

Project No. 052-05-2005

Aquifer Recharge Plan for the Fish Creek Reservoir Company

PRELIMINARY – REVISION B

Prepared for:

Fish Creek Reservoir Company, Inc.
Carey, Idaho

June 15, 2009

For information concerning this report, contact
Charles G. Brockway, Ph.D., P.E.



CHARLES E. BROCKWAY, Ph.D., P.E.
CHARLES G. BROCKWAY, Ph.D., P.E.

2016 NORTH WASHINGTON, SUITE 4
TWIN FALLS, IDAHO 83301

Preliminary Aquifer Recharge Plan for the Fish Creek Reservoir Company

Charles G. Brockway, P.E.
Brockway Engineering, PLLC

Revision B, June 15, 2009

A. OVERVIEW

Fish Creek Dam, owned by the Fish Creek Reservoir Company (the Company), is located on Fish Creek approximately 10 miles northeast of Carey, Idaho (see Figure 1). The dam spans a narrow valley and impounds water from the Fish Creek basin and tributaries. Fish Creek is a perennial stream which also carries minor year-round spring discharge. Inflow to the reservoir consists almost entirely of runoff due to snowmelt and rainfall on the catchment above the dam. The dam has been in operation since its construction in approximately 1921. The reservoir provides storage for irrigation water supply within the service area of the Fish Creek Reservoir Company, but ancillary uses include recreation and flood control, although the dam has not been operated to optimize these ancillary uses.

The dam is a reinforced concrete dam in a multiple arch-buttress configuration. The total length of the dam is 1,630 feet, and the height from the lowest downstream invert to the top of the concrete is 92 feet. Drawings showing the plan and upstream elevation of the dam and various photographs of the dam are on file with the Idaho Department of Water Resources (the Department).

Due to acute concerns about the structural integrity of the dam, the capacity of the original spillway, and the potential risk to public health and safety, the Department issued an order in January 2005 requiring that the emergency spillway be lowered approximately 19 feet vertically in an effort to reduce the hydraulic head restrained by the dam and lower both the risk of dam failure and the potential for loss of life should the dam fail. The Company complied with the order and completed the spillway reconstruction in March 2005. The result of the spillway lowering is the elimination about 62% of the storage capacity compared to the historical operation of the dam. The volume which will no longer be stored and used for irrigation will overflow to Fish Creek, be conveyed southward to the lava beds south of Highway 20. Under normal conditions, no hydraulic connection to tributary streams exists, and therefore the water will infiltrate within the basalt flows.

The Company desires to reclaim at least a portion of the economic injury caused by the Department's order to lower the spillway by marketing the recharged water to interested parties or organizations who have a need to acquire water on a short- or long-term basis. Such entities would primarily include groundwater pumping groups,

municipalities, or individual users who desire to obtain water to mitigate for groundwater depletion, either as a response to recent Department orders or as voluntary measures.

The purpose of the present study is to develop and present to the Department a conceptual plan for a managed recharge program to be operated by the Company. This conceptual plan could form the basis for negotiations with the Department relative to structure of the plan, allowable volume of recharge, or other facets of the plan. The desired end result will be explicit approval by the Department of a recharge plan which may be implemented beginning in 2008.

A.1. Report Revisions

The original version of this report was submitted to the Department in July 2007. A meeting was held on April 14, 2008 to discuss the conceptual plan. In attendance were David Tuthill, Gary Spackman, Jeff Peppersack, Doug Surerus, and Charles G. Brockway. A summary of this meeting is outlined on the memorandum included in Appendix A.

There was general consensus that the conceptual aquifer recharge mitigation plan could potentially be approved by the Department. However, three significant hydrologic issues needed to be adequately addressed, namely:

1. The magnitude of seepage loss in the Fish Creek channel that could be credited toward aquifer recharge.
2. The fraction of the "foregone storage" that has historically been infiltrated due to irrigation application, which therefore cannot be credited toward "new" aquifer recharge.
3. The magnitude of evaporation losses from the reservoir surface that would be saved due to the reduced water surface area.

Considerable discussion centered around these points, both of which involve hydrologic quantities that are difficult to quantify. It was postulated by Mr. Tuthill that perhaps the Fish Creek seepage could be considered approximately equal to the non-consumptive component of the irrigation application, so that the two effects could be assumed to cancel out. If this is the case, precise accounting of seepage losses each year would be unnecessary and management of the recharge system would be greatly simplified. Fish Creek Reservoir Company agreed to install measuring devices and/or conduct manual flow measurements during the 2008 season to adequately quantify the seepage losses. The company also agreed to make an estimate of irrigation infiltration on the lands which are served by stored water. This analysis is provided in Section H.

The reservoir evaporation will be significantly reduced due to the lowering of the dam spillway and the decrease in maximum surface area of the reservoir. This reduction could potentially be credited toward the amount recharged. Additional analysis has been performed to estimate the difference in evaporation and is described in Section H.

Additional data provided by the Department for maximum reservoir content has been added to the analysis. With the additional data plus the years 2007 and 2008, a sufficient record was available to allow a statistical characterization of potential aquifer recharge without relying on a reconstruction of Fish Creek runoff using a correlation with Little Wood runoff. The results with and without using this correlation are similar.

B. RESERVOIR CAPACITY CURVE

A volume-capacity curve was developed for the reservoir apparently near the time of construction of the dam by the project engineer. This curve has been in use since that time and represents the current best available information about storage characteristics of the reservoir. The volume-capacity and derived area-capacity relationship are shown in Figure 2, and the original table is provided in Appendix A.

The maximum usable storage volume at the historic spillway elevation is 12,743 acre-feet. However, historic practice often was to "check up" the spillway using boards to increase the water surface to 1 foot below the top of the dam, at which point the storage volume is 14,411 acre-feet. This is the volume allowed on water right 37-1162. There is essentially no dead storage. Current reservoir capacity due to lowering of the spillway elevation is 5,515 acre-feet.

The original spillway consisted of an uncontrolled, concrete side-channel spillway with an estimated capacity of approximately 300 cfs. Controlled outlet gates are located at the low point of the dam, consisting of two (2) 30-inch valves discharging directly to the natural Fish Creek channel. Estimated capacity of these gates is 240 cfs based on the discharge curve developed for the dam (source unknown, contained in IDWR files).

C. WATER USAGE FROM FISH CREEK

Irrigation using natural flow from Fish Creek and its tributaries has occurred in the vicinity of the dam, upstream of the reservoir, and downstream within the current company service area since perfection of the earliest right on the creek (1883). Natural flow rights held by private entities total 93.5 cfs, based on the SRBA recommendations, which are tabulated in Appendix A. Construction of the dam in 1921-22 allowed additional acreage to be reclaimed and put into agricultural production. The storage water right, 37-1162, was originally held by the Carey Valley Irrigation Reservoir Company, Inc., now the Fish Creek Reservoir Company, Inc.

Fish Creek Reservoir Company, Inc. is a mutual irrigation company with a total of 14,411 outstanding shares, each share representing 1.0 acre-feet of storage in the dam (see the incorporation document in Appendix A). Water released from storage is delivered to the project via the Fish Creek natural channel. A diversion dam in the channel diverts water to a system of man-made ditches throughout the project. A watermaster administers both storage and natural flow rights on Fish Creek, and traditionally has been a member of the Company.

Historical records of irrigated area with the Company service area are not available, but a current analysis was made utilizing the 1987 aerial photo with guidance from later photos. Total irrigated area was estimated to be 8,066 acres within the total service area, and approximately 6,746 acres within the lower service area below the dam shown on Plate 1. At its historical capacity, the reservoir could provide 2.14 ac-ft/acre to the lower area if it filled. At the current capacity, the reservoir could provide only 0.82 ac-ft/acre.

D. RECENT PROJECT HISTORY, IDWR ORDERS, AND COMPANY RESPONSES

Apparent accelerated deterioration of the concrete dam noted in approximately 2002 prompted the Department to compel increased monitoring, testing, and rehabilitation work on the dam. In an Order to Show Cause issued on October 31, 2003, the Department cited various deficiencies in the dam and required the Company to show cause why continued storage should be allowed above elevation 67. Numerous orders have been issued by the Department since that time, and the Company has responded to the various requirements of the orders. Following is a listing and content summary of each pertinent Department issuance and company response since October 31, 2003.

Order to Show Cause

October 31, 2003

After expiration of the authorization to store water in 2003, the Department issued this order citing a number of deficiencies in the dam integrity and warning system, and ordered the Company to show cause within 30 days why the reservoir elevation should not be restricted to 67 feet and why the dam should not be breached to maintain said elevation.

Compliance Conference

November 25, 2003

Interim Authorization to Store Water

December 1, 2003

The Department issued an interim authorization to store, expiring on January 15, 2004, providing that 1) the reservoir level not exceed 67 feet, 2) full response to show cause order by January 15, 2004.

Company Response

January 8, 2004 and January 16, 2004

Written specifications and details regarding proposed concrete repair work on buttresses with sever deterioration.

Order and Interim Authorization to Store Water

February 26, 2004

In this order, the Department set aside the show cause order and required remedial measures prior to the onset of spring runoff including 1) repair of nine deteriorated

buttresses, 2) construction of additional spillway capacity to provide a total capacity of 1,170 cfs, 3) enhanced testing of the emergency warning system (EWS), and 4) submission of a schedule by May 31, 2004 for developing plans for the full, permanent rehabilitation of the dam. This order did not require installation of a spillway at 67 feet unless the buttress repair was not completed by the onset of spring runoff. Interim authorization to store water was granted, expiring on October 31, 2004.

Company Response

March 29, 2004 Proposed design for additional spillway capacity.
May 30, 2004 Plan for rehabilitation of Fish Creek Dam. Department approved the Plan on July 29, 2004.

Order

December 10, 2004

After expiration of the interim authorization to store for 2004, the Department issued this order finding the buttress repair work to be satisfactory but cited a number of persistent deficiencies in the dam integrity, spillway capacity, and EWS, and noting that the seismic analysis and rehabilitation of high bays had not been done as proposed in the May 30, 2004 rehabilitation plan. The order required that the outlet valves be fully opened and prohibited any and all storage behind the dam.

Company Response

December 22, 2004 – Petition for Reconsideration of December 10, 2004 order.

Order

January 10, 2005

The Department granted the petition for reconsideration, requiring 1) modification of the dam so that 1,170 cfs can be passed at reservoir elevation 72.0 feet, 2) submittal of plans and specifications for approval by the Department, 3) inspection and approval of the work by the Department prior to storage, and 4) repair of buttress 52. The order also contained requirements for continued EWS testing and seepage monitoring.

Company Response

February 10, 2005 Engineering report and preliminary construction plans and technical specifications for new spillway construction (Brockway Engineering, PLLC). Approved by the Department on February 17, 2005.
February 16, 2005 Petition for Reconsideration of January 10, 2005 order, requesting authorization to store water after demolition but before entire spillway project is complete.

Second Amended Order

February 22, 2005

This order outlined the history of the project to date, including Department orders and company responses, and granted interim authorization to store water conditioned upon approval of the Department of the demolition work. The order also contained requirements for continued EWS testing and seepage monitoring. The Department also noted that the seismic analysis and high bay rehabilitation had not been completed.

Company Response

October 31, 2005 Proposal and cost estimate for dam replacement alternatives (Brockway Engineering, PLLC).

Order

November 25, 2005

After expiration of the interim authorization to store for 2005, the Department issued this order finding the buttress repair work to be satisfactory but cited a number of persistent deficiencies in the dam integrity and the EWS, and noting that the seismic analysis and rehabilitation of high bays had not be done as proposed in the May 30, 2004 rehabilitation plan. The Department extended the authorization to store water through January 31, 2006, and required 1) submittal of plans to repair a hole in the arch between buttresses 23 and 24, 2) repair of the hole, and 3) submittal of a dam break analysis based on the new spillway elevation and incorporating detailed cross-sections. The order also contained requirements for continued EWS testing and seepage monitoring.

Company Response

December 2005 Plans and specifications for arch repair (Brockway Engineering, PLLC). Approved by Department on December 5, 2005.

January 2006 Performed repair work as required.

February 2, 2006 Requested extension of time for detailed dam break analysis to July 1, 2006, and proposed submitting an interim dam break analysis using existing cross-sections by February 21, 2006.

Order

March 3, 2006

This order partially recounted the project history, noted that the Department found the arch 23-24 work to be satisfactory, extended authorization to store water to April 1, 2006, and required submittal of both an interim dam break analysis and a detailed dam break analysis. The order also contained requirements for continued EWS testing and seepage monitoring.

Company Response

An interim dam break analysis was prepared by Brockway Engineering and submitted to the Department on April 4, 2006.

Order

April 25, 2006

The Department extended the authorization to store water through October 31, 2006. The order noted that the seismic analysis and rehabilitation of high bays had not be done as proposed in the May 30, 2004 rehabilitation plan, required the submittal of a detailed dam break analysis, required continued maintenance and testing of the emergency warning system, and required monitoring and reporting of reservoir levels to the Department. The order also suspended the seismic requirements until October 31, 2006 pending the outcome of a dam replacement alternatives study.

Company Response

A detailed cross-section survey was performed in August 2006. This data formed the basis for the detailed dam break analysis prepared by Brockway Engineering and submitted to the Department by e-mail on September 22, 2006 with a hard copy on September 25, 2006. Testing of the EWS has been ongoing.

E. SPILLWAY RECONSTRUCTION**E.1. Structural Deficiencies**

Deficiencies in the concrete structure of the dam have been noted by the Department and consultants retained by the Company since approximately 2002. Deficiencies generally include spawling concrete, development of holes or structural problems in the buttresses and arches, and exposure of steel reinforcement. A total of ten (10) buttresses have been repaired by patching excessively deteriorated areas with unreinforced concrete. A hole that developed in an arch section, located between buttresses 23 and 24, has been repaired by removing weakened concrete in the vicinity of the hole and placing a patch of reinforced concrete across the width of the upstream side of the arch. The Department continues to indicate concerns relative to the structural integrity of the dam.

Comprehensive testing of the dam's integrity by subjecting samples of the concrete to laboratory stress testing has not been performed. Seismic testing has also not been performed to date.

E.2. Storage Restrictions and Spillway Reconstruction

As a result of the Department's order dated January 10, 2005, the Company constructed a new spillway with a capacity sufficient to pass the 100-year flood inflow to the reservoir of 1,170 cfs, after routing through the reservoir and accounting for the outlet gate capacity.

The spillway was designed by Brockway Engineering and included removal of two arch sections, construction of an uncontrolled rip-rapped spillway, and a new spillway channel running southward and joining the old spillway channel. This project was constructed from January through March of 2005 and was approved by the Department. The new spillway elevation is 69.2 feet, corresponding to a storage volume of 5515 acre-feet.

The spillway operated flawlessly in 2005 and 2006, passing an estimated 500 cfs or more each year. The spillway has also operated in 2007 and 2008 to a lesser extent.

Abandonment of the original spillway and construction of a spillway at a lower elevation has alleviated to some extent the structural concerns, since the dam now holds about 38% of its maximum original volume and the hydraulic head has been reduced by 21 feet. The reduction in storage volume compared to the maximum historical storage of the dam (with the spillway check boards in place) is 8,896 acre-feet.

The volume contained in the reservoir above the lowered spillway elevation will no longer be stored each year and will continue to flow in Fish Creek to its natural terminus in the basalt flows south of Highway 20. Depending on the available water supply, the volume of foregone storage could be up to 8,896 acre-feet. In addition, evaporative losses from the reservoir surface during the period when the elevation would have been greater than 69.2 feet have been reduced.

F. FISH CREEK BASIN HYDROLOGY

The watershed above Fish Creek Dam is characterized chiefly by rangeland with minor forested areas above 6000 feet. Two major drainages have their confluence at Fish Creek Reservoir: West Fork Fish Creek and the main channel of Fish Creek. East Fork Fish Creek enters the main channel about 2 miles above the dam.

