for a continuous seven day pumping period. Therefore, in accordance with Section Env-Ws 372.11(b), a source capacity of 109.6 gpm is adequate to serve a design flow of 73.1 gpm, or 105,216 gpd. Equations used in the capacity analysis are included on page 27 of the Attachment, and calculations specific to the Base Area Well are included on page 28 of the Attachment.

This capacity analysis is very conservative (i.e., results in a low source capacity) because of the assumptions used in performing the analysis. These include:

- A total available head for the well based only on the tested portion of the well bore, ignoring the remaining well bore below this point (approximately 129 feet). In essence, the analysis uses only 45% of the projected total available head. This is extremely conservative given that the well was drilled using a pounder/percussion drilling methodology. The main water bearing fractures in wells of this type are usually at the bottom of the well bore, because additional percussion drilling becomes difficult after a substantial water bearing fracture zone is encountered.

- The continuous pumping for a seven day period at the source capacity, with no recovery or recharge events.
- The 1.5 reduction factor applied to the calculated source capacity to calculate the design flow able to be accommodated by the well.

Therefore, a permitted source capacity of 109.6 gpm is requested for this well. The actual source capacity is likely significantly greater than the requested capacity given the conservative assumptions used in the analysis. The aquifer characteristics noted during the 48-hour constant discharge test indicate that the source capacity may equal or exceed the constant discharge pumping rate of 134.4 gpm.

SANITARY PROTECTIVE AREA

A sanitary protective area has been designated for the Mt. Sunapee Base Area Well in accordance with Section Env-Ws 372.13. In this case, given the requested permitted source capacity of 157,824 gpd, the sanitary protective area is comprised of the area of land encompassed by a circle around the well with a 400-foot radius. This land is entirely included within Mt. Sunapee State Park land and the lease area.

The bottom termini of two chairlifts (Duckling double and North Peak triple) and the Lower Mountain Base Lodge exist within the sanitary protective area. According to Mt. Sunapee Resort personnel, there is no storage of petroleum products or hazardous materials within this area. A large expanse of lawn exists between the well and the North Peak triple chairlift to the west. Given this area's location within the sanitary protective area, no chemical soil fertilization will occur on this lawn area. No wastewater disposal systems are located within the sanitary protective area.

Please call with any questions or comments you may have during your review of this report. I hope to hear from you soon.

Sincerely,

Eric R. Hanson
Senior Hydrogeologist

cc: Tim Drew
Jay Gamble

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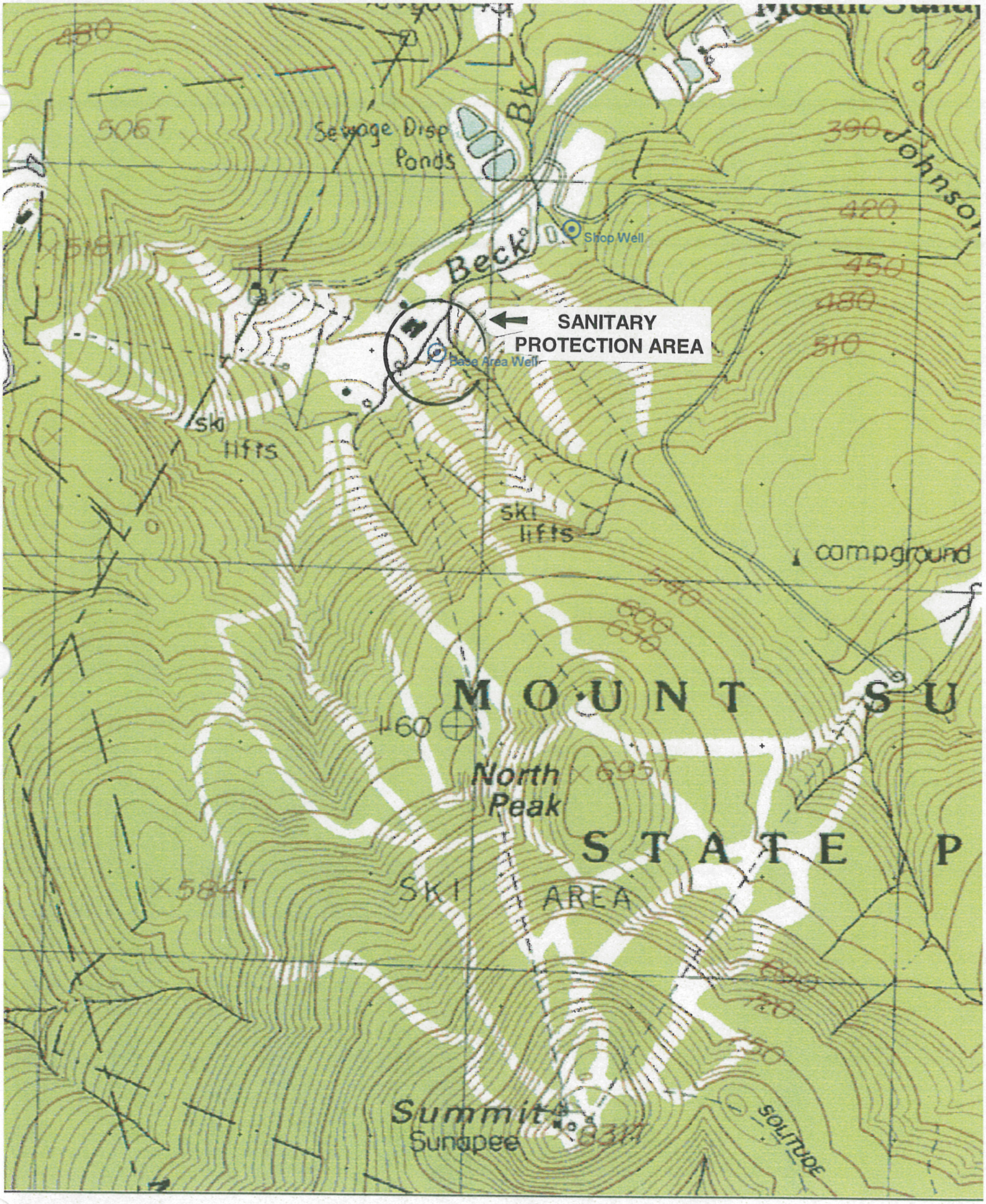

