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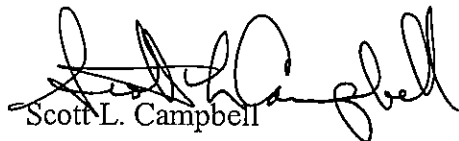
Re: Sun Valley Company
Trail Creek Water Rights 37-415 and 37-416
MTBR&F File No. 16845.5

Dear David:

As discussed during our meeting on Monday, March 12, 2007, I am forwarding you a copy of the report prepared by Brockway Engineering dated December 6, 1996, entitled, "Water Use and Water Supply Evaluation for the Trail Creek Diversion of the Sun Valley Company – Sun Valley, Idaho."

Thank you again for meeting with me earlier this week to discuss the above-referenced water rights.

Very truly yours,


Scott L. Campbell

SLC/tmh

Enclosure

cc: Wallace Huffman (w/o encl.)
Scott Mayeda (w/o encl.)

**Water Use and Water Supply Evaluation for the
Trail Creek Diversions of the Sun Valley Company
Sun Valley, Idaho**

Brockway Engineering, PLLC

December 6, 1996

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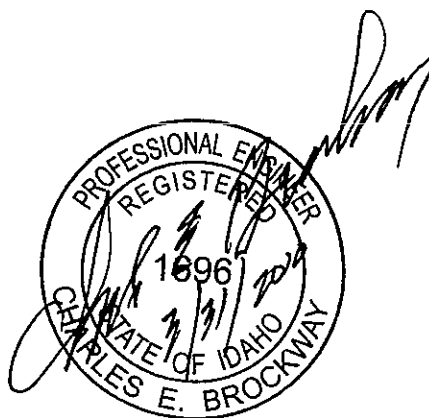
ADDENDUM TO REPORT

Water Use and Water Supply Evaluation for the Trail Creek Diversions of the Sun Valley Company, Sun Valley, Idaho

Brockway Engineering, PLLC

December 6, 1996

The analysis of water use and water requirements performed by Brockway Engineering, PLLC included estimates of water use on land north of Trail Creek Road that was planned for development as an extension of the existing Sun Valley golf course. The report (pp 9,10) stated that, based on the best recollections of the staff, that portable pumps were utilized to irrigate the area on the proposed new golf course area and on a parcel south of Trail Creek near Trail Creek Cabin in 1989 and 1993-1995. Subsequent testimony by Sun Valley Company grounds personnel indicate that the portable pumps were actually utilized for irrigation in 1988 and 1993-1995.



**Water Use and Water Supply Evaluation for the
Trail Creek Diversions of the Sun Valley Company
Sun Valley, Idaho**

Brockway Engineering, PLLC

December 6, 1996

Water Use and Water Supply Evaluation for the Trail Creek Diversions of the Sun Valley Company

Brockway Engineering, P.L.L.C.

October 21, 1996

Introduction

The Sun Valley Company holds water rights which allow diversions from Trail Creek at points above Ketchum, Idaho. The water is diverted from Trail Creek at two points into a system of open channels and ponds, and returns to Trail Creek at several points in the vicinity of Sun Valley Lake and further downstream. The development to which the water is appurtenant consists of an 18-hole golf course, several condominium complexes and recreational facilities, and the Sun Valley Lodge and Sun Valley Inn complexes. Diverted water is used for recreation and aesthetic purposes, and for irrigation of the golf course and other greenspaces in the development.

Claims have been filed in the Snake River Basin Adjudication (SRBA) process for surface water rights held on Trail Creek. The purpose of this report is to document actual water usage and potentially irrigable areas to provide justification for claimed beneficial use diversions, to document losses in the pond and ditch system due to seepage and operational losses, and to compute irrigation water requirements based on vegetation and reasonable irrigation efficiencies.

Overview of distribution system

Diversion of water from Trail Creek is accomplished from two headgates and one pump station. The two headgates divert water into two independent ditch systems. The headgate on the north side of the river (referred to as the Lewis #1 diversion) diverts water into the Lewis Ditch which flows along Trail Creek road and bifurcates in several locations. The headgate on the south side of the river (referred to as the Ketchum #2 headgate) diverts water into the Ketchum Ditch which flows along the southeast side of the valley. The pump station withdraws water from Trail Creek further downstream and discharges into Ketchum ditch. A diagram of the diversion system showing the diversions, ditches and pump stations is provided in Figure 1.

Water in the ditches flows through several ponds throughout the golf course and condominium complexes. Irrigation is accomplished both by sprinkler and by flooding. A pump withdraws water from a pond on the Lewis ditch and supplies the sprinkler irrigation system for the golf course and most of the other irrigated land. An additional pump station on the pond near the hospital is being constructed during the summer of 1996. This pump will supply water to the existing irrigation network, but is not currently in operation. Flood irrigation takes place mostly at the downstream end of the Lewis ditch. A small amount of flood irrigation occurs from the Ketchum ditch.

Seepage loss evaluation

The channels which carry water throughout the golf course and condominium complexes are composed largely of gravel to gravelly sand material. None of the ditches or ponds are lined. It is necessary therefore to evaluate the amount of water which is lost to seepage throughout the system.

Seepage loss estimation was accomplished by measuring the flow rate at various points in the ditch system while no irrigation was taking place. The golf course pump

station was not operating, and no flood irrigation was taking place except at the downstream terminus of the Lewis ditch. These flow measurements will allow the computation of seepage losses occurring in several sections of the entire diversion system.

Figure 2 is a schematic of the system showing all Trail Creek diversions, ditches, pipelines, and points where water returns to the river. Flow measurements were made on three days at the locations shown on Figure 2. At points 1, 5, and 11, flow was measured with a current meter (Ott 446 Type 10.002). The discharge from the pump station (point 12) was measured with an existing in-pipe propeller meter. All other measurements were made using a portable flume. The flume was a standard 2-inch 45-degree trapezoidal flume. To measure the flow, the flume was placed in the channel and adjusted until it was level. The upstream depth of water in the flume was then measured and a rating curve used to estimate the discharge. The results are presented in Table 1.

On September 15, 1994, the flow was measured in the Lewis ditch (denoted by sections A and B on Figure 2). On this date, there was no flow in the Penny Pasture ditch (section PP), so the flow at points 8 and 9 was measured later on October 14, 1994 when the ditch was flowing. Flow measurements were made in the Ketchum ditch (section C) on October 3, 1994.