The total drainage area and other pertinent hydrologic characteristics of the basin above the dam were calculated using topographic digital elevation model (DEM) data utilizing the Streamstats web-based tool developed by the U.S. Geological Survey. Mean annual precipitation was taken from the most recent map prepared by the Idaho State Climatologist's office. The results are shown in Table 1. The drainage basin delineation is shown on Figure 1.

Table 1. Characteristics of Fish Creek basin above reservoir.

Drainage area	74.7 mi ²
Average elevation	6540 feet
Maximum elevation	9240 feet
Average slope	33%
Mean annual precipitation	18 inches

G. HISTORICAL STORAGE STATISTICS

Typical operation of the dam has been to close the outlet gates in November after the irrigation season. From November through the onset of runoff, base flow in Fish Creek is stored in the reservoir. All runoff has generally been stored in the reservoir up to the spillway elevation. However, in extremely high runoff years, e.g. 1997, 2005, and 2006, the outlet gates are also opened to release water and alleviate the spillway flow.

Records have reportedly been kept by the Fish Creek watermaster since the dam's construction, but most of the records are not contained in either the Company files or IDWR files, and likely do not exist based on personal conversations with the current watermaster. Fortunately, recent records exist for 1991-current, and a portion of the historic reservoir fill data has survived in the Company files and IDWR files for 1954-1965, 1971, 1975, and 1985-1987. This data is presented in Table 2. Included in the table is a value representing the foregone storage each year if the spillway had been at its current elevation.

Table 2. Maximum fill data for the reservoir.

Year	Maximum Fill (ac-ft)	Note	Foregone Storage (surplus above 5,515 ac-ft)
1954	8500		2985
1955	5729		214
1956	14410	(1)	8895
1957	14410	(1)	8895
1958	14410	(1)	8895
1959	9857		4342
1960	8926		3411
1961	5200		0
1962	13548	(2)	8033
1963	13200	(2)	7685
1964	12743		7228
1965	14411	(1)	8896
1971	14411	(1)	8896
1975	13548	(2)	8033
1985	14400	(1)	8885
1986	14400	(1)	8885
1987	9320		3805
1991	5329		0
1992	5374		0
1993	13274	(2)	7759
1994	7195		1680
1995	13274	(2)	7759
1996	13828	(2)	8313
1997	13828	(2)	8313
1998	13828	(2)	8313
1999	13828	(2)	8313
2000	10110		4595
2001	5875		360
2002	6502		987
2003	7450		1935
2004	6250		735
2005	14411	(3)	8896
2006	14411	(3)	8896
2007	14411	(3)	8896
2008	10081	(4)	4566

(1) Assume reservoir filled and spilled with check boards at or near maximum

(2) Assume reservoir filled and spilled with check boards less than maximum

(3) Spillway lowered, but reservoir would have filled to 14,411 ac-ft.

(4) Spillway lowered, maximum fill estimated from measured spill at new weir.

Because of the historic practice of "checking up" the spillway to some unknown degree, it is assumed that any maximum fill volume above the spillway elevation of 12,743 ac-ft represents a year in which checking up occurred and the reservoir filled and spilled. It is possible that some of the values above 12,743 ac-ft but less than 14,411 ac-ft represent situations where the spillway was checked up fully but the reservoir did not spill, but it is not possible to determine this from the available data.

Note that the storage was limited in 2005 through 2008 by the Department's storage restriction described above. In 2005 and 2006, the runoff was extremely high, with a peak discharge probably exceeding 500 cfs, and the reservoir unquestionably would have filled to capacity had the spillway not have been lowered. In 2007, runoff was also high and the reservoir probably would have filled. In 2008, the reservoir spill and releases during the runoff period were measured using the new weir at the upper road crossing. Based on this record, it is estimated that the reservoir would have filled to 10,081 acre-feet.

Including estimated maximum fill for 2005-2008, the reservoir has filled (or would have filled) to at least the old spillway elevation in 20 out of 35 years, or 57% of the years. Because the runoff which spills or is intentionally released has not historically been measured, the reservoir fill data cannot be used to determine statistics of total runoff for all years. However, in years when the reservoir did not fill, the peak reservoir content is likely a reasonable proxy for total runoff plus any carryover storage, which includes off-season base flow storage. In these years, the mean peak content is 7,778 ac-ft and the standard deviation is 2,219 ac-ft. The one factor unable to be accurately accounted for in historical data is the possibility of irrigation deliveries from natural flow and storage releases which occurred early in the season around the time of the peak.

The percentage of years in which the reservoir would have spilled with the spillway at its current elevation is of interest in assessing the potential frequency of recharge to the ESPA. The available fill data indicates that the runoff exceeded 5,515 acre-feet in 32 of the 35 years of data, or 91%. However, the total runoff magnitude for these years cannot be determined due to the limitations described above.

Statistical characteristics of future foregone storage were calculated assuming that the historical data shown in Table 2 is reasonably representative of future conditions. These statistics are shown in Table 3.

Table 3. Summary statistics for estimated future foregone storage.

Mean	5666
Median	7759
Maximum	8896
Minimum	0
Upper quartile	8885
Lower quartile	2460
% zero years	9%
% maximum years	29%

This analysis shows that, assuming the available record is reasonably representative of future patterns, the full allotment of potential recharge would be realized in 29% of the years, and the median recharge would be 7,759 acre-feet (87% of the maximum). Due to the high variability in water supply in this basin, a significant percentage of very low runoff years is expected, but only 9% of the years are expected to have runoff plus carryover less than the current reservoir capacity.

Based on the water supply analysis, significant recharge volume will be available in a high percentage of years, and it appears reasonable to pursue the approval of an aquifer recharge plan by the Department.

H. POTENTIAL AQUIFER RECHARGE CREDIT

H.1. Framework

Due to the state-mandated lowering of the overflow spillway, the capacity of Fish Creek reservoir has been reduced by 8,896 acre-feet (the difference between 14,411 ac-ft and 5,515 ac-ft). This value represents the maximum annual volume of water that will not be stored in the future (termed "foregone storage") and which will continue downstream in Fish Creek. Foregone storage may be less than 8,896 acre-feet in years when the reservoir would not have filled with the spillway at the original level, i.e. when runoff volume plus carryover is less than 14,411 ac-ft.

Due the spillway lowering, the maximum water surface area has been reduced to 270 acres from 580 acres.

Fish Creek does not normally discharge to any other surface stream. Water passing under Highway 20 in the Fish Creek channel reaches the basalt fields east of Carey and south of the highway and infiltrates to the Eastern Snake Plain Aquifer. The exception to this fact occurs during extremely high years such as 2006. In these years, water flowing in Fish Creek may reach Carey Lake. Carey Lake ordinarily has no overflow and all water entering the lake either evaporates or infiltrates. If overflow does occur from the lake, it reaches one or more laterals at the lower end of the Little Wood Irrigation District system, which subsequently discharge to disposal areas within the lava beds south of Carey. This is an extremely rare event, however.

H.2. Other Factors

In estimating total recharge credit, three ancillary factors must be considered:

1. **Seepage Losses.** Losses due to seepage will occur in the Fish Creek channel downstream of the dam. These seepage losses will infiltrate to the alluvial depositions within the Fish Creek valley. Lithologic information regarding this alluvium between the dam and the populated areas near Highway 20 is essentially nonexistent. However, it can be reasonably inferred that the Fish

Creek alluvium is similar to nearby intermontane aquifers, likely consisting of depositions of sand, gravel, and clay to varying degrees, underlain by granitic bedrock which forms essentially the lower boundary of the aquifer. Under this assumption, the aquifer should be considered tributary to the ESPA, and therefore the magnitude of seepage that would not have occurred but for the lowering of the spillway should be added to the recharge credit.

2. **Irrigation Recharge.** The block of foregone storage has been used historically for irrigation on lands served by the stored water within the service area of Fish Creek Reservoir Co. Some fraction of this volume was not consumed by the crop and contributed to incidental recharge to the aquifer. Since this recharge has always been occurring, it should be deducted in estimating recharge credit.
3. **Reservoir Evaporation Reduction.** Because the water surface area of the reservoir is limited by the spillway lowering, the evaporation losses from the water surface will be lower than they historically have been. Since the evaporation loss is a consumptive use implicitly allowed by the storage water right, a reduction in this consumptive use should be added to the recharge credit.
4. **Evaporation from Fish Creek and Recharge Pond.** Evaporation losses will occur in the Fish Creek reach from the reservoir to the recharge site, and from the recharge pond itself. These losses are small but should be deducted from the foregone storage in estimating potential recharge credit.

The magnitude of these factors is estimated as described in the following sections.

H.2.1. Seepage Loss Measurements

The portion of seepage losses that should be credited as new recharge is equal to the seepage in the channel which would not ordinarily have occurred due to storage releases. For example, if no storage deliveries are made prior to May 15, then seepage from the commencement of spillway overflow prior to May 15 should all be credited toward recharge because no water would have been in the channel historically. Once storage deliveries begin, the seepage attributable to foregone storage should be pro-rated according to the other water in the creek.

In order to facilitate seepage loss determinations in the Fish Creek channel reach from the dam to Hot Springs Ditch, a weir was installed in April 2008 at the upper crossing of Fish Creek road, known as the Upper Crossing Weir. In addition, multiple current meter measurements were made in April, May, and November 2008 to 1) measure seepage directly, and 2) calibrate the upper crossing weir since the weir becomes submerged at high flows.

Controlled releases from the dam through the outlet gates were measured using the existing Cippoletti weir at the gates. Uncontrolled spill from the dam is not measured, and enters the Fish Creek channel 0.74 miles below the dam.

The location of measurements and channel distances are shown on the aerial maps in Figures 3 through 5

The Upper Crossing Weir was installed at the inlet to a new 12-foot culvert recently installed under the county road. The weir is a sharp-crested, contracted device with a crest length of 15.95 feet. The weir behaves as a standard device at heads less than about 0.7 feet. Above this level, downstream submergence occurs but the flow appears to pass through critical depth and the device is able to be rated. Two current meter measurements were made to develop the high-flow portion of the curve.

No other weirs or measuring devices exist in the system below the reservoir. Current meter measurements were made at the Highline Ditch diversion, the pipeline diversion from the Highline Ditch, and at the Hot Springs Ditch diversion, as described below.

- ① 4/30/08 measurements. On this day, significant runoff was occurring and the reservoir was spilling. The outlet gates were closed. The flow in Fish Creek at the upper crossing was measured at 73.2 cfs. All diversion headgates were closed; however the Highline Canal and Hot Springs Ditch headgates were leaking and the flow was measured at 2.57 cfs and 1.65 cfs, respectively. The flow in Fish Creek below the Hot Springs Ditch was measured at 58.06. These measurements were used to determine the overall seepage from the upper crossing to the Hot Springs Ditch.

5/14/08 measurements. On this day, significant runoff was continuing to occur and the reservoir was spilling. The outlet gates were closed. The flow in Fish Creek at the upper crossing was measured at 51.3 cfs. Flow was being diverted to the Highline Canal and was measured to be 43.0 cfs. The remaining flow in Fish Creek was measured at 4.51 cfs. The gravity pipeline was diverting from the Highline Canal. The measured flow downstream of the pipeline intake was 22.9 cfs, indicating that the pipeline was taking 20.1 cfs. The pipeline intake has an overflow which spills back to Fish Creek. The flow in the creek downstream of this spill was measured to be 7.46 cfs, indicating that the spill was 2.95 cfs. All of the flow was being diverted to the Hot Springs Ditch, and was measured to be 3.84 cfs at this location.

- ② 11/4/08 measurements. On this day, all irrigation deliveries had ceased but the outlet gates were open. The flow in Fish Creek at the upper crossing was measured to be 6.23 cfs. All flow was being taken into the Highline Canal, and was measured to be 5.75 cfs. The creek was dry below this point.

The current meter measurements at the upper crossing were used to calibrate the new weir at the road crossing. The resulting rating curve is shown in Figure 6, which illustrates the submergence effect at flows higher than about 30 cfs.

Seepage losses in the upper reach of Fish Creek from the dam to the upper crossing were estimated for 2008 using the watermaster's readings of the Cipoletti weir at the outlet and the Upper Crossing weir. The flow at the Cipoletti weir was based on a standard rating table with correction for upstream velocity. The flow at the upper crossing weir was based on the rating curve in Figure 6. The upper reach data is provided in Appendix B. Because the reservoir spill is unmeasured, only the period after spill ceased was used. During this period, 5026 acre-feet was released from the dam

and 4632 passed the upper crossing weir. This equates to a total loss of 7.4%, or 4.5% per mile.

A summary of the current meter measurements made in 2008 and seepage loss calculations are provided in Appendices B and C. The resulting seepage losses are summarized in Table 4. Locations in this table correspond to those indicated on Figures 3 through 5.

Table 4. Summary of seepage loss measurements in Fish Creek.

Middle reach (2 to 3) - 3.41 miles			
Seepage loss (cfs)	nm	3.75	0.48
Seepage loss percentage	nm	7.3%	7.7%
Seepage loss per mile (cfs)	nm	1.10	0.14
Seepage loss percent per mile	nm	2.1%	2.3%
Lower reach (3 to 8) - 1.59 miles			
Seepage loss (cfs)	nm	3.62	no flow
Seepage loss percentage	nm	48.5%	no flow
Seepage loss per mile (cfs)	nm	2.28	no flow
Seepage loss percent per mile	nm	30.5%	no flow
Upper reach (spill return to Location 2) - 1.00 miles			
Seepage loss (cfs) based on 4.5% per mi from outlet & upper crossing weir data	3.4	2.4	0.3
Entire reach (spill return to Location 8) - 6.00 miles (5.0 miles for 11/4/08 measurement)			
Seepage loss estimate (cfs)	14.4	9.8	0.8
Seepage loss percentage	18.8%	18.2%	11.9%
Seepage loss per mile (cfs)	2.40	1.63	0.15
Seepage loss percent per mile	3.13%	3.04%	2.37%

The seepage loss measurements are consistent between the three dates, ranging from 2.37% to 3.13% per mile. The total loss from the dam to Hot Springs Ditch was 18.8% on 4/30/08 and 18.2% on 5/14/08. Note that the lower value of 11.9% on 11/4/08 reflects the fact that the creek was dry below the Highline Canal diversion.

Based on these measurements, the best estimate of total seepage is 18.5%, or the average of the two spring measurements. This loss should be applied to the volume spilled to determine the total volume lost to seepage. For example, if the entire 8,896 ac-ft of foregone storage is spilled, the seepage credit would be 0.185×8896 or 1,646 ac-ft. The average expected foregone storage based on the period of record is 5,666 ac-ft. The corresponding average seepage loss would be 1,048 ac-ft. These values do not account for adjustments necessary if irrigation deliveries are being made during the spill period, which would reduce the pro-rated seepage allocated to the foregone storage.

H.2.2. Historic Irrigation Recharge

The Director of IDWR has indicated that the fraction of the foregone storage that has historically infiltrated due to application on irrigated lands should be a deduction in calculating recharge credit. Lands in the southern portion of the Fish Creek service area are covered by storage shares, but most property owners also hold natural flow decreed water rights. The watermaster tracks deliveries according to owner, but since 1994 has not recorded storage and decreed flow separately on a daily or monthly basis. He has, however, reported annual totals for storage and decreed water for each water users. Watermaster records from 1994-2008 were used for this analysis. Earlier data is apparently available on microfiche in IDWR files. Further refinement of the analysis could be done by including earlier data, but it was felt that the recent period is more likely to reflect current land use conditions. This period included several wet years, several dry years, and a few average years, and is assumed to be reasonably representative.

Lands downstream of the dam served by Fish Creek natural flow and reservoir storage were delineated from the 1987 aerial photo, with additional guidance from the 2006 aerial photo (Figure 7). Irrigated area appears to have changed little since 1987, although many fields appear to be lightly irrigated or dry-farmed compared to 1987. This is likely due to the drought years experienced in 2001-2004, and the reduced water supply due to lowering of the dam spillway. Total irrigation was calculated to be 6,746 acres. This should be considered an upper limit. Irrigation in 2006 appeared to be about 30% less, although no delineation of individual farms was attempted.