Name: NEWPORT
Date: 6/4/99
Scale: 1 inch equals 1000 feet

Location: 043° 19' 34.4" N 072° 04' 35.1" W
Caption: Mount Sunapee Resort
Base Area Well Location Map
Newbury, New Hampshire

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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:

Table 2-1
Annual Ski Season Attendance

	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:

Table 3-2
Off-Seasonal Wastewater Data

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:

Table 3-3
Meteorological Inputs into Lagoon

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**

[1]The season year is from November thru October.

By examining the last four years of operating data, one can seen 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:

Table 4-1
Projected Wastewater Flows

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.

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

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CONSULTING SCIENTISTS

MEMORANDUM

To: Jay Gamble
From: Sean W. Donohue
Subject: Wetland and Surface Water Delineation Dodd Johnson Parcel Goshen, New Hampshire
Date: April 19, 2004

Introduction

Pioneer Environmental Associates, LLC. (Pioneer) has completed field delineation of wetlands and surface water features on approximately 15 acres of the subject property (see site location map on page 1 of the Attachment), in the vicinity of the proposed chairlift base station at the request of Mount Sunapee Resort. Field investigation was conducted by Sean Donohue, Wetland Scientist of Pioneer, on September 9, September 10, and October 1, 2003. Wetland determinations were made using the criteria outlined in the United States Army Corps of Engineers (Corps) Wetlands Delineation Manual (Corps 1987). The purpose of the investigation was to identify wetlands and surface water features within the designated portion of the property that are subject to federal and state regulation, for project planning purposes.

Previously, on November 1, 2001 Shelley Gustafson, Senior Wetland Scientist of Pioneer, conducted a preliminary wetland walkover on the entire 130 acre parcel owned by Dodd Johnson (see cover letter, memorandum, and attachment dated January 25, 2002 summarizing this investigation on pages 2 through 9 of the Attachment). Wetlands delineated by Pioneer in 2003 are primarily associated with the stream identified as "Perennial Stream 1" in the above-referenced memorandum.

The subject property is located in the town of Goshen, New Hampshire, on the east side of Brook Road. To the north, east, and south the property is bordered by forested land. To the west the property is bordered by forested land and private residences located along Brook Road. Delineated wetland and surface water features are shown on the map on page 10 of the Attachment.

Site Description

The property is currently managed as a woodlot, and a network of skidder trails and logging roads are present on the site. The site has been heavily logged, and saplings common to the uplands on the site include *Quercus rubra* (northern red oak), *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple), and *Betula papyrifera* (paper birch). Other saplings that are also present in the upland vegetation communities include *Prunus virginiana* (chokecherry), *Fraxinus americana* (white ash), and *Acer pennsylvanicum* (striped maple). Larger *Pinus strobus* (white pine) and *Tsuga canadensis* (eastern hemlock) are occasionally present in the sparse overstory, and inclusions of hemlock dominated stands that have not been logged as heavily are also present. The various wetland communities present on the site are described in the relevant sections below.

Site topography is substantial, with a steady increase in elevation from west to east. Elevation of the project area ranges from approximately 430 feet above sea level at the west end of the property and 570 feet above sea level at the eastern edge of the site, based on United States Geological Survey topographic mapping. The project area lies at the western foot of Mount Sunapee, and is located within the watershed of the ## River.