Table 1. Flow measurement points

No.	Flume Head	Flow (cfs)	Location/remarks	Tributary to	Date
1	CM ^a	10.67	50' downstream of diversion #1 headgate	Lewis Ditch	9-15-94
2	0.79	0.89	Return to Trail Creek at #11 tee	Lewis Ditch	9-15-94
3	0.70	0.67	Return to Trail Creek at #2 tee	Lewis Ditch	9-15-94
4	0.84	1.03	Return to Trail Creek at Atilier Condos	Lewis Ditch	9-15-94
5	CM	2.84	Lewis Ditch at the laundry	Lewis Ditch	9-15-94
6	0.70	0.67	Return 1 from Cottonwood condos at east end of stables	Lewis Ditch	9-15-94
7	0.50	0.31	Return 2 from Cottonwood condos at east end of stables	Lewis Ditch	9-15-94
8	0.89	1.18	Penny pasture ditch at head	Lewis Ditch	10-14-94
9	0.69	0.65	Penny pasture ditch at end	Lewis Ditch	10-14-94
10	0.79	0.89	Return to Trail Creek at west end of stables	Lewis Ditch	9-15-94
11	CM	1.49	At diversion #2 headgate	Ketchum Ditch	10-3-94
12	M ^b	1.60	Pipe into box from Trail Creek pump station	Trail Creek	10-3-94
13	0.35	0.14	Ketchum Ditch at Fairway Rd. just upstream of box	Ketchum Ditch	10-3-94
14	0.82	0.98	Outflow from box to Dollar Meadows	Ketchum Ditch	10-3-94
15	0.75	0.79	Outflow from box to Villagers	Ketchum Ditch	10-3-94
16	0.38	0.17	Return to Trail Creek downstream from Villagers	Ketchum Ditch	10-3-94
17	0.49	0.30	Return to Trail Creek downstream from Dollar Meadows	Ketchum Ditch	10-3-94

^a Current meter ^b In-pipe flow meter

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The data presented in Table 1 are sufficient to estimate seepage losses separately for sections A, B, C, and PP. In order to estimate the unit loss for each section, the wetted area is required. The total wetted area within each section was computed by measuring the length of ditches and estimating the area of ponds using an aerial photo of the Sun Valley area. For wetted area calculations, the cross-section characteristics of ditches (approximate width and water depth) were assessed during the three visits to the site. Bank slopes of the ponds were assumed to be shallow and/or the depths relatively small so that the water surface area is a good approximation of the wetted area. The total wetted area of the ponds (equal to the water surface area) is estimated as 4.75 acres, and the wetted area of the ditches is estimated as 9.13 acres, for a total area of 13.88 acres. The wetted area of the ditches is greater than the water surface area since the ditch depths are not negligible compared to the width.

For each section, the measured total loss in cubic feet per second, the estimated wetted area including ditches and ponds, and the computed unit loss rate in feet per day are presented in Table 2. Unit seepage losses in sections A and B are lower than those in sections C and PP because there are more and larger ponds in A and B. Ponds allow sediment to settle, thereby causing a partial seal on the pond bottom. The Penny Pasture ditch loss is probably a good indicator of the expected unit loss in the ditches themselves since there are no ponds within Penny Pasture.

The total inflow to the Lewis Ditch system (sections A and B) was 10.67 cfs on September 15. On this date, the flow returning directly to Trail Creek was 3.57 cfs and there was no flow in the Penny Pasture ditch, so the Lewis ditch system loss excluding Penny Pasture was 7.10 cfs (66.5% of the total inflow). This loss includes infiltration of the flood irrigation which was taking place downstream of Bitterroot road. Excluding this infiltration, the loss due to seepage in ponds and ditches only was 6.21 cfs (58.2% of the inflow).

Table 2. Seepage losses in the ditch and pond system (not including infiltration near Bitterroot Road of 0.89 cfs).

Section	Measured loss (cfs)	Wetted area (acres)	Unit loss (feet/day)
A	5.24	8.32	1.25
B	0.97	1.87	1.03
C	2.62	2.41	2.16
PP	0.53	0.49	2.17

In the Ketchum Ditch system, the total inflow from the diversion and from the pumping station was 3.09 cfs. The flow returning directly to Trail Creek was 0.47 cfs, for a system loss of 2.62 cfs (84.8% of the inflow). No flood irrigation or other large-scale infiltration was occurring during the measurements, so this loss represents actual losses due to pond and ditch seepage.

The Penny Pasture ditch flow was measured separately since there was no flow when the Lewis Ditch system was measured. The loss of 0.53 cfs, or 44.9% of the inflow (Table 1) was measured from a point near the Sun Valley Road crossing to the point where the ditch turns 90 degrees and flows southeast. Downstream of this point, all of the flow infiltrates. No flood irrigation was taking place between the measuring points.

Because no flow was being diverted into Penny Pasture when the Lewis Ditch system was measured, the total Lewis Ditch system loss cannot be directly computed from the measurements. Had water been flowing in Penny Pasture ditch, the seepage losses would have been greater. The additional loss may be estimated from the measured unit loss rate in Penny Pasture ditch. It is assumed that the wetted area of the ditch had water been

land near Trail Creek Cabin, and small parcels near the reservoir. Separate, portable pump stations have been used to withdraw water from the north branch of the Lewis ditch at a pond near the Gun Club and near the diversion from Trail Creek. The area northwest of the club and significant portions of the hills northwest of Sun Valley Road have been irrigated by sprinkler in this way.

Irrigation also takes place by flooding water directly from the ditches. Such flood irrigation is accomplished from the Lewis ditch on Penny Pasture and on land near the stables.

A pump station on the river approximately 0.5 miles above Sun Valley Lake pumps water via a pipeline into the Ketchum ditch at a junction box. From this point, flood irrigation occurs on a small parcel northeast of the Villager condominiums. No other irrigation takes place from the Ketchum ditch.

To determine the extent of current irrigation, an aerial photo of the Sun Valley area in conjunction with the knowledge of the grounds staff and golf course staff was used to estimate the acreage of each irrigated parcel. The scale of the photo was determined by comparison of landmarks with a USGS 7.5' quadrangle of the area. Most areas were delineated visually by estimating the boundaries according to the color and type of vegetation present in the aerial photo. Acreage was then estimated using a planimeter.

Areas northwest of the Sun Valley Road were estimated by delineating the areas according to information obtained during on-site inspections with the staff. Results of the acreage determination are presented in Table 3. The acreages shown in the table do not include surface area of ditches, ponds, Trail Creek, roads, buildings, or parking lots. Figure 3 is a reproduction of the photo with an overlay showing the areas irrigated from each ditch. Depictions of the irrigation which has taken place using the portable pumps is given in Figure 4.

Lawn and landscaping within the condominium complexes (Villagers, Dollar Meadows, Cottonwood, Atlier, and Wildflower) are irrigated with Ketchum city water and not from the golf course pump or from either ditch system. This land is not delineated on Figure 3.

Table 3. Irrigated areas. Method: S = Sprinkler, PS = Portable sprinkler, F = Flood.