Crop consumptive use was determined from Allen & Robison (2007) using data from the Picabo NWS station. The best estimate of consumptive use was assumed to be the precipitation deficit (Pdef) data for alfalfa (less frequent cuttings). Nearly all cropping in Fish Creek is alfalfa or pasture due to the unreliable water supply.

The total consumptive use for 6,746 acres is 16,489 acre-feet (see Appendix D). A review of the annual delivery records since 1994 indicates that the total storage and natural flow deliveries never exceeded this value, and in fact were significantly lower in most years. This finding alone suggests that irrigation infiltration is minimal. However, a monthly analysis was performed to evaluate the possibility that excess water above consumptive use was applied during the high-runoff period (May-June) when the water is available, followed by deficit irrigation for the remainder of the season. Monthly total delivery volumes from 1994 through 2004 were analyzed and compared with the monthly consumptive use volume (Appendix D). 1995, 1997, and 2000 are apparently missing from IDWR files (IDWR staff is investigating further). The 1994-2004 reflects the usage prior to the spillway lowering. The monthly analysis indicates that recharge occurred in 1994-2000, but no recharge occurred during the drought years of 2001-2004. The average recharge for all years was 312 acre-feet and the maximum of 890 acre-feet occurred in 1998. See Table 5.

Table 5. Summary of annual irrigation recharge estimate.

Year	Irrigation Recharge (ac-ft)
1994	486
1995	--
1996	730
1997	--
1998	890
1999	393
2000	--
2001	0
2002	0
2003	0
2004	0
Average	312

The effect of the reduced storage capacity will likely be to lower the average irrigation recharge, unless the water users respond by drastically reducing irrigated acreage over the long term. Since virtually no substantial crop yield or quality can be obtained on this tract with zero water application, the more likely scenario is that the water users will continue to cultivate alfalfa and irrigate the same or somewhat less acreage under deficit conditions, accepting a lower but workable crop yield. Therefore, the average value in Table 5 may be near the high end of future values. Future values will vary each year, but it is desired to develop a reasonable average value to avoid complex calculations every year.

H.2.3. Reservoir Evaporation Reduction

The lowering of the spillway will cause the water surface area of the reservoir to be limited to 270 acres, corresponding to gauge height 69.2 (see Figure 2). Historically, the maximum reservoir water surface area was 14,411 at gauge height 91.0. These values neglect the small increases due to surcharge above the spillway.

Using reservoir gauge records supplied by the watermaster, a hydrograph of water surface area was developed for the years 1994-2004 (spillway at the original height) and 2005-2008 (spillway lowered). The first period appears to cover a reasonably representative sample of climatic conditions as described above. The second period contains only four years, but includes two wet years, one moderate year, and one dry year. These hydrographs are shown on Figures 8 and 9. From this data, the average monthly water surface area was calculated for the two periods. The monthly values

were calculated only through August, since the reservoir is typically exhausted or nearly exhausted by the end of August. For years when gauge height was not recorded for all of August due to the reservoir being exhausted, the record was extended by applying the last recorded gauge height through the end of August. Figure 10 shows the average monthly water surface area calculated as described above for the two time periods.

For each month, an average evaporation value was obtained from Allen & Robison (2007) for the Picabo NWS station. Three evaporation values are contained in this dataset for different categories of open water:

1. Open water - shallow systems (ponds, streams)
2. Open water - deep systems (lakes, reservoirs)
3. Open water - small stock ponds

At first glance it would appear that the second option is most applicable to Fish Creek Reservoir; however, the annual evaporation for this category is only 370 mm or 14.6 inches. This is much less than evaporation estimates contained in other publications such as the NOAA Evaporation Atlas (38 inches), and does not coincide with evaporation pan coefficients of 0.6 to 0.7 for reservoirs and lakes as suggested by hydrologic engineering textbooks. In contrast, the Allen & Robison values for the first and third categories are 813 mm and 949 mm (32.0 inches and 37.4 inches), respectively. These values are more in line with expected values and based on the publications cited above. The first and third categories were calculated using standard procedures employing pan coefficients of 0.7 and 0.6, respectively, whereas the "deep system" evaporation value was calculated using "aerodynamic algorithms developed for American Falls Reservoir (Allen and Tasumi, 2005)." The applicability of this algorithm to other reservoirs is not known. Allen & Robison indicate that the first category is applicable to "large, shallow water bodies or deep water bodies that have high turbidity...this class may be generally applicable to relatively shallow (<4 m in depth) ponds, reservoirs and streams."

It appears that the most defensible estimate of open water evaporation from Allen & Robison (2007) is the first category. Therefore, these values were used for the monthly evaporation estimates.

The results of applying the monthly evaporation values to the average water surface areas for the 1994-2004 and 2005-2008 time periods are shown in Table 6. The estimated average difference in evaporation is 271 ac-ft. The actual difference between evaporation with the spillway at its current level and the evaporation that would have occurred with the spillway at its original height will vary each year depending on the runoff pattern and the climatic conditions affecting open-water evaporation. However, it is proposed to use a single average value to preclude a complicated calculation every year. The average of 271 ac-ft is 3.4% of the predicted median foregone storage volume, so the potential variations in this value each year will be a very small fraction of the total recharge credit.

Table 6. Average monthly reservoir storage (ac-ft), water surface elevation (acres), and evaporation (ac-ft).

	Monthly	1994-2004 (original spillway)			2005-2008 (lowered spillway)		
Month	(in)	Volume	Surface Area	Evap	Volume	Surface Area	Evap
April	2.95	8800	387	95	4936	246	60
May	4.19	10296	439	153	5183	256	89
June	4.90	8900	385	157	4384	221	90
July	5.39	6434	285	128	2540	140	63
August	5.39	2896	143	64	774	55	25
			Total	598		Total	327
Difference in Evaporation: 271 ac-ft							

H.2.4. New Evaporation

Free water surface evaporation from the Fish Creek channel and recharge site during an estimated recharge period from April 15 through June 15 was calculated to be 22 acre-feet using the values from Allen & Robison (2007) described above (Table 7).

Table 7. Estimate of evaporation from Fish Creek and recharge site.

April 15 – June 15 evaporation	8.11 inches
Maximum length of Fish Creek	7 miles
Average water surface width	15 feet
Creek water surface area	12.7 acres
Recharge pond site area (assumed)	20 acres
Total evaporation April 15 – June 15	22.0 acre-feet

I. PROPOSED WATER RIGHT ADMINISTRATIVE MECHANISM

The water right held by Fish Creek Reservoir Company for storage of surface water is numbered 37-1162. This right has been recommended in the Snake River Basin Adjudication for 14,411 acre-feet of storage with an 11/2/1922 priority date. The right allows storage for irrigation purposes only, and therefore would not allow water to be released for recharge, which is a recognized beneficial use.

In the April 2, 2008 meeting referenced in Section A, several options were discussed for administrative procedures which could allow the contemplated recharge to occur. It was decided that two administrative options are feasible:

Option 1. Transfer of water right 37-1162 from the current structure to the following structure:

Irrigation Storage	1/1-12/31	14,411 ac-ft
Irrigation From Storage	4/15-10/31	14,411 ac-ft
Recharge Storage	1/1-12/31	8,896 ac-ft
Recharge From Storage	3/1-7/31	<u>8,896 ac-ft</u>
TOTAL		14,411 ac-ft

There may be issues with recording a storage component for recharge when the reservoir cannot physically store this water. A transfer of this magnitude would require legislative approval, but IDWR staff indicated that this would likely not be difficult obtain. ^{to}

Option 2: New Permit

A permit application with a mitigation plan, without a transfer of the storage right, can be processed by IDWR. The volume not stored would be protected from forfeiture since it would be part of a mitigation plan per Idaho Code 42-223(10). The permit would list both a diversion rate and volume. This option would not require legislative approval. At this time, it appears the permit option may be the cleanest approach to accomplishing the goal.

Options involving utilization of the state water supply bank, administered by the Idaho Water Resource Board, as a mechanism by which a portion of water right 37-1162 may be used for recharge purposes were determined to be less feasible than the administrative options largely due to the 10% administrative fee that would be levied on the entire recharge volume regardless of whether any portion of the water right was leased.

J. PROPOSED OPERATION

J.1. Reservoir storage and release timing

It is proposed to close the outlet gates on or about November 1, corresponding to historic operational practice. With only 5,515 acre-feet of storage, carryover of previous-season storage is assumed to be essentially zero in all years. However, storage of base flow will occur from November 1 to about April 1, the approximate average date of runoff commencement. Base flow magnitude is expected to range from 10 to 20 cfs based on spot discharge measurements at the upstream and downstream weirs.

Assuming an average 15 cfs base flow for these 151 days, off-season storage will be 4,493 acre-feet, but will be highly variable from year to year.

Releases from the reservoir for irrigation will occur typically no earlier than about May 15. Generally, releases begin after the reservoir has either filled or reached a volume very close to the peak. In most years, the reservoir will fill and the spillway will discharge. In very high-flow years, the outlet gates may be operated as a secondary spillway.

J.2. Recharge Measurement

Some means of measuring the volume of recharge to allow calculation of the recharge credit is required. Ideally, the discharge should be measured in Fish Creek channel near the dam downstream of the inflow from the spillway channel. A measurement at this location would also measure the channel seepage, a portion of which should be credited toward recharge. However, several unmeasured irrigation diversions are delivered by the watermaster from Fish Creek, and thus water flowing in the creek may be a combination of natural flow rights, released irrigation storage, and foregone storage water. These factors complicate the measurement of recharge, and it may be difficult to isolate the recharge volume without significant error. Furthermore, a weir located near the dam would sometimes be difficult to access and maintain due to snowpack and weather conditions in April.

To avoid the above problems and obtain the most direct measurement of recharge possible, it is proposed to install a measuring weir just downstream of the last irrigation diversion, located at the Hot Springs Ditch. This location is shown on Plate 1. Historically at this location, the creek has been physically blocked except during times of very high spring runoff. All water flowing past this point will eventually recharge the ESPA. An inspection and survey has been made of the existing concrete structure at this location, and it has been determined that a sharp-crested weir can readily be installed which will essentially meet U.S. Bureau of Reclamation criteria for a standard weir.

The device will be equipped with a stilling well, an ultrasonic level sensor, and data recorder to record flow rate at intervals not greater than 1 hour, thereby allowing a total daily volume calculation.

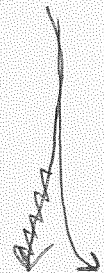
J.3. Recharge Credit Calculation

Calculation of the recharge credit should be based on actual measured values at the weir, but must also account for the factors described in Section H. As indicated in Section A, the Director of IDWR has postulated that if the estimated magnitudes of the additions and deductions are comparable, the two could be considered roughly equivalent, especially considering that the error in determining each factor is significant. If this were the case, they could be assumed to essentially cancel out, precluding the need to estimate them each year. However, the magnitude of the additions (seepage and reservoir evaporation reduction) are significantly larger than the magnitude of the deductions (irrigation recharge and new evaporation). Therefore, it is recommended that an accounting be made of all factors.

The treatment of these factors depends on whether or not they are included in the measured volume passing the weir at the proposed Hot Springs Ditch location. Amounts which are not measured should be added to or subtracted from the measurement to arrive at an "adjusted recharge volume." Amounts which are included in the weir measurement should be reflected as adjustments to the upper limit of the recharge credit.

I
LIKE
THIS

IDEA!



The measured volume at the weir will not include seepage losses from the dam to the weir, the incidental recharge from irrigation, or the new evaporation in the Fish Creek channel and the recharge pond. Therefore, an adjustment for these three effects must be applied to the measured volume at the weir.

On the other hand, the measured volume will include the evaporation difference due to reduction of water surface area. In other words, the incremental volume that would have been evaporated instead will pass over the spillway, down Fish Creek, and through the weir (implicit in this statement is that seepage losses are assumed to apply solely to the block of storage which is not evaporated). Because the evaporation reduction is measured by the weir the upper limit of recharge credit should be increased by the amount of the evaporation savings.

It is desired to develop a straightforward and simple, yet scientifically defensible, method to calculate the recharge credit each year that does not require estimation of every adjustment factor every year. Therefore, it is proposed to use constant average values for all factors except seepage.

Special treatment must be given to seepage from the dam to the proposed weir, because irrigation deliveries typically commence in April or May while runoff is still occurring and recharge credit should be accumulating. Before irrigation deliveries commence, 100% of the channel seepage should be credited to recharge. After this time, seepage credited to recharge should be a pro-rated portion of the total seepage based on the estimated fraction of the total streamflow which is foregone storage. This fraction would be determined by the watermaster by subtracting irrigation deliveries from the total streamflow.

Following the above framework, the recharge credit each year would be calculated as follows:

$$R_{adj} = V_m + S - R_i - E_{new} \quad (1)$$

where

R_{adj} = Adjusted recharge volume

V_m = Measured volume at the weir

S = Seepage losses from the dam to the weir

R_i = Incidental recharge from irrigation

E_{new} = New evaporation in Fish Creek channel and recharge pond

Based on the evaluation described in Section H, total seepage losses may be expressed as a constant fraction, s , of the volume spilled. The portion of the total seepage that is credited to recharge may be calculated by applying a factor, r , that is the estimated fraction of the total streamflow which is foregone storage. The total seepage may therefore be expressed as

$$S = \frac{s}{1-s} V_m r \quad (2)$$

and equation (1) becomes

$$R_{adj} = \left(\frac{1}{1-s} \right) V_m r - R_i - E_{new} \quad (3)$$

The value of s has been measured to be 0.185, but the value of r will vary from 0 to 1 and cannot be assumed constant. Irrigation recharge and new evaporation are assumed to be equal to their average values calculated above, 271 ac-ft and 20 ac-ft respectively. Substituting all values into equation (2) yields

$$R_{adj} = 0.227 V_m r - 251 \quad (4)$$

Because r will vary over the recharge period, R_{adj} must be calculated weekly or possibly daily, and summed to arrive at the total adjusted recharge for the season.

The upper limit on total recharge credit will be 8896 ac-ft plus the reservoir evaporation reduction of 271 ac-ft, or 9167 ac-ft. Thus the total credit each year will be

$$R_{credit} = \max \left\{ \sum R_{adj} \right. \quad (5)$$

J.4. System Monitoring

Responsibility for monitoring the recharge system during the typical recharge period (April – June) will lie with the Fish Creek watermaster, currently Lawrence Kimball.

The discharge measuring device will be visually inspected at least once per week from the onset of recharge through June 30. During this inspection, the following activities will be performed:

1. Inspect the weir plate for damage or leakage.
2. Remove debris and/or vegetation from the weir plate and pool.
3. Verify adequate aeration of the weir.
4. Backflush stilling well pipe.
5. Verify that the level sensor readout agrees with the staff gauge in the weir pool to within +/-0.01 feet; apply shift as necessary.

Conditions downstream of Highway 20 will be inspected at least twice per month from the onset of runoff through June 30 to verify that the water is reaching the basalt flows and recharging, and no unauthorized diversions are taking place.

Worksheets will be prepared to facilitate entry of all required data.

9187
5515
+
14,682
↑
THIS IS >>
TOTAL WR
STOR. VOL.
OF 14,411

J.5. Reporting

A tabulation of all measured data, calculated adjusted recharge, and calculated recharge credit will be reported each year to the Department within 30 days after the cessation of recharge but no later than September 30.

J.6. Maintenance

General repairs and maintenance to the measurement weir will be the responsibility of Fish Creek Reservoir Company.