Soils on the site are primarily composed of ablation and basal glacial till, and generally have textures of sandy loam to loamy sand. The National Resources Conservation Service (NRCS) Soil Survey of Sullivan County, New Hampshire shows soils on the property to be mapped as Mondadnock (well-drained), Monadnock-Hermon association (well-drained to somewhat excessively drained), Marlow (well-drained), and Lyme-Moosilauke loams (somewhat poorly drained to poorly drained) series soils. Field investigation has verified that hydric soil inclusions are present along the riparian corridor within the area of investigation.

National Wetland Inventory (NWI) mapping of the project area shows a wetland complex located at the western edge of the project area (see site location map on page 1 of the Attachment). This complex is identified as a scrub-shrub/forested wetland feature on the NWI mapping, which is consistent with the observed characteristics of the portion of the wetland that was delineated.

Fourteen wetlands were identified within the area of investigation, and were flagged using pink wetland delineation tape and labeled with the year, wetland number, and flag number (i.e., 2003-1-1). The top of bank of one perennial stream was also flagged. Wetland and top of bank flagging was located by Pioneer using sub-meter Global Positioning System (GPS) and transferred onto the wetland delineation map. The wetlands and surface water features identified in the project area are summarized in Table 1 and discussed in detail below.

Table 1: Summary of Wetland and Surface Water Features

Feature Identification	Jurisdictional Classification	Description
2003-1	Corps/ NHDES	Riparian Fringe Wetland
2003-2	Corps/ NHDES	Forested Riparian Wetland
2003-3	Corps/ NHDES	Forested Riparian Wetland
2003-4	Corps/ NHDES	Riparian Fringe Wetland
2003-5	Corps/ NHDES	Riparian Seepage Wetland
2003-6	Corps/ NHDES	Forested Riparian Wetland
2003-7	Corps/ NHDES	Scrub-Shrub/ Forested Wetland
2003-8	Corps/ NHDES	Emergent/ Scrub-Shrub Wetland
2003-9	Corps/ NHDES	Riparian Fringe Wetland
2003-10	Corps/ NHDES	Disturbed Riparian Wetland
2003-11	Corps/ NHDES	Constructed Riparian Wetland Ditch
2003-12	Corps/ NHDES	Forested Riparian Wetland

Table 1: Summary of Wetland and Surface Water Features		
Feature Identification	Jurisdictional Classification	Description
2003-13	Corps/ NHDES	Riparian Fringe Wetland
2003-14	Corps/ NHDES	Disturbed Forested Riparian Wetland
TB-1	Corps/ NHDES	Perennial Stream

Riparian Wetlands

As indicated in Table 1, twelve riparian wetlands were delineated along the corridor of Stream TB-1. The vegetation communities of these features have been influenced by the previous logging activity on the property, and most exhibit early successional vegetation. All of these wetlands are small in size and occupy riparian terraces, areas of groundwater seepage along the streambank, or the ordinary high water (OHW) of Stream TB-1. Logging disturbance history in the features is variable, ranging from none to evidence of excavation associated with construction of logging trails. Most of the wetlands exhibit some indication of recent logging activity. Some wetland features are located along the fringe of the channel of Stream TB-1 and are dominated by herbaceous growth, while others are forested features along the riparian corridor of Stream TB-1.

Herbs and shrubs typical of these wetlands include *Onoclea sensibilis* (sensitive fern), *Spirea latifolia* (meadowsweet), *Carex crinita* (fringed sedge), and *Impatiens capensis* (jewelweed). Asters and goldenrods are also common in these wetlands and include *Aster novae-angilae* (New England aster), *Solidago canadensis* (Canada goldenrod), *Solidago gramnifolia* (grass leaved goldenrod), and *Solidago rugosa* (rough-stemmed goldenrod). *Osmunda cinnamomea* (cinnamon fern), *Thelypteris thelypteroides* (marsh fern), *Carex lurida* (shallow sedge), *Spirea tomentosa* (steeplebush), *Scirpus cyperinus* (woolgrass), and *Rubus allegheniensis* (blackberry) are other herbs and shrubs that are present in some of these wetland features, but not as common.

Betula alleghaniensis (yellow birch) and *Acer rubrum* (red maple) saplings are very common to these riparian wetlands. Striped maple, hemlock, and other saplings more typical of the uplands on the site are present but less prevalent. Presence of woody vegetation varies between wetlands and is primarily a function of the extent of previous logging activity and successional phase. As with adjacent uplands, large overstory trees are less common. Some features are almost entirely devoid of woody vegetation while others have a dense sapling layer. In certain upland areas with non-hydric soils, hydrophytes that also function as aggressive post-disturbance colonizers are present in the species composition. Photographs 1, 2, and 3 on pages 11 and 12 of the Attachment depict selected riparian wetlands and adjacent uplands on the property.