Parcel	Acres	Source	Method
Main golf course area	168.0	Lewis	S
Golf course south of Fairway Road	27.3	Lewis	S
Lodge/Inn complex	18.5	Lewis	S
Stable area 1 (east)	16.6	Lewis	S
Stable area 2 (middle)	16.1	Lewis	S
Stable area 3 (west)	7.0	Lewis	F
Penny Pasture	14.7	Lewis	F
Field east of Villager condominiums	4.3	Ketchum	F
Parcels near Trail Creek cabin	3.8	Lewis	S
Two parcels around Sun Valley lake	3.0	Lewis	S
Gun Club parcel	3.5	Lewis	S
Flat area behind Gun Club	88*	Lewis	PS
Hills northwest of road	77*	Lewis	PS
Parcel near Lewis diversion	13.0	Lewis	PS
TOTAL	460.8	456.5 Lewis 4.30 Ketchum	

*These areas were irrigated with a portable pump system in 1989

The 165 acres behind the Gun Club and on the hills northwest of the road were irrigated in 1989. A portable pump and the necessary main lines, hand lines, and sprinkler heads have been rented in order to accomplish the irrigation. Based on the best recollections of the staff, irrigation of this area took place during 1989 and 1993 to 1995. However, the amount of irrigation has varied, ranging from 165 acres in 1989 to 47 acres in 1993 and 1994. The pump rented was a 128 HP Godwin JA6 diesel pump, according to invoices on file with the Sun Valley Company. In addition to the supply pump at the Gun Club pond, a booster pump was located approximately halfway up the hill to provide sufficient pressure for the hand lines on the ridge. The manufacturer's specifications indicate that, at 1800 rpm, the JA6 can deliver 600 gpm at 250 feet of head at the optimal operating point. An analysis was performed to determine whether this pump was sufficient to irrigate the area delineated by the staff. Assuming a minimum 60 psi delivery pressure to the hand lines, the analysis shows that the system is capable of delivering at least 9 gpm per acre, which is a sufficient rate for sprinkler irrigation.

The parcel of 13.0 acres south of the river near the Lewis diversion along the northwest boundary of the property was irrigated in 1989, according to the staff. This parcel was irrigated from the Lewis ditch with a portable pump and a main line across the river to hand lines.

Consumptive use estimation

The applicable consumptive uses in the Sun Valley system are evaporation from the ponds and ditches and evapotranspiration of water from the irrigated vegetation. Evaporation from the ponds and ditches is a function of exposed water surface area and climatological conditions over the area. The total water surface area of the ponds and ditches is given in Table 4. Evaporation was estimated with the Kohler-Nordenson-Fox

procedure using data for the Silver Creek triangle, Blaine County, Idaho. It is assumed that the period over which the ditches are carrying water corresponds with the irrigation season, so that evaporation and evapotranspiration can be directly added to find total annual consumptive use. The total water surface area subject to evaporation is 10.5 acres. Evaporation from the ponds and ditches during the irrigation season is estimated as 29.1 acre-feet. Calculations are given in Appendix A.

Table 4. Water surface area of ponds and ditches

	Ponds	Ditches
Lewis Ditch		
Section A	3.10 acres	3.33 acres
Section B	0.90 acres	1.02 acres
Section PP	0.00 acres	0.29 acres
TOTAL Lewis	4.00 acres	4.64 acres
Ketchum Ditch	0.85 acres	1.01 acres
TOTAL	4.85 acres	5.65 acres

Crop evapotranspiration (ET) was estimated for current irrigation using the FAO-modified Blainey-Criddle method, which takes into account air temperature and sunshine variations to compute usage of water by various crops over the growing season. Brockway and Allen (1983) have computed monthly evapotranspiration at the Hailey Ranger Station. These values were assumed to be reasonably representative of conditions at Sun Valley. ET values for pasture are indicative of the type of vegetation present. The total crop consumptive use for the irrigation season is estimated as 1308 acre-feet for the

461 acres of irrigated land, or 2.84 acre-feet / acre. This is less than the 3 acre-feet / acre allowed by IDWR. Combined with evaporation, the total annual consumptive use is 1337 acre-feet. Consumptive use calculations are summarized in Table 5. Complete calculations are provided in Appendix A.

Table 5. Consumptive use of water for current irrigation.

	Lewis ditch	Ketchum ditch
Irrigation season length	210 days	210 days
Pond and ditch evaporation	23.9 ac-ft	5.15 ac-ft
Crop evapotranspiration	1296 ac-ft	12.2 ac-ft
Total annual consumptive use	1320 ac-ft	17.3
Annual c.u. (both ditches)	1337 ac-ft	

This estimate of consumptive use does not include seepage losses in the ditches and ponds, which were shown to be very large. Based on the underlying geology of the valley, seepage losses return to Trail Creek or the Big Wood River as subsurface flow through the alluvial aquifer, and therefore should not be considered a consumptive use. If, however, seepage losses were included, the total water used by the system annually is 4040 acre-feet for the Lewis ditch and 1108 acre-feet for the Ketchum ditch.

Irrigation diversion requirements

An estimate was made of the maximum amount of water which the diversion system must be able to carry to maintain the pond and ditch system and to provide sufficient

irrigation water for current irrigation. The diversion requirement consists of a rate of flow sufficient to 1) irrigate 461 acres, 2) make up for pond and ditch seepage, and 3) make up for pond and ditch evaporation.

The total pond seepage was measured as 9.15 cfs excluding the flood irrigation on Penny Pasture, the stable area, and the field east of the Villager condominiums. During the irrigation season, a peak rate equal to 9 gallons per minute (gpm) per acre was assumed to be required for the irrigated land. This is the rate which is typically allowed by the Idaho Department of Water Resources in allocating water for irrigation. It may be slightly high for the sprinkler irrigation, but low for the flood irrigation. At this rate, the diversion requirement for irrigation of 461 acres is 9.22 cfs. The distribution system must also be capable of carrying enough water to compensate for the maximum evaporation rate expected from the pond and ditch surface area, which in an average year occurs in July. This amount is 0.09 cfs.

Thus, the maximum diversion rate required by the irrigation component of the water right is $9.15 + 9.22 + 0.09 = 18.46$ cfs for both ditches during the irrigation season. During the non-irrigation season, it is assumed that no water is being diverted from Trail Creek. The diversion rate required for each ditch separately is summarized in Table 6. Calculations are given in Appendix A.

The total discharge of 18.46 cfs is sufficient to compensate for seepage and evaporation, while providing enough water for irrigation. However, this rate is not sufficient to supply the other beneficial uses within the system. An additional diversion rate is necessary for aesthetic and recreational purposes for the following reasons.

Because ditch infiltration is high, vegetation growth along the ditches and in other areas of the valley is augmented both by the local unsaturated flow regions surrounding the ditch and by the contribution of the seepage to the regional aquifer system. It is unlikely that the dense vegetation along the ditch banks would prosper if the ditches were

absent or if the ditch flow rate were insufficient. Without adequate vegetation, the ditches would not serve an aesthetic purpose.