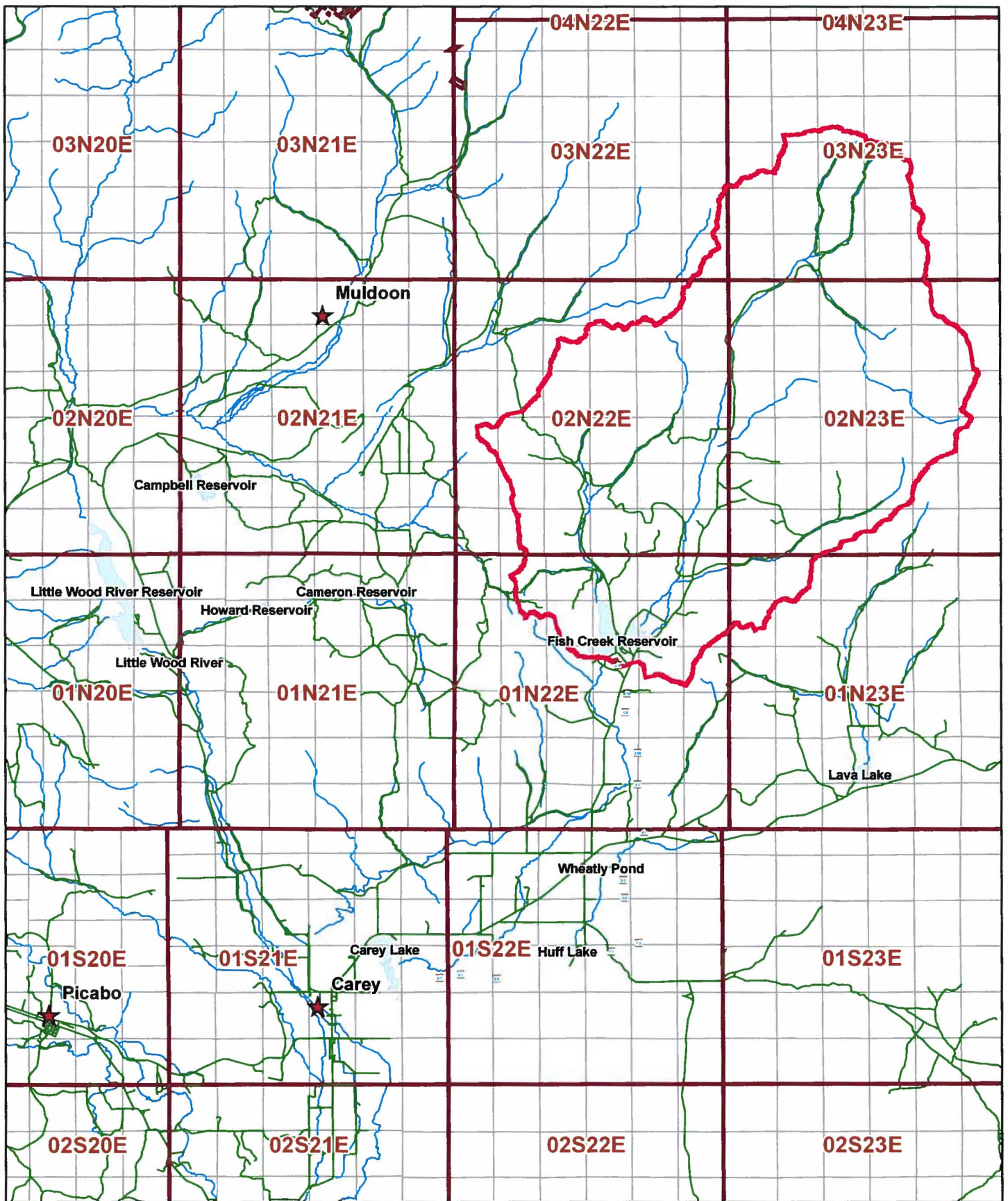


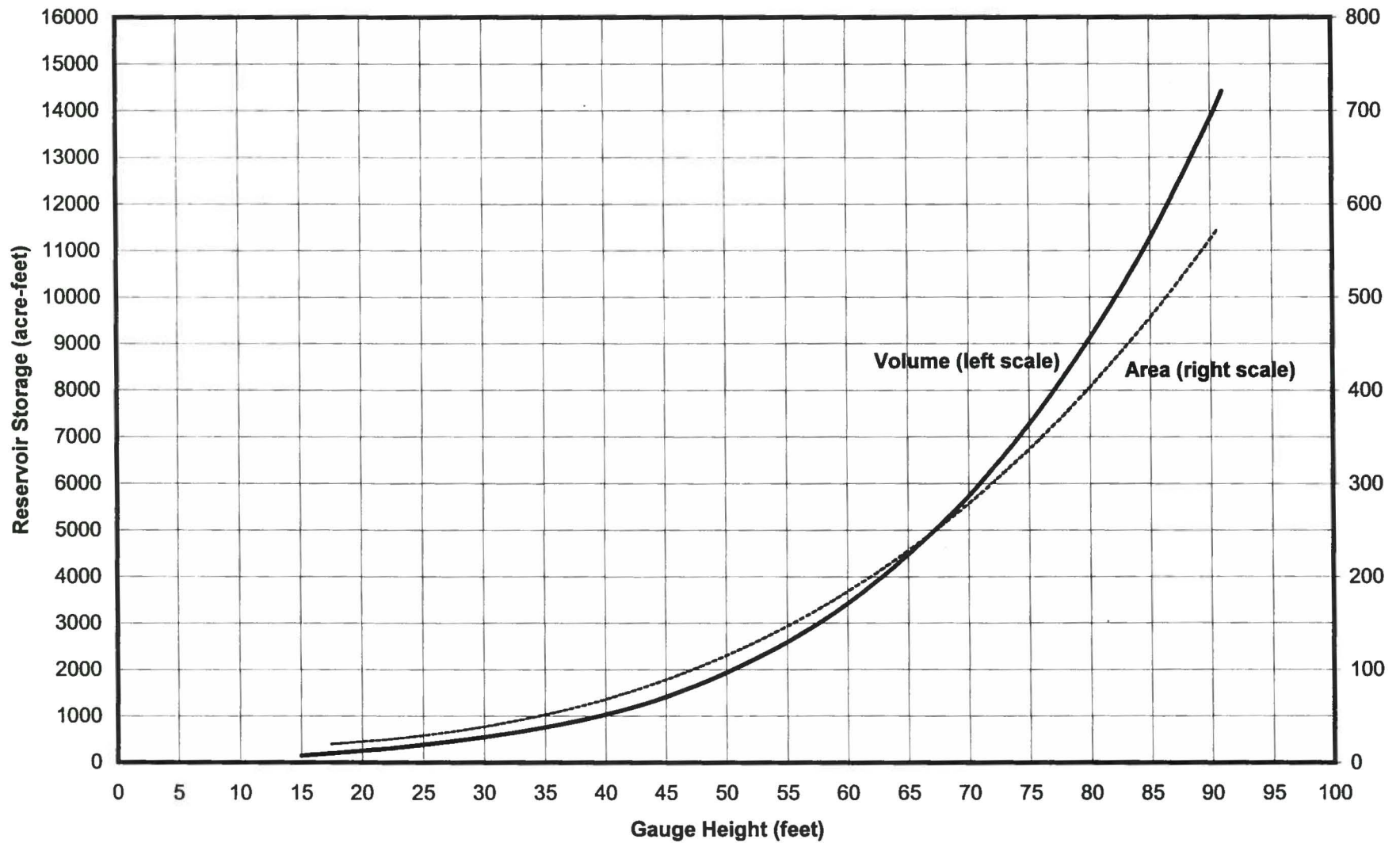
**FIGURE 1 - VICINITY MAP
FISH CREEK RESERVOIR COMPANY**

BROCKWAY ENGINEERING, PLLC.
ALR - MAY 31, 2007

Legend
 Drainage Basin
 Roads

N


Figure 2. Volume-Capacity and Area-Capacity Curves for Fish Creek Reservoir



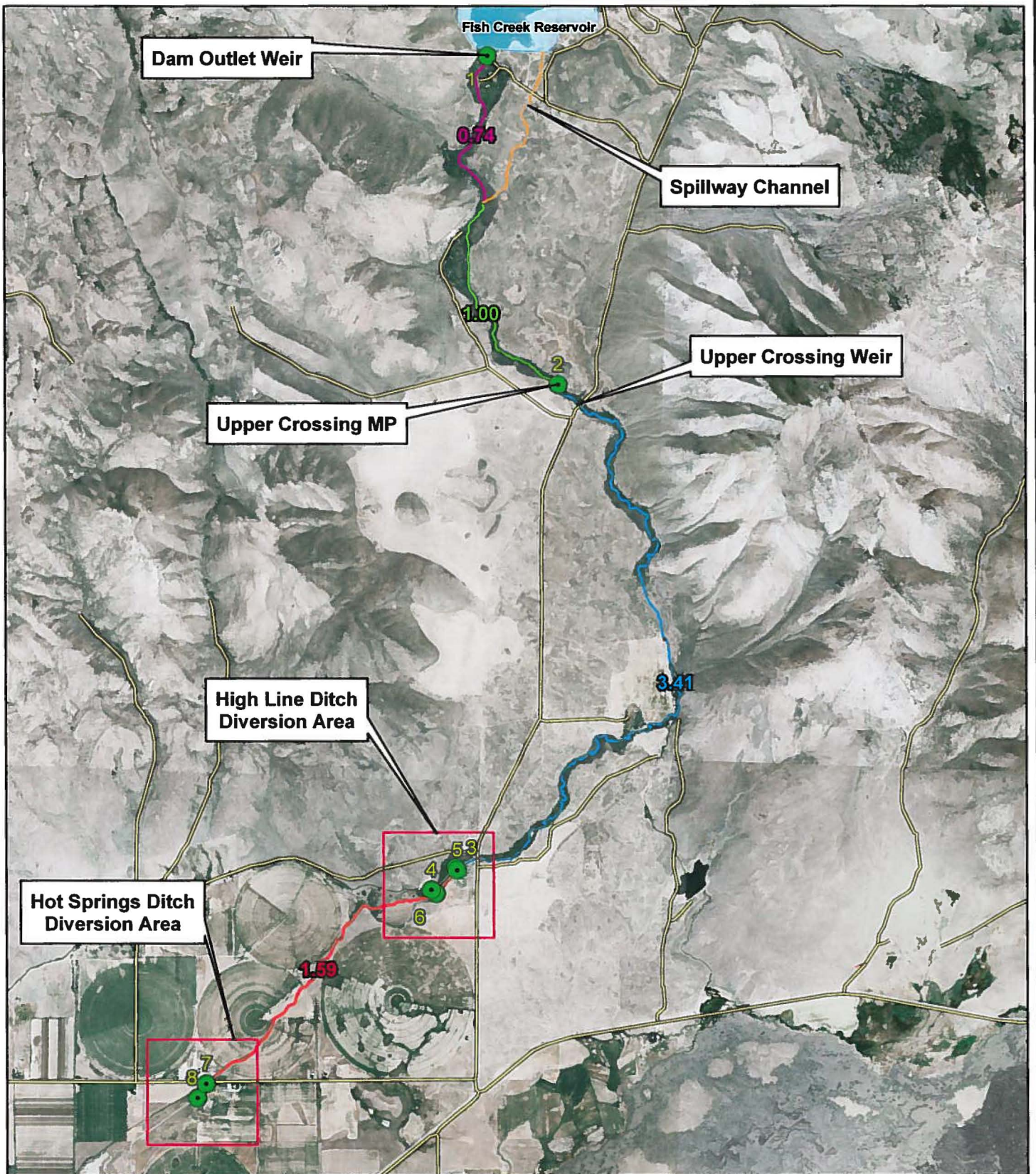


**FIGURE 3: FISH CREEK RESERVOIR COMPANY
MEASUREMENT LOCATIONS
2006 NAIP AERIAL PHOTOGRAPH**



1 inch equals 3,000 feet

BROCKWAY ENGINEERING, PLLC.
ZL- 6/12/09

F:\Projects\Fish Creek Dam\Arcview9\Fish Creek Irrigation Co. Current Meter Measurement Locations ZL 4-30-08

Legend

- Measurement Locations
- Fish Creek upper reach
- Fish Creek lower reach
- Dam outlet weir to spill way channel confluence
- Spillway confluence to upper crossing weir
- Spillway Channel



**FIGURE 4: FISH CREEK RESERVOIR COMPANY
MEASUREMENT LOCATIONS
2006 NAIP AERIAL PHOTOGRAPH**



1 inch equals 200 feet

Legend

● Measurement Locations

BROCKWAY ENGINEERING, PLLC.
ZL- 6/12/09

F:\Projects\Fish Creek Dam\Arcview9\Fish Creek Irrigation Co. Current Meter Measurement Locations- High Line Canal ZL 5-14-08