The soils along the riparian corridor tend to exhibit horizons and profile development that have been influenced by depositional processes associated with Stream TB-1. Soil profiles often exhibit a sandy loam A horizon underlain by a horizon of sandy parent material. In wetland areas the A horizon exhibits a dark color (black or dark brown), and the underlying horizon exhibits a gray color, often with redoximorphic features. Soils in upland portions of the riparian corridor lack dark A horizons and/or are not underlain by horizons exhibiting redoximorphic features that suggest soil saturation within one foot of the surface for significant durations during the growing season. At the location of skidder roads and stream crossings, the upper part of the soil profile has been significantly altered, and constructed drainage ditches are evident in some areas.

At the time of field investigation, wetland hydrology in these riparian wetland features was evidenced by active groundwater seepage, soil saturation within one foot of the surface, and/or drainage patterns within the wetland boundary.

The Highway Methodology of the United States Army Corps of Engineers (Highway Methodology) for wetland evaluation identifies 13 different ecological, social, and economic functions provided by wetlands, which can be utilized as a framework for conducting wetland functional assessments. As summarized in Table 2, the riparian wetlands that have been delineated on the property may contribute to the following wetland functions and values within the landscape:

- floodflow alteration
- groundwater discharge and recharge
- retention of sediment and pollutants
- nutrient removal
- sediment/streambank stabilization

In addition, smaller species of wildlife may utilize the riparian corridor in which these features are located as a protected travel corridor.

Table 2: Matrix Summary of Wetland Functions

Wetland Unit	Groundwater Discharge/ Recharge	Sediment/ Toxicant/ Pathogen Retention	Nutrient Removal	Floodflow Alteration	Sediment/ Streambank Stabilization
2003-1					
2003-2	*	*	*	*	*
2003-3	*	*	*	*	*
2003-4	*	*	*	*	*
2003-5	*		*		
2003-6	*	*	*	*	*
2003-9	*		*		
2003-10	*	*	*	*	
2003-11					
2003-12	*	*	*	*	*
2003-13	*		*		*
2003-14	*	*	*	*	*

* = Function associated with a given wetland

Scrub-Shrub/ Forested Wetland Complex

Wetland 2003-7 consists of a scrub-shrub/forested wetland complex that is identified on NWI mapping. Stream TB-1 also drains into and runs through Wetland 2003-7. *Salix sp.* (willow), *Alnus rugosa* (speckled alder), goldenrods, asters, meadowsweet, *Populus tremuloides* (quaking aspen), and sedges are common to the portion of the wetland that was delineated. Red maple and white ash with shallow root systems are also present.

Along the periphery of the wetlands sensitive fern, cinnamon fern, and *Osmunda regalis* (royal fern) are also present. Adjacent upland communities are typical of the site.

Wetland soil profiles along the delineated boundary tend to exhibit a brown, fine sandy loam A horizon that is friable, and depleted B horizons or B horizons with depletions grading into a depleted matrix color within 20 inches of the surface. However, other areas of the wetland have a dark, thick A horizon underlain by a sandy horizon with a gray color and redoximorphic concentrations and depletions.

Data plots from Wetland 2003-7 and adjacent uplands are included on pages 13 to 16 of the Attachment. In addition, Photographs 4 and 5 on pages 12 and 17 of the Attachment depict these wetland and upland data plots.

Based on functions listed in the Highway Methodology, Wetland 2003-7 has the potential to contribute to the following wetland functions and values:

- floodflow alteration
- groundwater recharge/discharge
- retention of sediment, nutrients and pollutants
- production export (for wildlife)
- sediment/streambank stabilization
- wildlife habitat
- aesthetics

Scrub-Shrub/ Emergent Wetlands

Wetland 2003-8 is a scrub-shrub/emergent wetland located on the north side of the existing unpaved access road. Wetland 2003-7 and Wetland 2003-8 appear to have been contiguous prior to construction of the road, and still share a hydrologic connection via a 12 inch diameter metal culvert.

Meadowsweet, fringed sedge, jewelweed, New England aster, goldenrods, sensitive fern, and speckled alder are common to Wetland 2003-8. Adjacent uplands are typical of the site.

The soil profile is composed of a dark olive-gray A horizon with pieces of undecomposed organic material and oxidized rhizospheres, that is underlain by a depleted B horizon within 12 inches of the surface. The soil texture is fine sandy loam that is friable in the A horizon and firm in the B horizon. Free water was observed at two inches below grade at the time of field investigation. Although a significant amount of surface and subsurface water movement appears to occur in Wetland 2003-8, a stream with a defined channel is not present in the delineated portion of the wetland. The wetland boundary extends beyond the delineated area.

A small constructed ditch on the north edge of the existing access road drains into and is contiguous to Wetland 2003-8. The ditch contains hydric soils, and vegetation within the ditch is similar to Wetland 2003-8. The average width of the ditch is three feet.