Table 6. Diversion rate requirements for current irrigation and evaporation.

	Lewis Ditch	Ketchum Ditch
Pond and ditch seepage	6.53 cfs	2.62 cfs
Maximum evaporation	0.074 cfs	0.016 cfs
Irrigation	9.13 cfs	0.086 cfs
Total diversion rate required	15.73 cfs	2.72 cfs
TOTAL for both ditches	18.46 cfs	

Maintaining the aesthetic qualities of the water flowing in the ditches is also necessary. Without a sufficient diversion, the flow rate in some parts of the ditch network can drop as low as 0.5 cfs. Such low flows and corresponding low velocities would prevent some of the ditches from performing one of their purposes, which is to provide an aesthetically pleasing environment.

A sufficient flow rate is also required to provide adequate turnover times to maintain the aesthetic qualities of the ponds within the property. A pond and ditch network model was developed which computes evaporation, seepage, and turnover times within each of the ponds and the inter-pond ditches. The model was run for the Lewis Ditch with an upstream inflow of 15.0 cfs. The results are shown in Appendix A. With this diversion rate, turnover times are high for the large pond at the golf course pump station and for the pond across from the hospital. In particular, the 33.3-hour turnover time for the hospital pond is not acceptable to adequately maintain the aesthetic qualities of the pond. Note in

Appendix A that five of the smaller ponds were treated as one unit, so that the 31.2-hour turnover time for the five ponds equates to approximately 6.2 hours per pond, which is acceptable.

An acceptable turnover time which will adequately maintain the aesthetic qualities of the hospital pond is 12 hours. The pond model was employed to determine the diversion into the Lewis ditch which will yield this turnover time. The resulting required diversion is 17.6 cfs.

Although most of the irrigation is accomplished by sprinkling, three parcels of pasture totaling 26.0 acres are flood irrigated. If land is to be irrigated by flooding, a certain amount of flow is necessary to deliver the required water to the crop. If the flow rate is too low, the water simply cannot be delivered to field, even though sufficient water may be present. The parcels irrigated by flooding from the ditches are very permeable, which increases the required flow, and they are close to the terminus of the ditch system where the least amount of flow is available. Therefore, in order to effectively manage the irrigation of these 26.0 acres, an increased flow rate is required.

Historical diversion

Watermaster records for water district 37A were obtained as evidence of actual diversion patterns from Trail Creek. The watermaster is charged with delivering water to water right holders and measuring the rate of withdrawal. The maximum flow rate withdrawn from the river is of interest, since it is a good indicator of the diversion capacity of the system.

Maximum diversion rates into the Lewis and Ketchum ditches as recorded by the watermaster are shown in Table 7. For the past eleven years, the maximum diversion to the Lewis ditch has ranged from 16.0 cfs to 31.8 cfs, and the maximum diversion to the Ketchum ditch has ranged from 4.5 cfs to 8.0 cfs. In addition, the maximum amount of

water pumped from the river has been as much as 2.5 cfs (1122 gpm). This analysis indicates that, as long as sufficient water is present in Trail Creek, the maximum possible diversion is at least 42.3 cfs. However, this rate has not been achieved in the past eleven years; the maximum diversion from all three diversions in combination was 39.2 cfs in 1987.

Table 7. Maximum diversions recorded by the watermaster.

Year	Lewis	Ketchum	Pump	Total
1984	16.1	4.5	--	20.6
1985	16.0	8.0	--	24.0
1986	20.0	4.8	--	24.8
1987	31.8	7.4	--	39.2
1988	28.4	6.7	1.4	36.5
1989	17.4	5.2	2.5	25.1
1990	19.8	7.4	2.5	29.7
1991	18.8	5.7	1.2	25.7
1992	17.4	8.0	1.0	26.4
1993	16.6	6.7	1.0	24.3
1994	17.4	6.4	1.0	24.8
1995	16.6	4.9	--	21.5
Maximum	31.8	8.0	2.5	39.2

Capacity of the conveyance ditches

Both ditches are essentially conveyance devices which carry water to the points of re-diversion from the ditches (or ponds). Therefore, a low conveyance capacity could limit the amount of water which could be utilized.

Estimates of the carrying capacity of both ditches were made from the geometry of the channel section and roughness of the channel bottom and sides. Measurements of the channel bottom width and side slopes were made at several points along both ditches. The minimum height of the bank was also measured to determine the maximum possible water depth and hence the capacity.

Stage-discharge relationships were constructed using the Manning equation with a roughness coefficient of 0.040. This is a conservative estimate of the channel roughness based on a visual inspection of the soil composition and channel condition. The gross slope of each ditch was scaled from 7.5-minute USGS quadrangles. The results of this analysis are given for the Lewis ditch in Table 8 and for the Ketchum ditch in Table 9.

Table 8. Estimated capacity of the Lewis Ditch

Location	Capacity
Diversion	138 cfs
Spill and measuring point	129 cfs
Trail Creek cabin road crossing	71 cfs
500 feet downstream of Trail Creek cabin road	54 cfs
50 feet downstream of Hemmingway memorial	45 cfs
At first bifurcation	37 cfs

Table 9. Estimated capacity of the Ketchum Ditch

Location	Capacity
100 feet downstream of diversion	80 cfs
Near 15th hole	61 cfs
Near 4th hole	13 cfs
Upstream of culvert crossing of 12th fairway	11 cfs
50 feet downstream of culvert crossing of 12th fairway	6.1 cfs

Potentially irrigable area

The potentially irrigable area is defined as that land within the Sun Valley property boundaries that could reasonably be irrigated. Estimates of potentially irrigable area were made from reasonable interpretations of the aerial photo in conjunction with topographic information from the USGS 7.5' quadrangle. Areas on hills with greater than 25% slope or that could not be served without extensive modification to the irrigation system are not included. The acreage also does not include roads, waterways, trails, or other non-irrigable hardscape. The same exclusions as above for condominium complexes and other land irrigated from the Ketchum city water system apply.

This area cannot at present be completely served by the existing system without modification. In order to irrigate all of the potentially irrigable land, additional pump stations and piping, and perhaps other modifications to improve system efficiency would be required.