**FIGURE 5: FISH CREEK RESERVOIR COMPANY
MEASUREMENT LOCATIONS
2006 NAIP AERIAL PHOTOGRAPH**



1 inch equals 200 feet

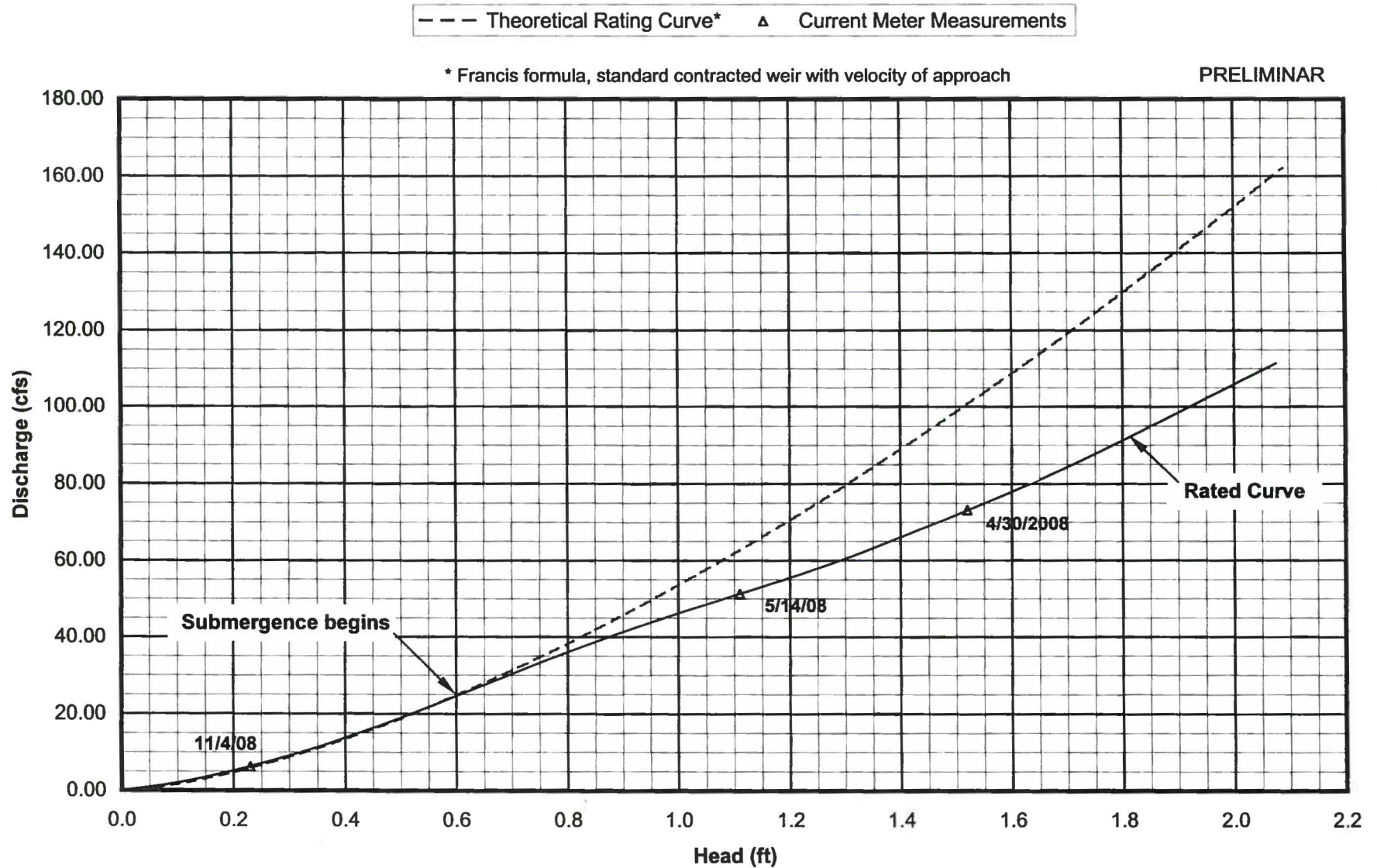
BROCKWAY ENGINEERING, PLLC.
ZL- 6/12/09

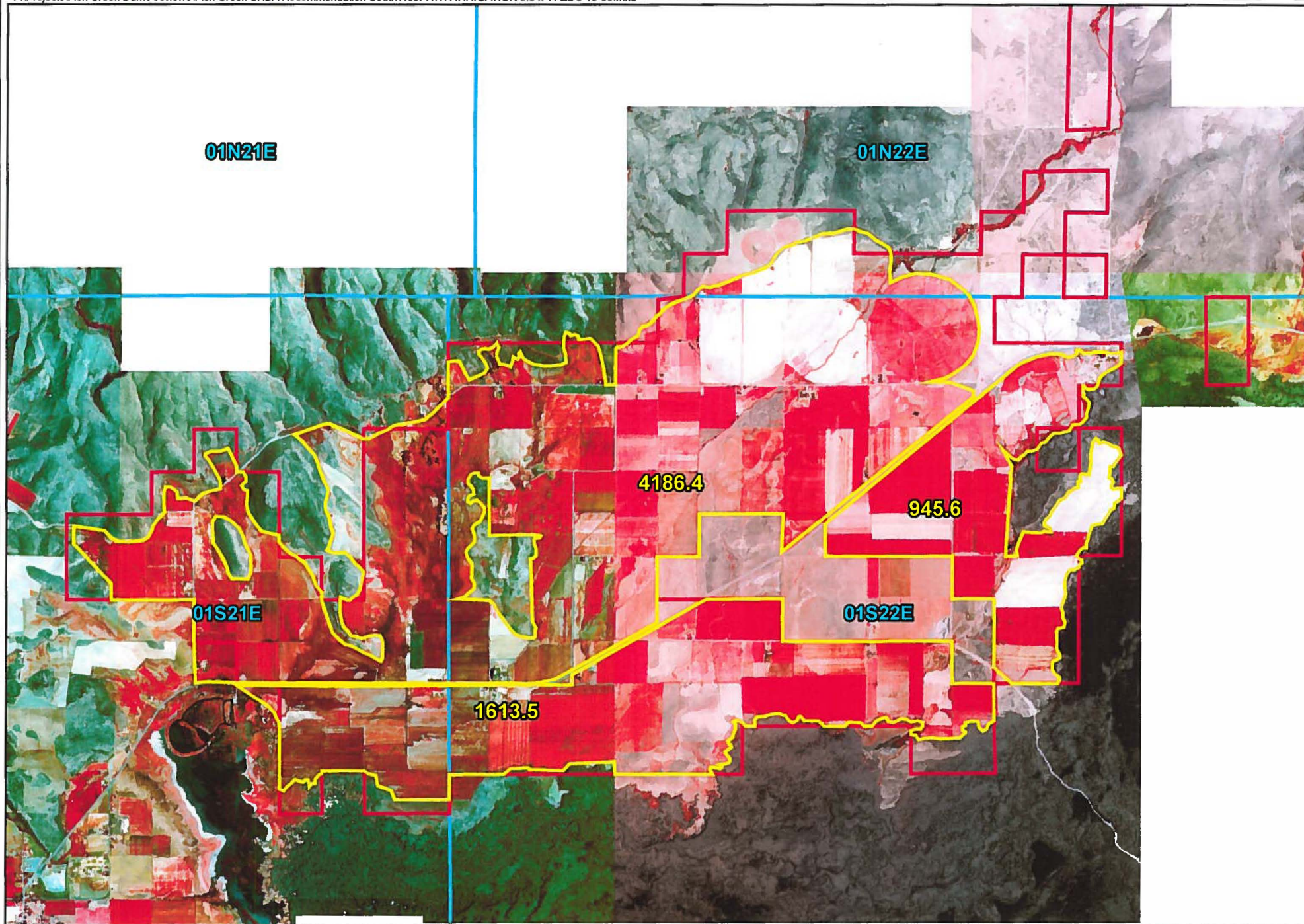
F:\Projects\Fish Creek Dam\Arcview9\Fish Creek Irrigation Co. Current Meter Measurement Locations- Hot Springs Ditch ZL 5-14-08

Legend

● Measurement Locations

Figure 6. Upper Crossing Weir Rating





1 inch equals 0.75 miles
BROCKWAY ENGINEERING, PLLC.
ALR -APRIL 28, 2009
(ZL 6/15/09)

**FIGURE 7: FISH CREEK RESERVOIR COMPANY
Water Right Recommendation 37-1162 (SOUTHERN PORTION)
1987 INFRARED AERIAL PHOTOGRAPH**

Total 1987 Irrigated Area = 6745.5 acres
 IDWR Recommended POU- WR 37-1162
 Township, Range



Figure 8. Fish Creek Reservoir Surface Area 1994-2004 (Spillway at Original Height)

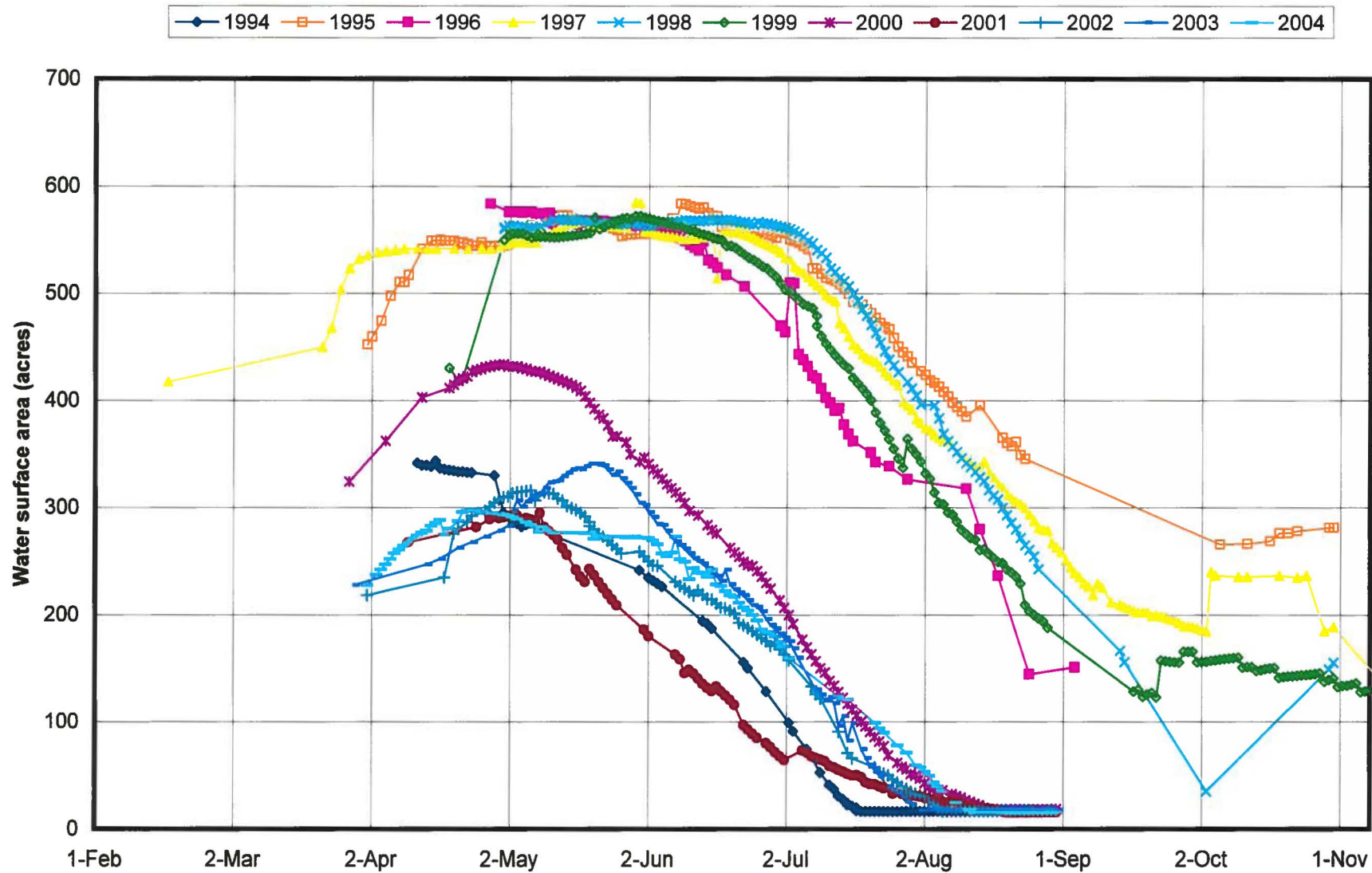


Figure 9. Fish Creek Reservoir Surface Area 2005-2008 (Spillway Lowered)

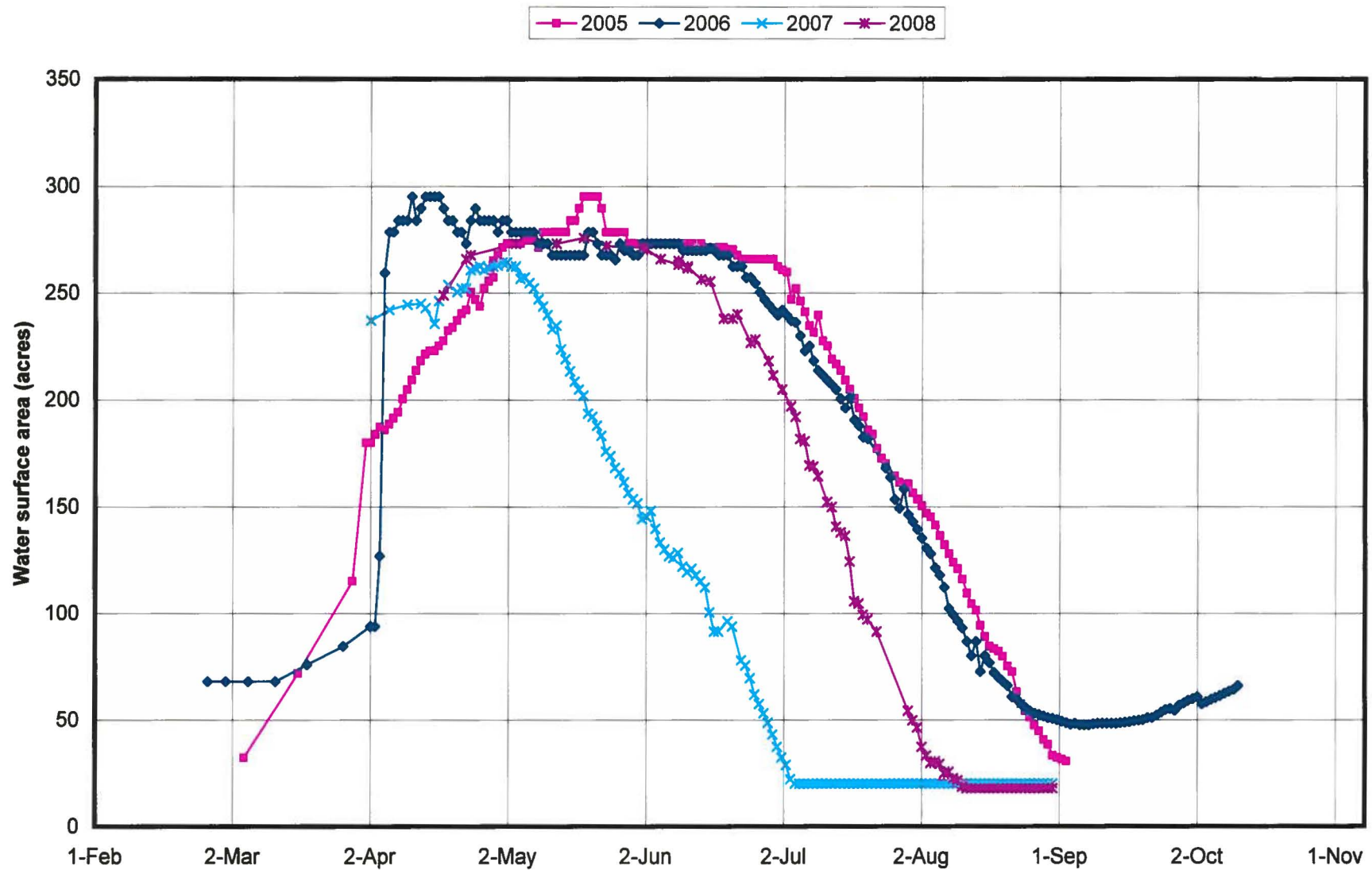
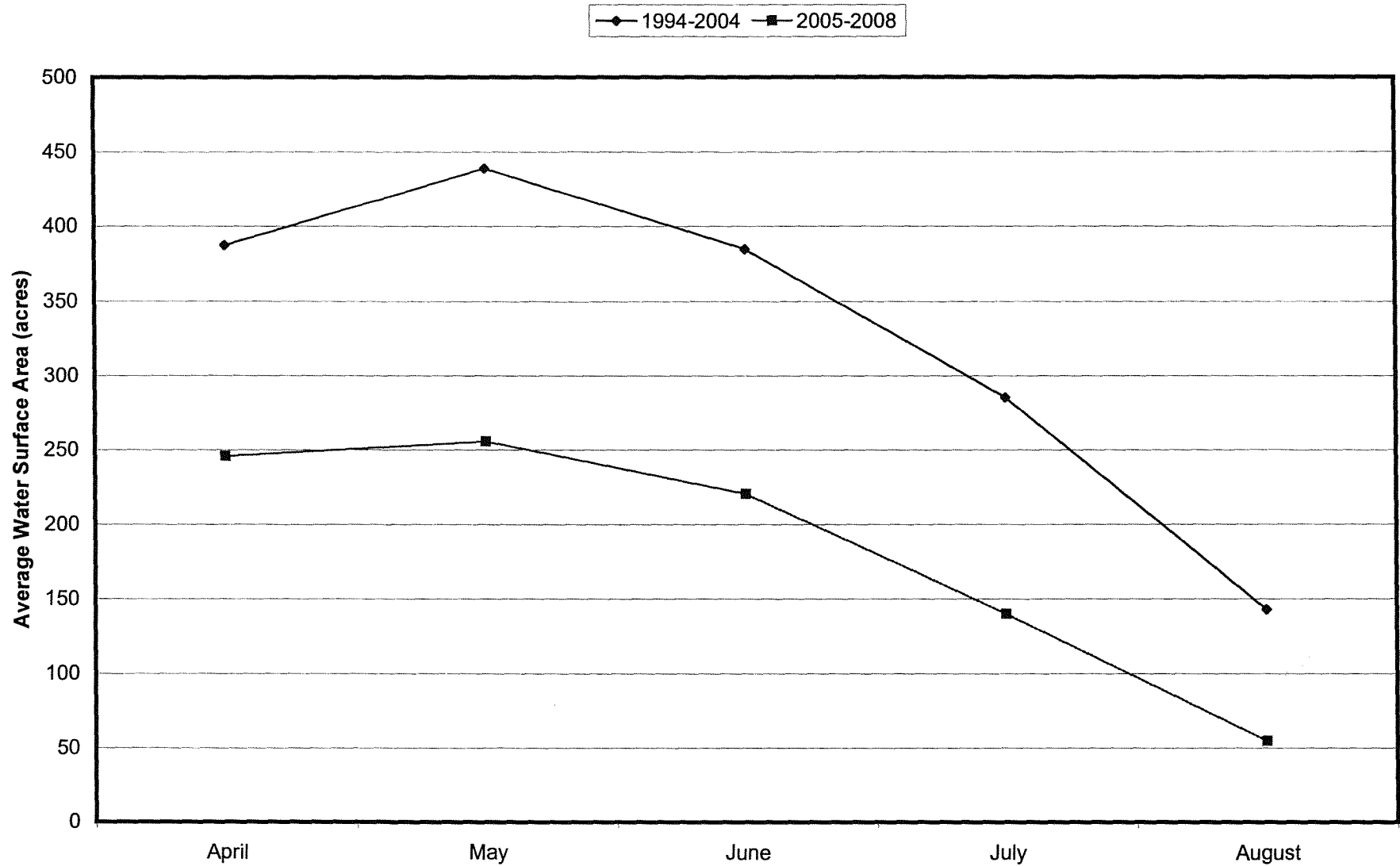


Figure 10. Fish Creek Average Monthly Reservoir Water Surface Area



Appendix

Supplemental Material

Memorandum
Reservoir Storage Table
Fish Creek Reservoir Company Water Rights
Fish Creek Natural Flow Water Rights
Fish Creek Reservoir Company Incorporation Documents



Memo

To: David Tuthill, Gary Spackman, Jeff Peppersack, Doug Surerus
From: Charles G. Brockway
Cc:
Date: April 14, 2008
Re: Re-cap of April 2, 2008 meeting regarding aquifer recharge and mitigation for the Fish Creek Reservoir Company

In attendance were David Tuthill, Gary Spackman, Jeff Peppersack from IDWR; Doug Surerus, Chip Molyneux, and Lawrence Kimball from Fish Creek Reservoir Company, and Charles G. Brockway.