Based on the functions listed in the Highway Methodology the delineated portion of Wetland 2003-8 may contribute to the following wetland functions and values:

- floodflow alteration
- groundwater recharge/discharge
- retention of sediment, nutrients and pollutants
- production export (for wildlife)
- wildlife habitat

Streams

The top of bank of a perennial stream identified as TB-1 was delineated on the property. The stream channel consists of sand, gravel, and small stones and exhibits an average OHW of 9 feet. However, the OHW width was observed to range from 6 to 15 feet. In a few areas where the stream channel widens and becomes less deep, small sedge dominated wetlands are confined within the defined stream channel and OHW, and were, therefore, not delineated. At other locations "overflow" channels and upland islands situated where the stream channel temporarily splits are included within the delineated top of bank. Water flow was present at the time of field investigation. The channel is incised in some areas, and the bank is also undercut in a few locations. The bank topography ranges from short, steep gullies to flat stream terraces. Vegetation along the TB-1 corridor is consistent with the previously described upland and wetland communities. Photograph 6 on page 17 of the Attachment depicts the channel of Stream TB-1 at the location of Wetland 2003-3.

Conclusions and Recommendations

All delineated wetlands and surface waters on the property fall under the jurisdiction of the New Hampshire Department of Environmental Services (NHDES) and the Corps. With regard to wetlands and surface water permitting, avoidance and minimization of impacts to the extent practicable for any proposed project will be required in the project permitting process.

As stated in the introduction to this memorandum, Pioneer's 2003 wetland investigation was limited to an area of approximately 15 acres in the vicinity of the proposed chair lift base station. Pioneer recommends that the remainder of the project area be comprehensively surveyed for wetlands in the growing season of 2004. Delineation of all jurisdictional wetland boundaries and surface waters in these areas would be required during regulatory review of any proposed project.

However, using the mapping and findings of Pioneer's 2003 wetland delineations in conjunction with Pioneer's 2001 site walkover would provide sufficient information for preliminary project planning purposes, and for initiation of avoidance and minimization of wetland impacts.

REFERENCE

Corps 1987. Environmental Laboratory. 1987. "Corps of Engineers Wetlands Delineation Manual," Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss. 1987.

Highway Methodology Workbook 1987. U.S. Army Corps of Engineers. 1987. "The Highway Methodology Workbook – Integrating Corps Section 404 Permit Requirements with Highway Planning and Engineering and NEPA EIS Process."

F:\PROJECT\03075 Sunapee Wetlands 2003\delineation memo.doc

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CONSULTING SCIENTISTS

MEMORANDUM

To: Sunapee/Additional Parcel File
From: Shelley E. Gustafson
Subject: Wetlands and Streams Reconnaissance
Date: January 25, 2002

In November of 2001, Shelley E. Gustafson of Pioneer Environmental Associates, LLC. (Pioneer) conducted a site reconnaissance for wetlands and streams on three separate parcels located near the Mount Sunapee Resort in Goshen, New Hampshire (see site location map on page 1 of Attachment). The largest of the three properties is a 130-acre parcel currently owned by Dodd Johnson and surveyed on November 1, 2001. The remaining two properties are 35.5 acres and 9 acres, owned by Lamb and Dodd Johnson, respectively. These parcels were surveyed on November 12, 2001. All three parcels are situated between the Mount Sunapee Resort area and Brook Road.

Dodd Johnson Parcel – 130 Acres

The 130-acre parcel owned by Dodd Johnson can be accessed from Brook Road via an existing logging road. The parcel as a whole has been heavily impacted by recent logging efforts evidenced by the predominance of young, regenerating forest and myriad cleared, access roads. In general, the vegetation throughout the parcel is indicative of upland communities. The most common sapling species found throughout these young woods include *Betula papyrifera* (paper birch), *Fagus grandifolia* (American beech), *Acer saccharum* (sugar maple) and *Quercus rubra* (red oak). Larger individuals of *Tsuga canadensis* (hemlock) and *Pinus strobus* (white pine) are also found sparsely throughout the canopy.

Three distinct surface water features were identified during the course of the site walkover. First, a perennial stream bisects the property from an east to west direction (see "Perennial Stream 1" on Dodd Johnson Parcel map, page 2 of Attachment). Patches of riparian wetland can be found along its stream course, dominated by hydrophtyic vegetation species including *Carex sp.* (sedge) and *Spiraea sp.* (steeplebush). However, much of its course is bordered by upland, with hemlock in the canopy and upland ferns dominating the herbaceous understory. The stream also contains sections of eroded banks, most likely the result of heavy logging activities nearby. If this parcel were to be developed, Pioneer recommends maintaining a substantial buffer area of at least 100 feet around the stream to avoid impacting wetland areas and further degradation of the stream course.

The second surface water feature is associated with another perennial stream located along the northwest edge of the property (see "Perennial Stream 2" on Dodd Johnson Parcel map, page 2 of Attachment). This stream is contained within a steep ravine that would likely be avoided during development activities. Nonetheless, Pioneer recommends maintaining a 100-foot buffer around this feature as well.