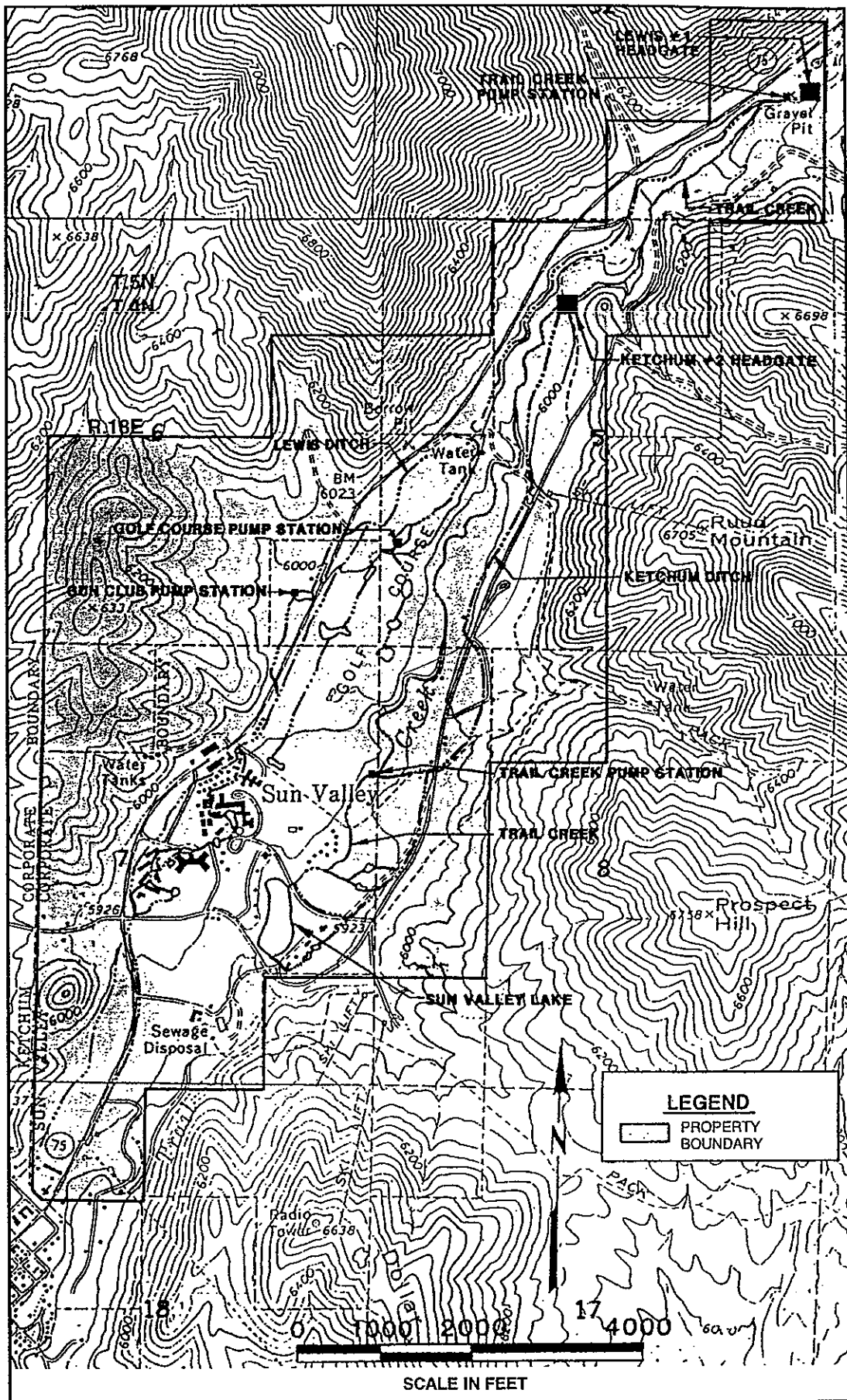


Figure 1. Overall layout of the Sun Valley diversion system.