General Discussion

There was general consensus on the following items.

Seepage from Fish Creek does not return to the creek. Very little data is available for the Fish Creek valley aquifer, but ample anecdotal evidence indicates that the water table near the creek is not shallow.

It is presumed that the Fish Creek valley aquifer is tributary to the Eastern Snake Plain Aquifer.

It is not necessary to account for carryover storage.

There may be an opportunity for a credit to the company due to reduction in reservoir evaporation. This warrants further exploration.

There are no diversions or returns to Fish Creek downstream of the Hot Springs Ditch diversion. All water in the creek at this point sinks in the basalt, with the exception of extremely high years such as 2006 when some water reaches Carey Lake.

The "forgone storage" volume of 8,896 acre-feet cannot all be credited as aquifer mitigation due to the likelihood that some of this water was not consumed by the crop due to irrigation inefficiencies. On the other side of the equation, some amount of seepage in the creek will likely occur that otherwise would not have occurred without the recharge plan.

These two components are difficult to quantify. In the interest of reaching a reasonable compromise, it was postulated that the Fish Creek seepage might be considered approximately equal to the non-consumptive component of the irrigation water so that the two effects could be assumed to cancel out.

For 2008, it was proposed that Fish Creek Reservoir Company would:

- Construct new weirs in Fish Creek at the upper road crossing and just downstream of the Hot Springs Ditch diversion. The lower weir would be a direct measure of water directed to recharge.
- During spring 2008, use the new weir in conjunction with the existing outlet weir to determine the total spill from the dam.
- Compare this measurement with the lower weir measurement to make an estimate of channel seepage.
- Evaluate potential evaporation credit for reduced reservoir surface area.

The Company will discuss the data collection with IDWR staff during the summer of 2008, and re-submit a final plan for aquifer recharge and mitigation.

Administrative Options

Water bank options were viewed as the least palatable due to the fact that a 10% administrative fee would be assessed whether the water was rented back to the company or to another party.

A transfer application can be processed by IDWR to modify the right to the following structure:

Irrigation Storage	1/1-12/31	14,411 ac-ft
Irrigation From Storage	4/15-10/31	14,411 ac-ft
Recharge Storage	1/1-12/31	8,896 ac-ft
Recharge From Storage	3/1-7/31	<u>8,896 ac-ft</u>
TOTAL		14,411 ac-ft

There may be issues with recording a storage component for recharge when the reservoir cannot physically store this water. A transfer of this magnitude would require legislative approval, which likely would not be difficult to obtain.

A permit application with a mitigation plan, without a transfer of the storage right, can be processed by IDWR. The volume not stored would be protected from forfeiture since it would be part of a mitigation plan (I.C. 42-223(10)). The permit would list both a diversion rate and volume. This option would not require legislative approval. At this time, it appears the permit option may be the cleanest approach to accomplishing the goal.

TABLE 3

CAPACITY TABLE FOR FISH CREEK OR — CAREY VALLEY RESERVOIR

G.H.	Capacity	Diff	G.H.	Capacity	Diff	G.H.	Capacity	Diff	G.H.	Capacity	Diff	G.H.	Capacity	Diff
15.0	145		24.5	732	23	54.0	2403	68	73.5	6784	162			
15.5	155	10	25.0	756	24	54.5	2522	69	74.0	6946	162			
16.0	165	10	25.5	780	24	55.0	2592	70	74.5	7111	165			
16.5	175	10	26.0	805	25	55.5	2664	72	75.0	7279	168			
17.0	185	10	26.5	830	25	56.0	2738	74	75.5	7450	171			
17.5	195	10	27.0	856	26	56.5	2814	76	76.0	7624	174			
18.0	205	10	27.5	883	27	57.0	2895	79	76.5	7801	177			
18.5	216	11	28.0	911	28	57.5	2975	82	77.0	7981	180			
19.0	227	11	28.5	940	29	58.0	3060	85	77.5	8164	183			
19.5	239	12	29.0	970	30	58.5	3148	88	78.0	8350	186			
20.0	252	13	29.5	1001	31	59.0	3238	90	78.5	8539	189			
20.5	265	13	30.0	1033	32	59.5	3330	92	79.0	8731	192			
21.0	278	13	30.5	1066	33	60.0	3424	94	79.5	8926	195			
21.5	291	13	31.0	1100	34	60.5	3520	96	80.0	9124	198			
22.0	304	13	31.5	1135	35	61.0	3618	98	80.5	9325	201			
22.5	317	13	32.0	1171	36	61.5	3718	100	81.0	9529	204			
23.0	330	13	32.5	1208	37	62.0	3820	102	81.5	9736	207			
23.5	343	13	33.0	1246	37	62.5	3924	104	82.0	9946	210			
24.0	356	13	33.5	1286	40	63.0	4030	106	82.5	10159	213			
24.5	370	14	34.0	1327	41	63.5	4138	108	83.0	10375	216			
25.0	384	14	34.5	1370	43	64.0	4248	110	83.5	10594	219			
25.5	398	14	35.0	1415	45	64.5	4360	112	84.0	10816	222			
26.0	413	15	35.5	1461	46	65.0	4474	114	84.5	11041	225			
26.5	428	15	36.0	1508	47	65.5	4590	116	85.0	11270	228			
27.0	443	15	36.5	1556	48	66.0	4708	118	85.5	11503	231			
27.5	459	16	37.0	1606	50	66.5	4828	120	86.0	11741	234			
28.0	475	16	37.5	1658	52	67.0	4950	122	86.5	11984	238			
28.5	492	17	38.0	1711	53	67.5	5074	124	87.0	12232	241			
29.0	509	17	38.5	1765	54	68.0	5200	126	87.5	12485	245			
29.5	527	18	39.0	1821	56	68.5	5329	129	88.0	12743	248			
30.0	545	18	39.5	1879	57	69.0	5461	132	88.5	13006	252			
30.5	564	19	40.0	1938	59	69.5	5596	135	89.0	13274	256			
31.0	583	19	40.5	1998	60	70.0	5734	138	89.5	13548	260			
31.5	603	20	41.0	2060	62	70.5	5875	141	90.0	13828	264			
32.0	623	20	41.5	2123	63	71.0	6019	144	90.5	14115	267			
32.5	644	21	42.0	2187	64	71.5	6166	147	91.0	14411	271			
33.0	665	21	42.5	2252	65	72.0	6316	150						
33.5	687	22	43.0	2318	66	72.5	6469	153						
34.0	709	22	43.5	2385	67	73.0	6625	156						

Spillway Crest

Crest of Dam

GAGE DATUM: 4990 FEET - 150 FT. GAGE HEIGHT

JAN 05 1953

#1A

IDAHO DEPARTMENT OF WATER RESOURCES
RECOMMENDED WATER RIGHTS ACQUIRED UNDER STATE LAW

RIGHT NUMBER: 37-1162

NAME AND ADDRESS: FISH CREEK RESERVOIR CO INC
C/O RONALD F PECK
395 AUSTIN RD
CAREY ID 83320

SOURCE: FISH CREEK

TRIBUTARY: LITTLE WOOD RIVER

QUANTITY: 14,411.00 AFY

PRIORITY DATE: 11/02/1922

POINT OF

DIVERSION: T01N R22E S15 SWNNW Within BLAINE County

PURPOSE AND
PERIOD OF USE:

<u>PURPOSE OF USE</u>	<u>PERIOD OF USE</u>	<u>QUANTITY</u>
IRRIGATION STORAGE	01/01 12/31	14,411.00 AFY
IRRIGATION FROM STORAGE	04/15 10/31	14,411.00 AFY

PLACE OF USE:

8066.3 ACRES TOTAL

The boundary encompassing the place of use for this water right is described with a digital boundary as defined by I.C. Section 42-202B(2) and authorized pursuant to I.C. Section 42-1411(2)(h). The data comprising the digital boundary are incorporated herein by reference and are stored on a CD-ROM disk issued in duplicate originals on file with the SRBA District Court and the Idaho Department of Water Resources. A map depicting the place of use is attached hereto to illustrate the place of use described by the digital boundary.

Place of Use is within Blaine County, and is on land irrigated by shareholders of the Fish Creek Reservoir Co Inc.

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

EXPLANATORY MATERIAL: BASIS OF CLAIM - Decreed

IDAHO DEPARTMENT OF WATER RESOURCES
RECOMMENDED WATER RIGHTS ACQUIRED UNDER STATE LAW

RIGHT NUMBER: 37-14273

NAME AND ADDRESS: FISH CREEK RESERVOIR CO INC
C/O RONALD F PECK
395 AUSTIN RD
CAREY ID 83320

SOURCE: GROUND WATER

TRIBUTARY:

QUANTITY: 2.400 CFS
17,094.00 AFY

PRIORITY DATE: 05/23/1961

POINT OF

DIVERSION: T01N R22E S11 SWSE Within BLAINE County
T01N R22E S11 NWNSE Within BLAINE County
T01N R22E S11 SENWSE Within BLAINE County

PURPOSE AND
PERIOD OF USE:

<u>PURPOSE OF USE</u>	<u>PERIOD OF USE</u>	<u>QUANTITY</u>
IRRIGATION STORAGE	01/01 12/31	1,738.00 AFY
IRRIGATION	04/15 10/15	2.400 CFS 17,094.00 AFY
DIVERSION TO STORAGE	01/01 12/31	2.400 CFS
IRRIGATION FROM STORAGE	04/15 10/15	1,738.00 AFY

PLACE OF USE:

4884 ACRES TOTAL

The boundary encompassing the place of use for this water right is described with a digital boundary as defined by I.C. Section 42-202B(2) and authorized pursuant to I.C. Section 42-1411(2)(h). The data comprising the digital boundary are incorporated herein by reference and are stored on a CD-ROM disk issued in duplicate originals on file with the SRBA District Court and the Idaho Department of Water Resources. A map depicting the place of use is attached hereto to illustrate the place of use described by the digital boundary.

OTHER PROVISIONS NECESSARY FOR DEFINITION OR ADMINISTRATION OF THIS WATER RIGHT:

This partial decree is subject to such general provisions necessary for the definition of the rights or for the efficient administration of the water rights as may be ultimately determined by the Court at a point in time no later than the entry of a final unified decree. Section 42-1412(6), Idaho Code.

EXPLANATORY MATERIAL: BASIS OF CLAIM - Beneficial Use

NATURAL FLOW RIGHTS ON FISH CREEK, BLAINE COUNTY
SRBA Recommendations from IDWR database