The third feature corresponds to the first perennial stream's course after it bears to the south and follows along the southwest edge of the property. At this location, the stream is interconnected with an extensive wetland complex (see "Wetland/Stream Complex on Dodd Johnson Parcel map, page 2 of Attachment). The boundary of this stream/wetland complex is abruptly marked by a steep change in slope, the upland edge of which is characterized by white pine and hemlock in the canopy. Abundant wildlife sign was noted throughout the forest along the wetland boundary. Pioneer also recommends 100 feet of buffer along this boundary so that wildlife corridor activity can be maintained and protected.

Lamb Parcel

The Lamb parcel is located just north of the 130-acre Dodd Johnson parcel. Although evidence of recent logging was not as obvious in this parcel, the forest was relatively young and contained abundant paper birch in the understory, indicating recent disturbance. Additional common tree species found within this parcel included hemlock and white pine in the canopy with beech and red oak common in the understory. Forest composition was generally indicative of upland conditions within this parcel.

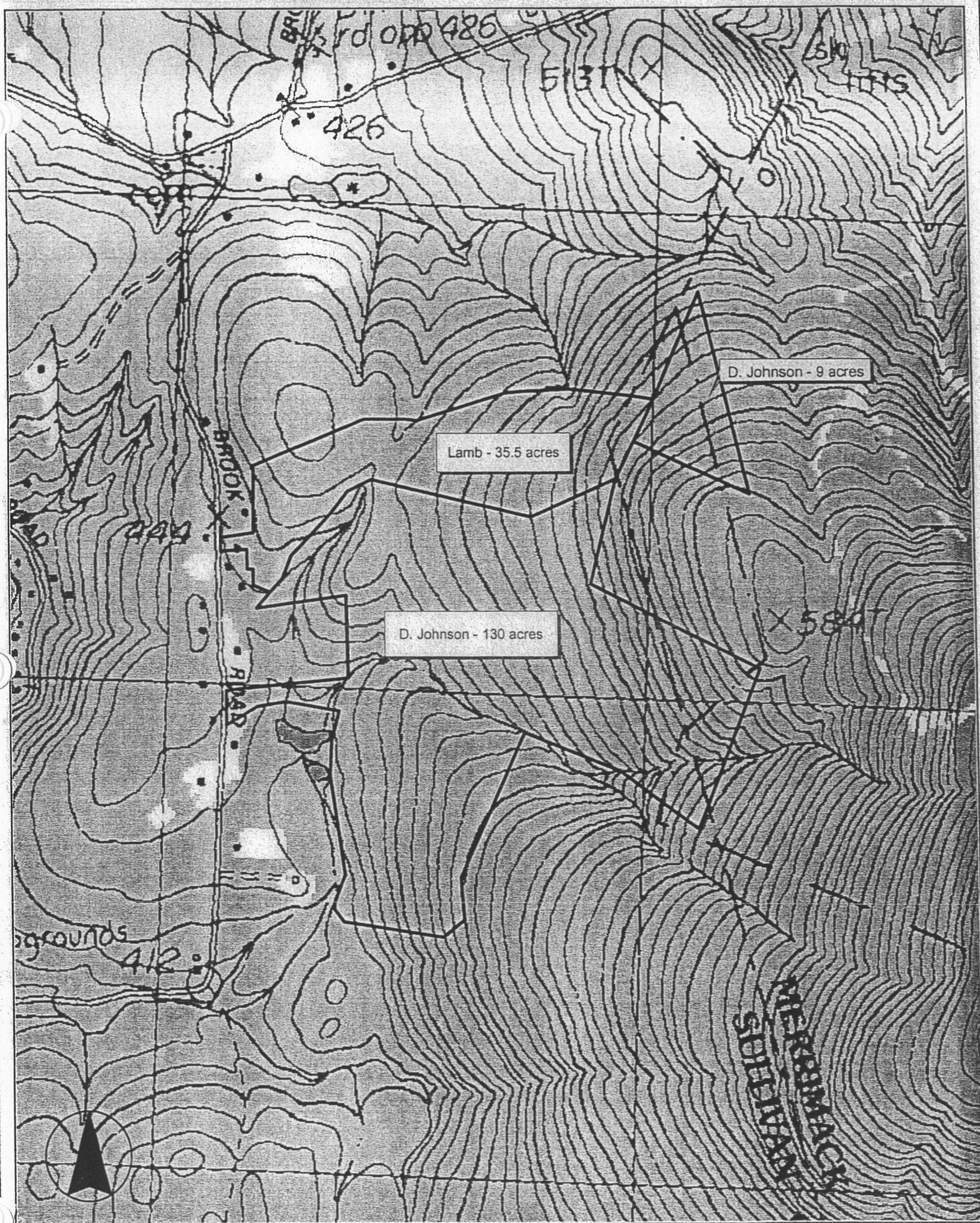
One basin-like wetland was located in the middle section of the parcel, near the saddle depicted on the USGS topographic quad (see "Wetland 1" on Lamb Parcel map, page 3 of Attachment). This roughly 4,000 square foot area was dominated by sedge, steeplebush, *Juncus sp.* (rush), and paper birch. Although no surface water was present on the day of the site walkover, this feature was characteristic of a vernal pool during the dry season. Care should be taken to avoid impact to this feature and the adjacent upland forest.