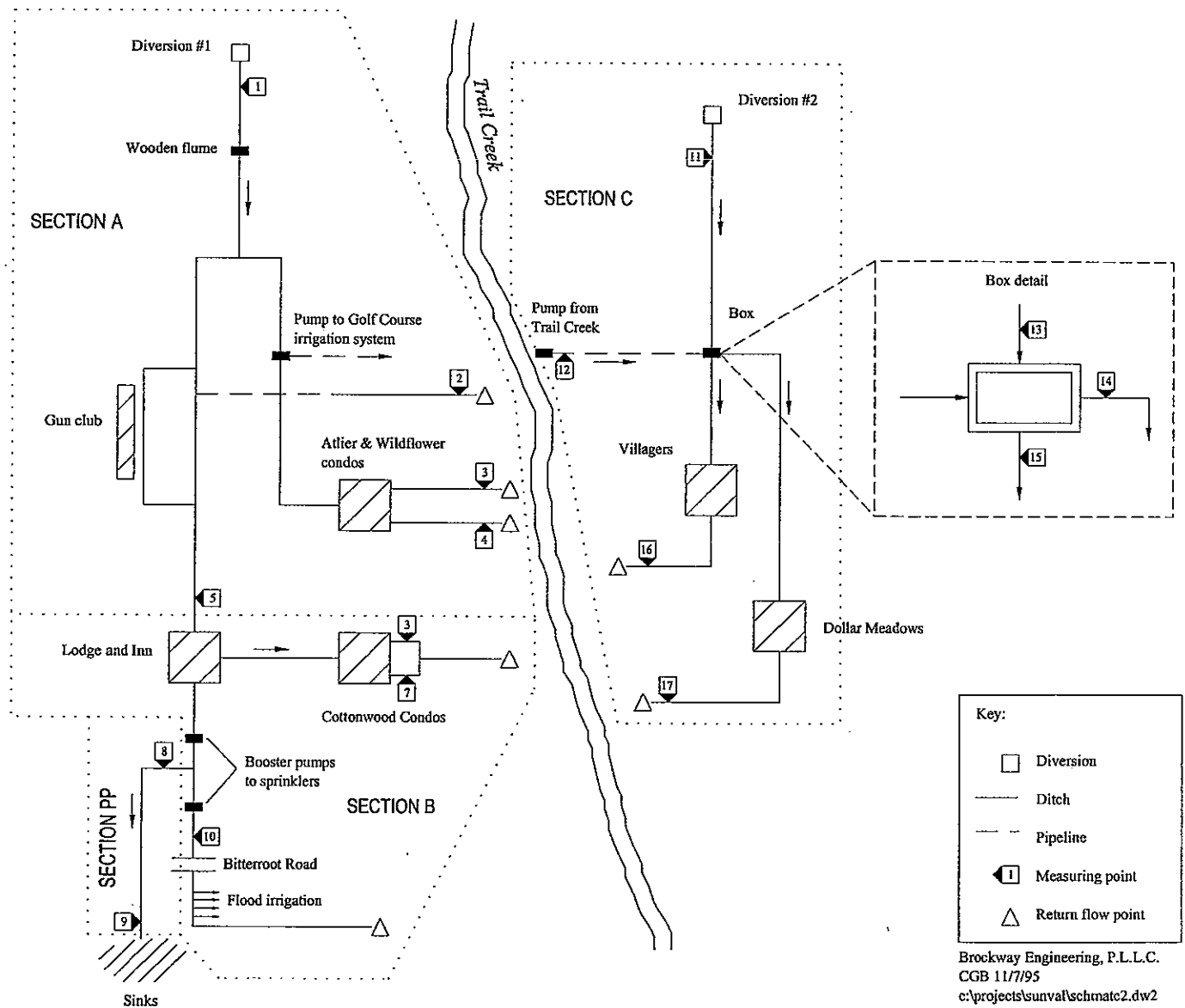
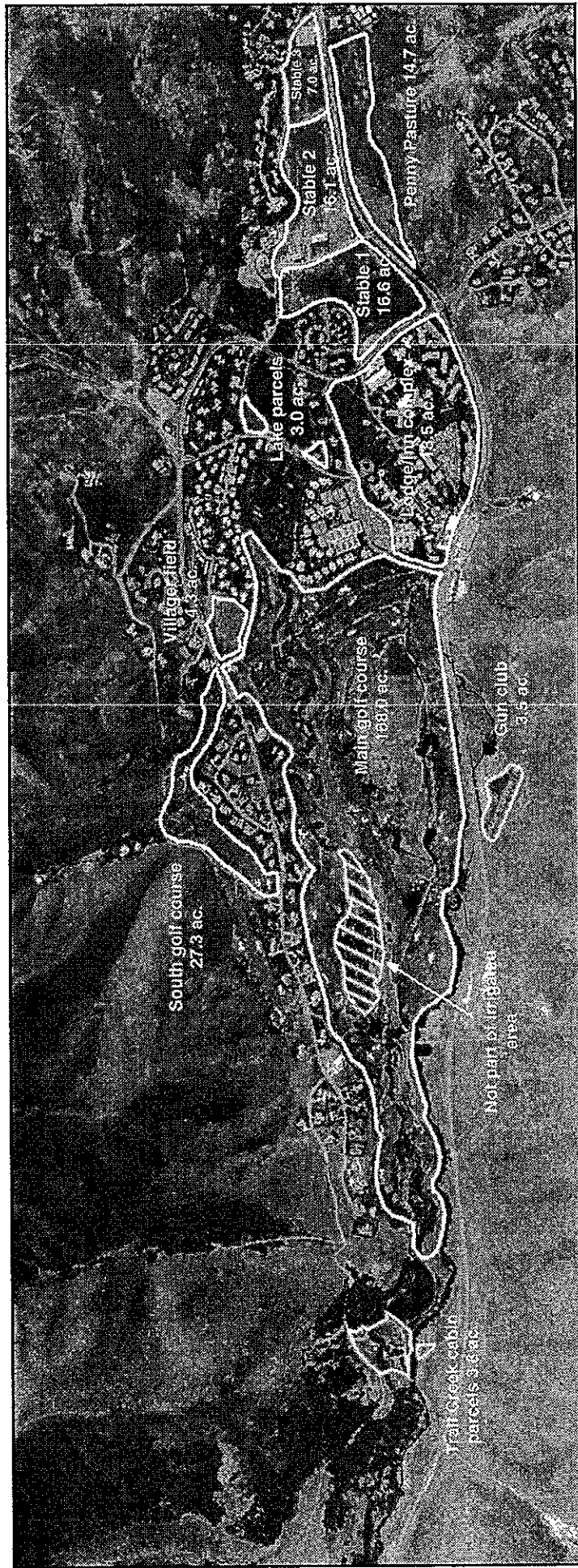


Figure 2. System schematic of the Trail Creek diversion and distribution systems showing flow measurement points.



Revised 8/14/96

Figure 3. Irrigated areas from Trail Creek based on Sun Valley staff information and aerial photo analysis. Acreages shown exclude non-irrigated spaces such as waterways and roads.

APPENDIX A

Water use estimate for Sun Valley Company - Lewis Ditch

Brockway Engineering, P.L.L.C. CGB 1/3/96

Evaporation data from Silver Creek triangle

Area sprinkled	435 acres	Max. daily evap. (July)	0.204 inches
Area flooded	21.7 acres	Max. daily evap. (October)	0.0815 inches
Pond surface area	4.00 acres	Irrigation season evap.	33.2 inches
Ditch surface area	4.64 acres	Non-irrig. season evap.	0 inches
Pond/ditch seepage	6.53 cfs	Irrigation requirement	9 gpm/acre

POND / DITCH EVAPORATION AND SEEPAGE

	Irrigation season	Non-irrigation season
Season length	210 days	155 days
Pond seepage	6.53 cfs	0 cfs
Season seepage	2720 ac-ft	0 ac-ft
Season evap.	23.9 ac-ft	0.0 ac-ft
Total seep/evap	2744 ac-ft	0 ac-ft

Total annual pond seepage and evaporation 2744 ac-ft

SYSTEM DIVERSION REQUIREMENT

	Irrigation season	Non-irrigation season
Pond seepage	6.53 cfs	0 cfs
Max. evap.	0.074 cfs	0.000 cfs
Irrigation	9.16 cfs	0.00 cfs
Total	15.76 cfs	0.00 cfs

CROP CONSUMPTIVE USE

Brockway and Allen (1983), assume pasture

Station: Hailey Ranger Station

Month	Daily C.U. (mm)	Mnth C.U. (inches)
April	1.48	1.75
May	4.38	5.17
June	5.80	6.85
July	5.92	6.99
August	4.91	5.80
September	3.78	4.46
October	2.55	3.01

Total seasonal crop consumptive use	34.04 inches	
Total seasonal crop use volume	1295.5 ac-ft	
Pond annual consumptive use (evaporation)	23.9 ac-ft	(does not include pond seepage of 2720 acre-feet)
TOTAL consumptive use	1319.4 ac-ft	

Water use estimate for Sun Valley Company - Ketchum Ditch

Brockway Engineering, P.L.L.C. CGB 1/3/96

Evaporation data from Silver Creek triangle

Area sprinkled	0 acres	Max. daily evap. (July)	0.204 inches
Area flooded	4.3 acres	Max. daily evap. (October)	0.0815 inches
Pond surface area	0.85 acres	Irrigation season evap.	33.2 inches
Ditch surface area	1.01 acres	Non-irrig. season evap.	0 inches
Pond/ditch seepage	2.62 cfs	Irrigation requirement	9 gpm/acre

POND / DITCH EVAPORATION AND SEEPAGE

	<u>Irrigation season</u>	<u>Non-irrigation season</u>
Season length	210 days	155 days
Pond seepage	2.62 cfs	0 cfs
Season seepage	1091 ac-ft	0 ac-ft
Season evap.	5.15 ac-ft	0.00 ac-ft
Total seep/evap	1096 ac-ft	0 ac-ft