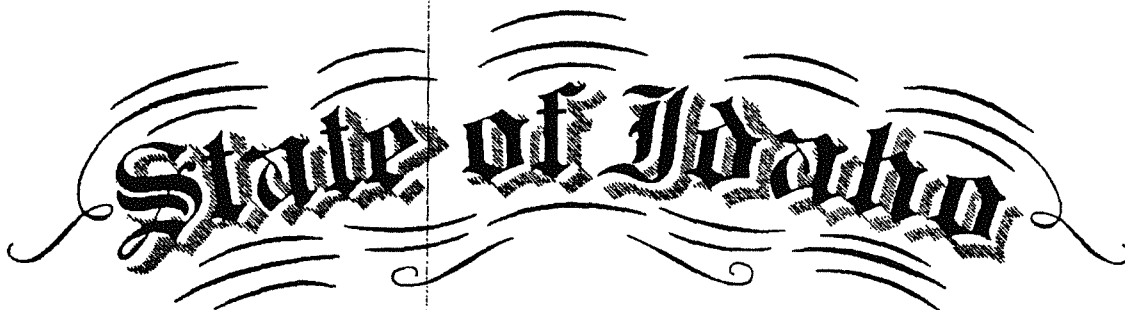
31-May-01

	Basis	Priority Date	Div Rate	Source	Water Uses	Owner List
37-733	Decreed	1883-03-30	0.225	FISH CREEK	IRRIGATION	ELLSWORTH ENTERPRISES (Current)
37-734	Decreed	1910-04-15	1	FISH CREEK	IRRIGATION	PARDUE, W D (Current)
37-735	Decreed	1883-03-30	0.225	FISH CREEK	IRRIGATION	ELLSWORTH ENTERPRISES (Current)
37-736	Decreed	1910-05-23	2	FISH CREEK	IRRIGATION	PARDUE, W D (Current)
37-737A	Decreed	1883-03-30	0.7	FISH CREEK	IRRIGATION	ELLSWORTH ENTERPRISES (Current)
37-737B	Decreed	1883-03-30	0.7	FISH CREEK	IRRIGATION	MOLYNEUX, C E (Current)
37-738	Decreed	1883-03-30	2	FISH CREEK	IRRIGATION	ELLSWORTH, MAURICE C (Current)
37-739	Decreed	1905-08-18	2	FISH CREEK	IRRIGATION	REAY, DELORES (Current); REAY, SHIRL (Current)
37-740	Decreed	1905-08-18	2.4	FISH CREEK	IRRIGATION	PECK, RONALD F (Current); PECK, WANDA (Current)
37-741	Decreed	1906-05-15	0.5	FISH CREEK	IRRIGATION	SHAW, T FRANK (Current)
37-743A	Decreed	1909-01-16	1.6	FISH CREEK	IRRIGATION	PARDUE, W D (Current)
37-743B	Decreed	1909-01-16	1.6	FISH CREEK	IRRIGATION	SWEAT, CATHERINE L (Current); SWEAT, MILFORD (Current)
37-744B	Decreed	1905-09-15	1.3	FISH CREEK	IRRIGATION	BAIRD, DENNIS (Current); FISCUS, LAURIE (Current)
37-745	Decreed	1909-05-05	0.4	FISH CREEK	IRRIGATION	LAVA LAKE LAND & LIVESTOCK LLC (Current)
37-746	Decreed	1911-05-30	0.5	FISH CREEK	IRRIGATION	LAVA LAKE LAND & LIVESTOCK LLC (Current)
37-747	Decreed	1908-06-01	2.6	FISH CREEK	IRRIGATION	REAY, DELORES (Current); REAY, SHIRL (Current)
37-748	Decreed	1905-08-18	1.6	FISH CREEK	IRRIGATION	KIMBALL, DARLA M (Current); KIMBALL, LAWRENCE C (Current)
37-749C	Decreed	1883-03-30	3.2	FISH CREEK	IRRIGATION	ELLSWORTH, MAURICE C (Current)
37-750	Decreed	1906-06-15	0.8	FISH CREEK	IRRIGATION	TELFER INC (Current)
37-751	Decreed	1907-05-01	0.5	FISH CREEK	IRRIGATION	PARDUE CATTLE COMPANY LLC (Current)
37-752	Decreed	1883-03-30	0.225	FISH CREEK	IRRIGATION	ELLSWORTH ENTERPRISES (Current)
37-754	Decreed	1908-05-15	1	FISH CREEK	IRRIGATION	PARDUE, W D (Current)
37-756	Decreed	1883-03-30	0.225	FISH CREEK	IRRIGATION	ELLSWORTH ENTERPRISES (Current)
37-757	Decreed	1909-01-16	4	FISH CREEK	IRRIGATION	PARDUE CATTLE COMPANY LLC (Current)
37-758	Decreed	1884-06-01	2	FISH CREEK EAST FORK	IRRIGATION	CARNEY, BARBARA J (Current); CARNEY, GARY (Current); CARNEY, PAUL (Current); CARNEY, POLLY (Current)
37-759	Decreed	1884-06-01	0.5	FISH CREEK EAST FORK	IRRIGATION	SKELTON, FRANCES (Current); SKELTON, LEON (Current)
37-760	Decreed	1885-06-01	0.8	FISH CREEK	IRRIGATION	CARNEY, BARBARA J (Current); CARNEY, GARY (Current); CARNEY, PAUL (Current); CARNEY, POLLY (Current)
37-761A	Decreed	1885-06-01	0.25	FISH CREEK EAST FORK	IRRIGATION	CARNEY, BARBARA J (Current); CARNEY, GARY (Current); CARNEY, PAUL (Current); CARNEY, POLLY (Current)
37-761B	Decreed	1885-06-01	0.75	FISH CREEK EAST FORK	IRRIGATION	SKELTON, FRANCES (Current); SKELTON, LEON (Current)
37-762	Decreed	1902-06-01	0.4	FISH CREEK EAST FORK	IRRIGATION	SKELTON, FRANCES (Current); SKELTON, LEON (Current)
37-763	Decreed	1887-06-01	0.8	FISH CREEK	IRRIGATION	CARNEY, BARBARA J (Current); CARNEY, GARY (Current); CARNEY, PAUL (Current); CARNEY, POLLY (Current)
37-764	Decreed	1890-06-01	0.6	FISH CREEK EAST FORK	IRRIGATION	CARNEY, BARBARA J (Current); CARNEY, GARY (Current); CARNEY, PAUL (Current); CARNEY, POLLY (Current)
37-766	Decreed	1905-04-10	0.8	FISH CREEK WEST FORK	IRRIGATION	BLANCHARD, RICHARD F (Current)
37-767	Decreed	1904-04-30	1	FISH CREEK	IRRIGATION	ELLSWORTH ENTERPRISES (Current)
37-768A	Decreed	1903-04-30	0.9	FISH CREEK	IRRIGATION	PARDUE CATTLE COMPANY LLC (Current)
37-769	Decreed	1883-03-30	2.3	FISH CREEK	IRRIGATION	ELLSWORTH ENTERPRISES (Current)
37-769A	Decreed	1883-03-03	0.9	FISH CREEK	IRRIGATION	PARDUE CATTLE COMPANY LLC (Current)
37-770C	Decreed	1883-03-30	2.5	FISH CREEK	IRRIGATION	ELLSWORTH ENTERPRISES (Current)
37-771	Decreed	1898-06-01	0.1	FISH CREEK	IRRIGATION	ELLSWORTH ENTERPRISES (Current)
37-772A	Decreed	1883-03-30	1.6	FISH CREEK	IRRIGATION	WHITBY, BEVERLY A (Current); WHITBY, ROBERT D (Current)
37-773	Decreed	1905-08-18	1.6	FISH CREEK	IRRIGATION	WILDE, EDRIC L (Current); WILDE, SHERRIE (Current)
37-774A	Decreed	1905-08-18	1.26	FISH CREEK	IRRIGATION	STYHL, EDITH (Current); STYHL, PHILIP (Current)
37-774B	Decreed	1905-08-18	1.34	FISH CREEK	IRRIGATION	STYHL, ELWYN (Current)
37-775	Decreed	1905-08-18	2.16	FISH CREEK	IRRIGATION	HAWKES, ANTHONY B (Current); HAWKES, CHERYL A (Current)
37-776	Decreed	1905-08-18	5.8	FISH CREEK	IRRIGATION	PECK, LEON (Current)
37-777	Decreed	1899-06-30	3.1	FISH CREEK	IRRIGATION, STOCKWATER	BARTON, JOHN K (Current); BARTON, LETA (Current)
37-778	Decreed	1907-06-15	2.2	FISH CREEK	IRRIGATION, STOCKWATER	BARTON, JOHN K (Current); BARTON, LETA (Current)
37-779	Decreed	1905-04-21	1.06	FISH CREEK WEST FORK	IRRIGATION	BLANCHARD, RICHARD F (Current)
37-780A	Decreed	1883-03-30	1.3	FISH CREEK	IRRIGATION, STOCKWATER	CROSS, GILBERT G (Current)
37-780B	Decreed	1883-03-30	0.8	FISH CREEK	IRRIGATION	MOLYNEUX, C E (Current)

37-781A	Decreed	1883-03-30	1.62 FISH CREEK	IRRIGATION
37-781B	Decreed	1883-03-30	1.58 FISH CREEK	IRRIGATION
37-782	Decreed	1904-05-18	1.2 WEST FORK FISH CREEK	IRRIGATION
37-786	Decreed	1904-08-23	1.4 FISH CREEK	IRRIGATION
37-1163	Decreed	1923-05-01	1.56 FISH CREEK	IRRIGATION
37-1178	Decreed	1907-07-25	0.8 FISH CREEK	IRRIGATION
37-1179	Decreed	1909-01-16	4 FISH CREEK	IRRIGATION
37-1181	Decreed	1910-06-10	1.1 FISH CREEK	IRRIGATION
37-1214	Decreed	1884-06-01	0.5 FISH CREEK	IRRIGATION
37-1215	Decreed	1885-06-01	1.6 FISH CREEK	IRRIGATION
37-2195	License	1910-11-13	0.86 FISH CREEK	IRRIGATION
37-4392	Beneficial U	1926-12-31	0.8 FISH CREEK	IRRIGATION
37-10675	Decreed	1883-03-30	1.6 FISH CREEK	IRRIGATION
37-12021	Decreed	1904-05-15	0.4 FISH CREEK	IRRIGATION
37-12022	Decreed	1905-08-18	1.6 FISH CREEK	IRRIGATION
37-12023	Decreed	1903-05-15	1.6 FISH CREEK	IRRIGATION
37-21127	Beneficial U	1930-01-01	0.02 LITTLE FISH CREEK	STOCKWATER
37-21218	Decreed	1905-08-18	0.9 FISH CREEK	IRRIGATION
37-21219	Decreed	1905-08-18	0.9 FISH CREEK	IRRIGATION
37-21636	Decreed	1905-09-15	0.65 FISH CREEK	IRRIGATION
37-21637	Decreed	1905-09-15	0.65 FISH CREEK	IRRIGATION
37-22082	Beneficial U	1885-07-01	0.02 UNNAMED STREAM , WEST F	STOCKWATER
37-22089	Beneficial U	1885-07-01	0.02 FISH CREEK , UNNAMED STF	STOCKWATER
37-22094	Beneficial U	1885-07-01	0.02 FISH CREEK , UNNAMED STF	STOCKWATER
37-22095	Beneficial U	1885-07-01	0.02 EAST FORK FISH CREEK , UN	STOCKWATER

TOTAL CFS 93.54

CENARRUSA, JANICE M (Current); CENARRUSA, JERRY (Current)
 CENARRUSA, JANICE M (Current); CENARRUSA, JERRY (Current)
 HANSEN, LANETA (Current)
 TELFER INC (Current)
 CARNEY, BARBARA J (Current); CARNEY, GARY (Current); CARNEY, PAUL (Current); CARNEY, POLLY (Current)
 KIMBALL, DARLA M (Current); KIMBALL, LAWRENCE C (Current)
 KIMBALL, DARLA M (Current); KIMBALL, LAWRENCE C (Current)
 ELLSWORTH ENTERPRISES (Current)
 SKELTON, FRANCES (Current); SKELTON, LEON (Current)
 SKELTON, FRANCES (Current); SKELTON, LEON (Current)
 PARDUE, W D (Current)
 LAVA LAKE LAND & LIVESTOCK LLC (Current)
 PETERSON, RICHARD E (Current); PETERSON, ROSEMARY (Current)
 PARDUE, W D (Current)
 PARDUE, W D (Current)
 PARDUE, W D (Current)
 MACLAIC CORP (Current)
 RUSH, ALMA E (Current); RUSH, JOE L (Current)
 VILLAVICENCIO, MARLA (Current); VILLAVICENCIO, VICTOR (Current)
 PECK, KATHI L (Current); PECK, ROBB (Current)
 ADAMS, ROBERT MICHAEL (Current)
 LAVA LAKE LAND & LIVESTOCK LLC (Current)
 LAVA LAKE LAND & LIVESTOCK LLC (Current)
 LAVA LAKE LAND & LIVESTOCK LLC (Current)
 LAVA LAKE LAND & LIVESTOCK LLC (Current)



Department of State.

**CERTIFICATE OF INCORPORATION
OF**

CAREY VALLEY IRRIGATION RESERVOIR COMPANY, INC.

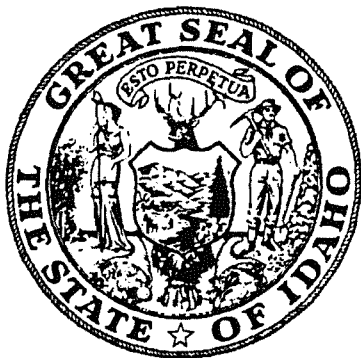
I, PETE T. CENARRUSA, Secretary of State of the State of Idaho, hereby certify that
duplicate originals of Articles of Incorporation for the incorporation of _____

CAREY VALLEY IRRIGATION RESERVOIR COMPANY, INC.

duly signed pursuant to the provisions of the Idaho Nonprofit Corporation Act, have been received
in this office and are found to conform to law.

ACCORDINGLY and by virtue of the authority vested in me by law, I issue this Certificate of
Incorporation and attach hereto a duplicate original of the Articles of Incorporation.

Dated _____ **October 3** _____, 19 **79** .



Pete T. Cenarrusa

SECRETARY OF STATE

Corporation Clerk

FILED

ARTICLES OF INCORPORATION

OCT 3 1 22 PM '79

OF

SECRETARY OF STATE

CAREY VALLEY IRRIGATION RESERVOIR COMPANY, INC.

We, the undersigned, full-aged citizens of the United States and all residents of the County of Blaine, State of Idaho, do hereby voluntarily associate ourselves together for the purpose of forming a mutual non-profit irrigation corporation under the provisions of Idaho Code Section 30-301, et. seq., and the amendments thereto.

ARTICLE I

Name

The name of this corporation shall be the "CAREY VALLEY IRRIGATION RESERVOIR COMPANY, INC.," and shall have perpetual existence.

ARTICLE II

Purposes

The purposes for which this corporation is formed are as follows:

(1) To construct, contract for the construction, own, hold, maintain and operate on a non-profit basis a certain dam, reservoir, irrigation system and appurtenant facilities located in Blaine County, Idaho, whereby certain waters are to be diverted from Fish Creek and its tributaries, stored in the Fish Creek Reservoir, conveyed, and delivered for beneficial use to irrigate lands which lie in Township 1 North, Range 42 E.B.M.,

1 Township 1 South, Range 22 E.B.M., and Township 1 South, Range
2 21 E.B.M., all in Blaine County, Idaho;

3 (2) To acquire, hold, own adequate water rights,
4 directly or by contract, for the irrigation of the lands under
5 said irrigation system, and to acquire additional or other water
6 rights if deemed desirable;

7 (3) To deliver said water represented by said water
8 rights for the benefit of the stockholders of this corporation
9 equally and ratably per share, or to convey water owned by
10 others under such rules as may be established in the company's
11 By-laws;

12 (4) To fix, charge, levy and collect from the stock-
13 holders assessments against said stock in sufficient and
14 appropriate amounts to pay construction charges, tolls, rentals,
15 assessments, operation and maintenance costs, pumping charges or
16 other service charges that are appropriate;

17 (5) To sell and issue shares of stock, as well as
18 different classes of stock, if necessary, for the purpose of
19 appropriately levying and assessing operation and maintenance
20 charges on an equitable basis among lands served by the system;

21 (6) To levy assessments against the capital stock in
22 accordance with Idaho law, and as provided in these Articles and
23 in the By-laws of this corporation and to provide the manner of
24 collecting the same and the penalty to attach for non-payment
25 thereof including the right to a lien against the land where the
26 water represented by such stock is appurtenant and to foreclose

1 such lien as provided in Idaho Code Section 42-2201 et. seq., or
2 any amendment thereto;

3 (7) To operate, maintain, rehabilitate, reconstruct,
4 and improve dams, reservoirs, canals, pumps, motors, pumping
5 stations, pipelines, lateral ditches, reservoirs, and other
6 irrigation structures or related facilities;

7 (8) To do any and all things necessary or proper to be
8 done in conducting the business of supplying the corporation's
9 stockholders with irrigation water for beneficial use on the
10 lands served by the corporation's system;

11 (9) To buy, own, hold, lease and dispose of such real
12 and personal property as may be necessary or expedient for the
13 proper conduct of the corporation's business;

14 (10) To commence, prosecute or defend suits, to
15 protect water rights appurtenant to the lands served by said
16 canal system, or suits for any and all other purposes;

17 (11) To borrow money, negotiate notes, bonds,
18 mortgages or other obligations for the payment of money for the
19 purposes of raising revenue to defray the expense of con-
20 struction, improvement, and all other capital expenditures, as
21 well as the management, maintenance and operation of its irriga-
22 tion system;

23 (12) To enter contracts with the Idaho Water Resource
24 Board, other State or Federal Agencies, or other persons or
25 entities in regard to the acquisition of water rights or for the
26 construction or reconstruction of dams, reservoirs, and all
27 other necessary facilities.

1 (13) To enter agreements for the joint ownership,
2 operation and maintenance of common project facilities as may be
3 appropriate and necessary with proper entities.

4 (14) To do and perform all acts necessary to carry
5 out the objects and purposes of this corporation.

6 ARTICLE III

7 Place of Business

8 The principal place of business of the corporation is
9 Carey Valley Irrigation Reservoir Company, Inc., c/o Elwin
10 Coates, Carey, Idaho, 83320, but the corporation may maintain
11 offices and places of business at such other places within the
12 State of Idaho as the Board of Directors may determine. *The registered*
13 *agent at this address is*
ARTICLE IV *Elwin Coates. 740.61*

14 The business of the corporation shall be managed by a
15 Board of Directors of five (5), to be elected, hold office, et.,
16 in the manner set out in the By-laws.

17 ARTICLE V

18 Private Property Not Subject to Corporate Debts

19 The private property of the shareholders of this
20 corporation shall not be subject to payment of corporation debts
21 other than as provided in these Articles and the corporate By-
22 laws.

23 ARTICLE VI

24 Corporate Stock and Assessments

25 Section 1. Under the terms and conditions prescribed
26 in the By-laws, this corporation shall admit as stockholders,

1 and stock shall be issued to only such persons, groups of
2 persons, organizations or corporations who own or operate real
3 property where the corporation can physically and has previously
4 made delivery of water from Fish Creek Reservoir under the
5 irrigation system presently constructed and operating, or as may
6 be later expanded or extended hereafter by acquiring additional
7 water supplies and improving and enlarging the distribution
8 system of the corporation. The corporation shall be entitled to
9 retain and hold in trust the legal title to all storage water
10 rights in Fish Creek Reservoir for the benefit of its
11 shareholders when such rights are transferred to the corporation
12 and each shareholder for whom the company holds such water
13 rights shall be entitled to his proportionate share of the water
14 rights so held in trust in accordance with his stock ownership,
15 conditioned upon the payment of all construction, operation and
16 maintenance, and other charges which may be levied against each
17 share of stock as is appropriate and in accordance with the
18 articles and By-laws of this corporation.