Additional surface water features located on site include two intermittent stream channels that lead to the north and beyond the property limits (see "Intermittent Stream 1 and 2" on Lamb Parcel map, page 3 of Attachment). Neither channel was flowing on the day of the delineation. Pioneer recommends maintaining a 50-foot buffer around both of these streams.

Dodd Johnson Parcel – 9 Acres

The 9-acre Dodd Johnson parcel is located to the east of the Lamb parcel and 1,660 feet above sea level. Steep slopes and exposed bedrock are predominant landscape features on this parcel. *Picea rubens* (red spruce) and *Abies balsamea* (balsam fir) dominate the canopy. No distinct surface water features were identified on the day of the site walkover.

ATTACHMENT



Property Boundaries

12/05/01

Source: USGS Topogr. Quad and Town of Goshen Tax Mapping

Mt. Sunapee Resort/Additional Parcel Investigation
Site Location Map
Goshen, New Hampshire

900 0 900 1800 Feet

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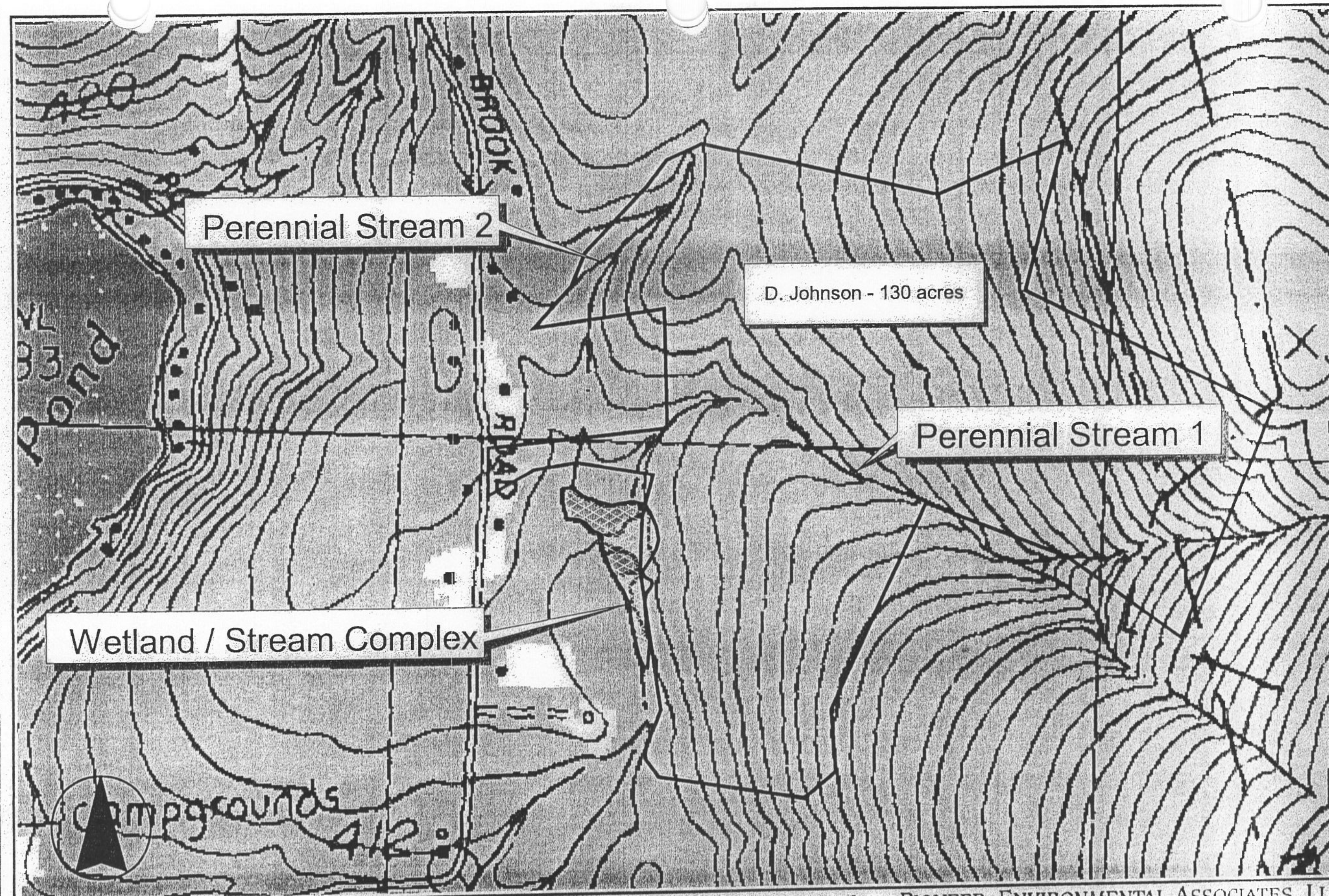