Total annual pond seepage and evaporation 1096 ac-ft

SYSTEM DIVERSION REQUIREMENT

	<u>Irrigation season</u>	<u>Non-irrigation season</u>
Pond seepage	2.62 cfs	0 cfs
Max. evap.	0.016 cfs	0.000 cfs
Irrigation	0.086 cfs	0.000 cfs
Total	2.72 cfs	0.00 cfs

CROP CONSUMPTIVE USE

Brockway and Allen (1983), assume pasture

Station: Hailey Ranger Station

Month	Daily C.U. (mm)	Mnth C.U. (inches)
April	1.48	1.75
May	4.38	5.17
June	5.80	6.85
July	5.92	6.99
August	4.91	5.80
September	3.78	4.46
October	2.55	3.01

Total seasonal crop consumptive use	34.04 inches	
Total seasonal consumptive use volume	12.2 ac-ft	
Pond annual consumptive use (evaporation)	5.1 ac-ft	(does not include pond seepage of 1091 acre-feet)
TOTAL consumptive use	17.3 ac-ft	

SUN VALLEY POND MODEL
WATER REQUIREMENTS AND USE DATA
SUN VALLEY COMPANY, LEWIS DIVERSION ON TRAIL CREEK
ESTIMATED POND EVAPORATION AND SEEPAGE
C.E. BROCKWAY P.E. 3/11/96

POND EVAPORATION DATA FROM J.L. WRIGHT AND MARVIN E. JENSEN 1975
 1975 EVAPOTRANSPIRATION AND CLIMATIC DATA FOR THE SILVER CREEK-
 CREEK TRIANGLE BLAINE COUNTY, IDAHO FEBRUARY 1976
 LAKE OR POND EVAPORATION CALCULATED USING THE KOHLER-NORDENSON-FOX PROCEDURE

MAX. IRRIG. DIV PER ACRE= 7 GPM USING SPRINKLERS IRRIG. EFFICIENCY= 90 PERCENT
 DIVERSION FROM TRAIL OR 750 INCHES
 RECIRCULATION 0 INCHES
 OTHER DIVERSION 0 INCHES
 TOTAL DIVERSION TO POND INFLOW= 750 INCHES OR 15.00 CFS
 ALL DITCHES & PONDS HAVE 3 TO 1 SIDE SLOPES TOTAL POND AREA = 3.60 ACRES

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SEEPAGE RATES ESTIMATED FROM LOSS MEASUREMENTS

MO.	PROJECT				PROJECT				PROJECT			
	AVG EVAP	AVG EVAP	TOTAL MON.	PRECIP	AVG EVAP	AVG EVAP	AVG EVAP	AVG EVAP	EVAP- PRECIP	EVAP- PRECIP	EVAP- PRECIP	EVAP- PRECIP
	DAY	DAY	IN.	IN.	HAILEY	IN.	CFS	MIN.IN	DAY	IN.	CFS	MIN.IN
	MM	IN										
JAN	0.56	0.022	0.68	2.67	0.008	3.44	0.38	0.00	0.00	0.000	0.00	0.00
FEB	0.91	0.036	1.00	1.83	0.012	5.68	0.62	0.00	0.00	0.000	0.00	0.00
MAR	1.43	0.056	1.75	1.22	0.020	8.77	0.98	0.02	0.02	0.006	2.64	0.29
APR	2.29	0.090	2.70	1.07	0.031	14.05	1.56	0.05	0.05	0.019	8.49	0.95
MAY	4.32	0.170	5.27	1.47	0.059	26.50	2.95	0.12	0.12	0.043	19.11	2.13
JUN	5.19	0.204	6.13	1.39	0.071	31.84	3.55	0.16	0.16	0.055	24.62	2.74
JUL	5.19	0.204	6.33	0.47	0.071	31.84	3.55	0.19	0.19	0.066	29.47	3.28
AUG	4.55	0.179	5.55	0.69	0.062	27.91	3.11	0.16	0.16	0.054	24.44	2.72
SEP	3.96	0.156	4.68	0.71	0.054	24.29	2.71	0.13	0.13	0.046	20.60	2.30
OCT	2.07	0.081	2.53	0.76	0.028	12.70	1.41	0.06	0.06	0.020	8.88	0.99
NOV	1.01	0.040	1.19	1.44	0.014	6.20	0.69	0.00	0.00	0.000	0.00	0.00
DEC	0.63	0.025	0.77	2.48	0.009	3.86	0.43	0.00	0.00	0.000	0.00	0.00
			6.33	2.67	0.071	31.84	3.55	0.19	0.19	0.066	29.47	3.28
			38.59	16.20								
			30.67	5.80								

SUN VALLEY POND MODEL

POND AND IRRIGATION SYSTEM INFLOW AND OUTFLOW LOSS ESTIMATES (SUMMER)

TOTAL DIVERSION DITCH SIDE SLOPE POND SIDE SLOPE	15 CFS		SEEPAGE RATES														TURN- OVER HRS
	0 TO 1		SEC. A		1.25 FT/DAY		SEC. B		1.03 FT/DAY		SEC. PP		2.17 FT/DAY				
	L FT	WIDTH FT	AVG DEPTH FT	SURF. AREA FT^2	AREA AC.	WET AREA FT^2	WET AREA AC.	SEEP. RATE FT/D	VOL FT^3	IN- FLOW CFS	SEEP- AGE CFS	EVAP (MAX) CFS	ACRES IRRIG.	IRRIG. DIV. CFS	OUT- FLOW CFS		
DITCH A1	5000	8	2.00	40000	0.92	60000	1.38	1.25	80000	15.00	0.868	0.0079	0.0	0.00	14.12	1.5	
POND AT SPLIT	93	93	3.00	8712	0.20	8803	0.20	1.25	26136	14.12	0.127	0.0017	0.0	0.00	13.99	0.5	
DITCH A2	3500	8	2.00	28000	0.64	42000	0.96	1.25	56000	7.00	0.608	0.0055	0.0	0.00	6.38	2.2	
GUN CLUB PONDS	2640	6	3.00	17424	0.40	18410	0.42	1.25	52272	1.92	0.266	0.0034	0.0	0.00	1.65	7.6	
GUN CLUB DITCH	2640	6	2.00	15840	0.36	26400	0.61	1.25	31680	1.92	0.382	0.0031	0.0	0.00	1.26	4.6	
DITCH A3	2000	8	2.00	16000	0.37	24000	0.55	1.25	32000	4.47	0.347	0.0032	0.0	0.00	4.12	2.0	
DITCH A4	400	8	2.00	3200	0.07	4800	0.11	1.25	6400	5.38	0.069	0.0006	0.0	0.00	5.31	0.3	
LODGE PONDS	175	175	1.50	30492	0.70	30577	0.70	1.25	45738	5.31	0.442	0.0060	0.0	0.00	4.86	2.4	
LODGE DITCHES	6000	2	0.50	12000	0.28	18000	0.41	1.25	6000	5.31	0.260	0.0024	0.0	0.00	4.60	0.3	
DITCH B1	200	2	0.50	400	0.01	600	0.01	1.03	200	2.30	0.007	0.0001	0.0	0.00	2.29	0.0	
DITCH PP (2)	4229	3	1.00	12687	0.29	21145	0.49	2.17	12687	0.46	0.531	0.0025	0.0	0.00	-0.08	7.7	
DITCH B2	2400	2	0.50	4800	0.11	7200	0.17	1.03	2400	1.83	0.086	0.0009	0.0	0.00	1.75	0.4	
DITCH B3	2000	3	1.00	6000	0.14	10000	0.23	1.03	6000	2.30	0.119	0.0012	0.0	0.00	2.18	0.7	
COTTONW/D PONDS	93	93	1.00	8712	0.20	8742	0.20	1.03	8712	2.18	0.104	0.0017	0.0	0.00	2.07	1.1	
COTTONW/D DITCHES	1180	3	1.00	3540	0.08	5900	0.14	1.03	3540	2.18	0.070	0.0007	0.0	0.00	2.00	0.5	
DITCH B4	100	3	1.00	300	0.01	500	0.01	1.03	300	2.00	0.006	0.0001	0.0	0.00	2.00	0.0	
DITCH A5	1000	6	2.00	6000	0.14	10000	0.23	1.25	12000	7.00	0.145	0.0012	0.0	0.00	6.85	0.5	
BIG POND	168	168	8.00	28314	0.65	28751	0.66	1.25	226512	6.85	0.416	0.0056	253.0	3.95	2.48	9.2	
DITCH A6	4000	6	2.00	24000	0.55	40000	0.92	1.25	48000	2.48	0.579	0.0047	0.0	0.00	1.90	5.4	
5 SM. FWY PONDS	264	264	4.00	69696	1.60	70039	1.61	1.25	278784	2.48	1.013	0.0137	0.0	0.00	0.87	31.2	
DITCH A7	1000	6	2.00	6000	0.14	10000	0.23	1.25	12000	0.87	0.145	0.0012	0.0	0.00	0.73	3.8	
HOSPITAL POND	104	104	8.00	10890	0.25	11161	0.26	1.25	87120	0.73	0.161	0.0021	0.0	0.00	0.56	33.3	
DITCH A8	1050	6	2.00	6300	0.14	10500	0.24	1.25	12600	0.56	0.152	0.0012	0.0	0.00	0.41	6.2	
TOT. DITCH	36999			185067	4.25	291045	6.68		321807		4.37	0.0365					
TOT. PONDS				156816	3.60	158072.764	3.63		673002		2.26	0.0309					
TOTAL				359307	8.25	467528	10.73		1047081		6.91	0.0708	253.00	3.95		121.3	

SYSTEM SEEPAGE LOSS=	6.91	CFS=	345.3	MINERS IN.=	3099	GPM
SYSTEM DESIGN EVAP LOSS=	0.071	CFS=	3.54	MINERS IN.=	32	GPM
SYSTEM IRRIG. REQ'T=	3.946	CFS=	197.30	MINERS IN.=	1771	GPM
SYSTEM WATER REQ'T=	10.92	CFS=	546.1	MINERS IN.=	4902	GPM
SYSTEM DIVERSION AVAILABLE=	15.00	CFS=	750.0	MINERS IN.=	6732	GPM
SYSTEM RETURN FLOW	4.06	CFS=	203.9	MINERS IN.=	1830	GPM

MAX POND TURNOVER TIME- ALL PONDS=

121.3 HOURS TOTAL WATER REPLACEMENT

SUN VALLEY POTENTIALLY IRRIGABLE AREA

Revised 8/13/96

All land within S.V. boundaries that could reasonably be irrigated.

Areas on hills with > 25% slope or that would be difficult to serve are not included.

Areas do not include roads, waterways, or other non-irrigable hardscape

Section	Quarter	Potentially irrigable acres	Claimed A37-00415	Claimed A37-00416	Total claimed	Diff
32	NESE	11.9	2.5	0.0	2.5	9.4
32	NWSE	0.0	2.5	0.0	2.5	-2.5
32	SESE	21.1	0.0	0.0	0.0	21.1
32	SWSE	19.6	17.4	0.0	17.4	2.2
5	NWNE	11.0	7.0	0.0	7.0	4.0
5	NENW	22.7	3.1	0.3	3.4	19.3
5	SWNW	10.3	2.5	0.0	2.5	7.8
5	SENW	28.7	12.1	1.4	13.5	15.2
5	NWSW	28.3	26.6	0.0	26.6	1.7
5	NESW	17.9	10.0	1.4	11.4	6.5
5	SWSW	29.4	31.7	0.8	32.5	-3.1
5	SESW	11.4	13.4	0.3	13.7	-2.3
6	NESW	11.3	0.0	0.0	0.0	11.3
6	SESW	23.4	0.0	0.0	0.0	23.4
6	NWSE	23.6	3.9	0.0	3.9	19.7
6	NESE	30.3	18.8	0.0	18.8	11.5
6	SWSE	32.1	12.7	0.0	12.7	19.4
6	SESE	33.4	11.7	0.0	11.7	21.7
6	SENE	4.6	0.0	0.0	0.0	4.6
7	NENW	28.0	23.1	0.0	23.1	4.9
7	NWNE	18.5	10.4	0.0	10.4	8.1
7	NENE	36.9	39.2	0.0	39.2	-2.3
7	SENE	16.2	13.1	1.0	14.1	2.1
7	SWNE	14.4	23.4	0.0	23.4	-9.0
7	SENW	12.4	11.9	0.0	11.9	0.5
7	NESW	8.7	6.1	0.0	6.1	2.6
7	SESW	21.8	14.4	0.0	14.4	7.4
7	SWSE	25.2	20.1	0.0	20.1	5.1
7	NWSE	21.6	24.9	0.0	24.9	-3.3
7	NESE	2.7	0.2	3.8	4.0	-1.3
7	SWNW	0.0	0.2	0.0	0.2	-0.2
8	NWNW	20.6	23.3	0.3	23.6	-3.0
8	NENW	11.5	11.1	0.0	11.1	0.4
8	SWNW	14.5	9.1	2.8	11.9	2.6
8	SENW	0.0	7.1	0.0	7.1	-7.1
8	NWSW	15.2	0.0	0.4	0.4	14.8
8	NWSE	0.0	0.0	0.4	0.4	-0.4
18	NENW	16.1	14.0	0.0	14.0	2.1
18	NWNE	0.0	1.8	0.0	1.8	-1.8
Total		655.3	429.3	12.9	442.2	