Mt. Sunapee Resort / Dodd Johnson Parcel

Wetlands and Surface Water Features

Goshen, New Hampshire

2000 0 2000 4000 Feet

Legend

D. Johnson Property Boundary

Wetland complex.shp

January 9, 2002

Source: USGS Topogr. Quad and Town of Goshen Tax Mapping

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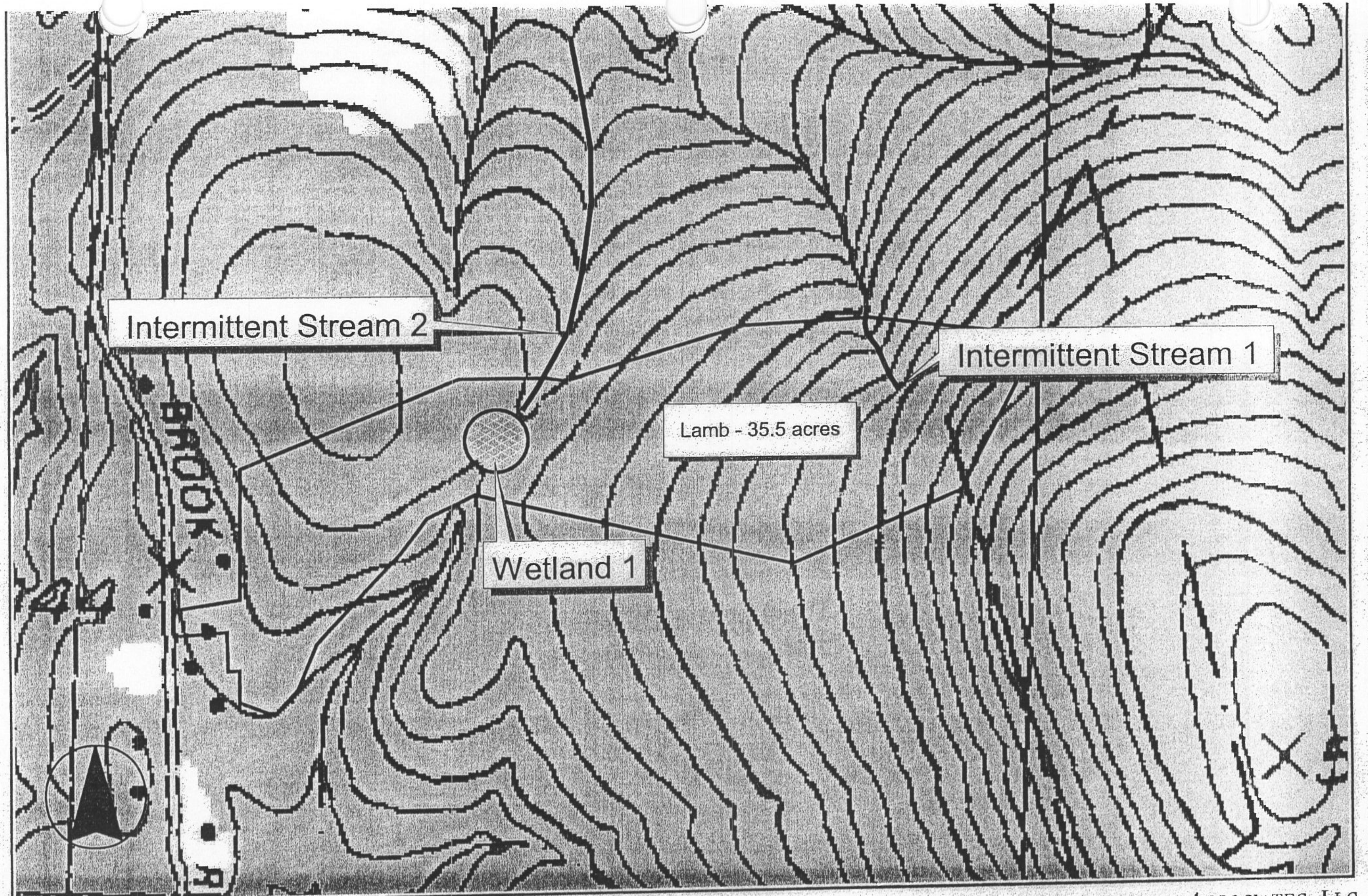

Mt. Sunapee Resort / Lamb Parcel
Wetlands and Surface Water Features
Goshen, New Hampshire

1500 0 1500 3000 Feet

Legend
- Wetland 1
- Lamb Property Boundary

January 9, 2002

Source: USGS Topogr. Quad and Town of Goshen Tax Mapping

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