19 Section 2. The authorized capital stock of this
20 corporation shall be ~~Fourteen Thousand Five Hundred~~ ^{Forty-Seven Hundred} (4,411) shares of no par
21 value stock. Each share of stock in this corporation shall
22 represent one acre foot of storage space in Fish Creek Reservoir
23 owned by the corporation, together with a proportionate interest
24 in the dam, reservoir, diversion works and other facilities.

25 Section 3. In the event that the system is a sub-
26 sequently enlarged and adequate water is available for the

1 delivery to additional acres of land without reducing the amounts
2 of water to which the then present stockholders are entitled,
3 subject to the pre-emptive rights of the then stockholders, the
4 corporation may issue additional shares of the capital stock to
5 new members who shall be entitled to vote and share in the
6 ownership of the corporation equally with old members so long as
7 the new members pay their proportionate part of the total
8 construction cost of the project, including all irrigation
9 facilities, all capital costs, and equipment, and thenceforth
10 assume and agree to pay the annual operation and maintenance
11 expenses necessary for the operation of the complete system.

12 Section 4. The shares of capital stock of this cor-
13 poration and the water represented thereby shall not be trans-
14 ferable except when said transfer is approved by the Board of
15 Directors under such criteria as are prescribed in the By-laws
16 and such rules and regulations as might be adopted by the Board
17 of Directors.

18 Section 5. Each shareholder of this corporation shall
19 be entitled to one vote for every share of stock held by said
20 shareholder, regardless of the class of stock.

21 Section 6. This corporation is organized on a non-
22 profit basis for the mutual benefit of its shareholders and
23 consequently will not have profits from which to pay dividends
24 on its capital stock. Each year after all expenses of the
25 corporation have been paid and reasonable reserves have been
26 said aside to meet anticipated costs as determined by the Board

1 of Directors, any additional monies of the corporation may be
2 accumulated in a fund for the purpose of replacing, enlarging,
3 extending, and repairing the system and property and property of
4 the corporation, and for such other purposes as the Board of
5 Directors may determine to be for the best interests of the
6 corporation. No distribution of any surplus funds shall be made
7 to the shareholders of this corporation except on final
8 dissolution of the corporation.

9 ARTICLE VII

10 Benefit of Shareholders

11 The corporation shall operate and maintain all por-
12 tions of the dam, reservoir and delivery system primarily for
13 the benefit of the lands to which said water rights are
14 appurtenant.

15 ARTICLE VIII

16 Right to Lien

17 The corporation shall be entitled to a first and prior
18 lien upon the lands to which the rights represented by the stock
19 in this corporation are appurtenant, for all amounts owing
20 pursuant to the assessments levied pursuant to these Articles,
21 said lien to be perfected, maintained and foreclosed in the
22 manner as set out in Idaho Code Sections 42-2202 -42-2209.

23 ARTICLE IX

24 Amendment of Articles

25 These Articles may be amended in any manner permitted
26 or authorized by law by a favorable vote of a majority of the

1 stockholders present or represented by proxy at a meeting of the
2 shareholders duly called on notice of the specific purpose
3 thereof and containing a statement of the proposed amendment.

4 ARTICLE X

5 Subscription of Stock

6 The amount of capital stock of said corporation which
7 has actually been subscribed is Fifteen Hundred Eighty Six (1586), and
8 the following are the names and addresses of each of the
9 incorporators and the number of shares subscribed by each:

Joe Rush	150 shares
Milford Sweat	200 shares
Maurice C. Ellsworth	84 shares
Shirl M. Reay	652 shares
Harold J. Tolman	500 shares

10 ARTICLE XI

11 By-Laws

12 The power to adopt, repeal and amend the By-Laws of
13 the corporation shall be in the stockholders and the By-Laws may
14 be amended, adopted, or repealed by a majority vote of the stock
15 issued and entitled to vote.

16 ARTICLE XII

17 Incorporators, Original Members and Directors

18 The names and addresses of the incorporators and
19 original members of the original Board of Directors of the
20 corporation each of whom shall serve as a trustee until his
21 successor is duly elected and qualified are:

	<u>NAME</u>	<u>ADDRESS</u>
1		
2	<u>Joe Rush</u>	<u>Route 1, Carey, Idaho 83320</u>
3		
4	<u>Milford Sweat</u>	<u>P.O. Box 234, Carey, Idaho 83320</u>
5		
6	<u>Maurice C. Ellsworth</u>	<u>P.O. Box 158, Carey, Idaho 83320</u>
7		
8	<u>Shirl M. Reay</u>	<u>Route 1, Carey, Idaho 83320</u>
9		
10	<u>Harold J. Tolman</u>	<u>P.O. Box 206, Carey, Idaho 83320</u>
11		

12 IN WITNESS WHEREOF, The undersigned, all being the
 13 incorporators of Carey Valley Irrigation Reservoir Company,
 14 Inc., have executed these Articles of Incorporation this 2d
 15 day of October, 1979.

16	<u>Joe Rush</u>
17	<u>Milford Sweat</u>
18	<u>Maurice C. Ellsworth</u>
19	<u>Shirl M. Reay</u>
20	<u>Harold J. Tolman</u>

21 STATE OF IDAHO)
 22) ss.
 23 County of Blaine)

24 On this 2d day of October, 1979, before me, the
 25 undersigned, a Notary Public in and for said County and State,
 26 personally appeared Joe Rush, Milford

1 Sweet, Maurice C. Ellsworth, Shirl M. Reay,
2 Harold J. Talman, known to me to be the persons whose
3 names are subscribed to the within instrument and acknowledged
4 to me that they executed the same.

5 IN WITNESS WHEREOF, I have hereunto set my hand and
6 affixed my official seal, the same day and year in this certi-
7 ficate first above written.

8
9
10


MARION O. MURRAY
Residing at: Carey

Appendix B
Seepage Calculations

FISH CREEK MEASUREMENT SUMMARY & SEEPAGE CALCS

Brockway Engineering 4/27/08

Location No.	Location description	Date of Measurement		
		4/30/2008	5/14/2008	11/4/2008
1	Dam outlet weir	0	0	??
2	Fish Creek above upper crossing	73.21	51.28	6.23
3	Highline Canal diversion or leakage	2.57	43.02	5.75
4	Highline Canal below pipeline	nm	22.9	nm
	Calculated: Pipeline diversion	0	20.12	0
5	Fish Creek below Highline Canal	nm	4.51	nm
6	Fish Creek below pipeline spill to creek	nm	7.46	nm
	Calculated: Pipeline spill	0	2.95	0
7	Hot Springs Ditch diversion or leakage	1.65	3.84	0
8	Fish Creek below Hot Springs Ditch	58.06	0	0

MEASUREMENT SUMMARY:

Gross measured loss 2 to 8	15.15	51.28	6.23
Measured seepage losses 2 to 8 (gross loss minus diversions + pipeline spill)	10.93	7.37	0.48
Seepage loss percentage	14.9%	14.4%	7.7%
Seepage loss per mile	2.19	1.47	0.14

BREAKDOWN BY REACH:

Middle reach (2 to 3) - 3.41 miles			
Seepage loss	nm	3.75	0.48
Seepage loss percentage	nm	7.3%	7.7%
Seepage loss per mile	nm	1.10	0.14
Seepage loss percent per mile	nm	2.1%	2.3%
Lower reach (3 to 8) - 1.59 miles			
Seepage loss	nm	3.62	no flow
Seepage loss percentage	nm	48.5%	no flow
Seepage loss per mile	nm	2.28	no flow
Seepage loss percent per mile	nm	30.5%	no flow
Upper reach (spill return to Location 2) - 1.00 miles			
Seepage loss based on 4.5% per mi from outlet & upper crossing weir data	3.4	2.4	0.3
Entire reach (spill return to Location 8) - 6.00 miles (5.0 miles for 11/4/08 measurement)			
Seepage loss estimate	14.4	9.8	0.8
Seepage loss percentage	18.8%	18.2%	11.9%
Seepage loss per mile	2.40	1.63	0.15
Seepage loss percent per mile	3.13%	3.04%	2.37%

Notes:

1. No diversion to pipeline was taking place on 4/30/08 or 11/4/08.
2. Gates were closed and reservoir was spilling on 4/30/08 and 5/14/08.
3. One gate was open on 11/4/08 but accurate measurement of outflow was not obtained.

FISH CREEK - ESTIMATION OF SEEPAGE IN UPPER REACH

Upper Reach is dam outlet to new weir at crossing

Use Cipoletti weir at outlet and new rated weir at crossing

Period of study is after reservoir spill stopped on about 6/10/08 (spill is unmeasured)

Readings taken by Lawrence Kimball, Watermaster

Date	Outlet weir		Upper Crossing weir	
	H	Q	H	Q
6/10/2008	0.88	39.43	0.9	40.4
6/11/2008	0.88	39.43	0.88	39.4
6/12/2008	0.88	39.43	0.87	38.9
6/13/2008	0.88	39.43	0.87	38.9
6/14/2008	0.9	40.80	0.87	38.9
6/15/2008	0.9	40.80	0.91	40.9
6/16/2008	0.9	40.80	0.91	40.9
6/17/2008	0.9	40.80	0.96	43.4
6/18/2008	0.86	38.08	0.89	39.9
6/19/2008	0.86	38.08	0.89	39.9
6/20/2008	0.86	38.08	0.89	39.9
6/21/2008	0.86	38.08	0.88	39.4
6/22/2008	0.92	42.18	0.88	39.4
6/23/2008	0.92	42.18	0.93	41.9
6/24/2008	0.98	45.72	0.97	43.9
6/25/2008	0.98	45.72	1.02	46.4
6/26/2008	1.04	50.82	1.01	45.9
6/27/2008	1.04	50.82	1.13	51.9
6/28/2008	1.06	52.32	1.13	51.9
6/29/2008	1.09	54.66	1.13	51.9
6/30/2008	1.09	54.66	1.13	51.9
7/1/2008	1.08	53.83	1.02	46.4
7/2/2008	1.1	55.35	1.02	46.4
7/3/2008	1.1	55.35	1.05	47.9
7/4/2008	1.18	61.60	1.05	47.9
7/5/2008	1.24	66.43	1.2	55.4
7/6/2008	1.24	66.43	1.25	58.0
7/7/2008	1.24	66.43	1.25	58.0
7/8/2008	1.24	66.43	1.25	58.0
7/9/2008	1.24	66.43	1.25	58.0
7/10/2008	1.26	68.07	1.28	59.6
7/11/2008	1.24	66.43	1.3	60.6
7/12/2008	1.22	64.80	1.28	59.6
7/13/2008	1.22	64.80	1.24	57.5
7/14/2008	1.22	64.80	1.24	57.5
7/15/2008	1.22	64.80	1.24	57.5
7/16/2008	1.24	66.43	1.28	59.6
7/17/2008	1.2	63.19	1.28	59.6
7/18/2008	1.2	63.19	1.22	56.5
7/19/2008	1.08	53.83	1.21	56.0
7/20/2008	1.1	55.35	1	45.4
7/21/2008	1.14	58.44	1.11	50.9
7/22/2008	1.14	58.44	1.16	53.4
7/23/2008	1.04	50.82	1.16	53.4

Total volume passing the device for overlap period:

Total volume released	5025.5 ac-ft
Total volume at crossing weir	4632.3 ac-ft
Total seepage loss	393.2 ac-ft
Percent loss	7.8%
Percent per mile (1.74 miles)	4.5%
Loss for reach from spillway return to upper crossing (1.00 miles)	4.5% 226.0 ac-ft

7/24/2008			1.06	48.4
7/25/2008			0.98	44.4
7/26/2008			0.98	44.4
7/27/2008			0.88	39.4
7/28/2008			0.91	40.9
7/29/2008			0.95	42.9
7/30/2008			0.84	37.4
7/31/2008				
8/1/2008	0.9	40.80		
8/2/2008	0.88	39.43		
8/3/2008	0.84	36.74		
8/4/2008	0.72	29.09		
8/5/2008	0.72	29.09		
8/6/2008	0.68	26.68	0.6	24.5
8/7/2008	0.68	26.68	0.59	23.9
8/8/2008	0.68	26.68	0.59	23.9
8/9/2008	0.68	26.68	0.53	20.5
8/10/2008	0.68	26.68	0.53	20.5
8/11/2008	0.6	22.08	0.53	20.5
8/12/2008	0.6	22.08	0.5	18.8
8/13/2008	0.62	23.20		
8/14/2008	0.6	22.08	0.41	14.0
8/15/2008	Gates open - natural		0.2	4.8
8/16/2008	flow, no measurement		0.2	4.8
8/17/2008			0.2	4.8
8/18/2008			0.2	4.8
8/19/2008			0.2	4.8
8/20/2008			0.2	4.8
8/21/2008			0.2	4.8
8/22/2008			0.2	4.8
8/23/2008			0.2	4.8
8/24/2008			0.2	4.8
8/25/2008			0.2	4.8
8/26/2008			0.2	4.8
8/27/2008			0.2	4.8
8/28/2008			0.2	4.8
8/29/2008			0.2	4.8
8/30/2008			0.2	4.8
8/31/2008			0.2	4.8

Appendix C
Current Meter Measurements

FISH CREEK**CURRENT METER CALCULATIONS**

LOCATION: Above Upper Crossing:

DATE: 4/30/2008

HYDROGRAPHER: ZL

METER: Pygmy

MEASUREMENT NO.: 1 of 3

REMARKS: Current metering was done at across section location staked out by ZL upstream of upper crossing
Substrate is gravel, banks consist of gravel.

TIME START: 11:00 AM

TIME END: 11:45 AM

GAUGE START: -

GAUGE END: -

STAFF GAUGE READING (ft): 1.52

TIME OF STAFF GAUGE READING: 11:45 AM

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANG. CORR.	V1	V2	BuRec method:			SUM Q
									V SECT.	DELTA AREA	DELTA Q	
1-Bank	1.50	0.00	0		50	1.000	0.00	NM	0.00	0.00	0.00	0.00
2	2.00	0.05	0		50	1.000	0.00	NM	0.00	0.04	0.00	0.00
3	3.00	0.22	34		50	1.000	0.68	NM	0.68	0.22	0.15	0.15
4	4.00	0.45	37		50	1.000	0.74	NM	0.74	0.68	0.50	0.65
5	6.00	0.65	64		50	1.000	1.28	NM	1.28	1.30	1.66	2.31
6	8.00	0.90	58		50	1.000	1.16	NM	1.16	1.80	2.09	4.40
7	10.00	1.05	106		50	1.000	2.12	NM	2.12	2.10	4.45	8.85
8	12.00	1.20	121		50	1.000	2.42	NM	2.42	2.40	5.81	14.66
9	14.00	1.35	148		50	1.000	2.96	NM	2.96	2.70	7.99	22.65
10	16.00	1.55	174		50	1.000	3.48	NM	3.48	3.10	10.79	33.44
11	18.00	1.50	180		50	1.000	3.60	NM	3.60	3.00	10.80	44.24
12	20.00	1.55	152		50	1.000	3.04	NM	3.04	3.10	9.42	53.67
13	22.00	1.60	135		50	1.000	2.70	NM	2.70	3.20	8.64	62.31
14	24.00	1.50	118		50	1.000	2.36	NM	2.36	3.00	7.08	69.39
15	26.00	1.05	89		50	1.000	1.78	NM	1.78	1.58	2.80	72.19
16	27.00	0.75	61		50	1.000	1.22	NM	1.22	0.75	0.92	73.10
17	28.00	0.30	19		50	1.000	0.38	NM	0.38	0.29	0.11	73.21
18-Bank	28.90	0.00	0		50	1.000	0.00	NM	0.00	0.10	0.00	73.21

AVG. VEL.	2.49	FPS
AREA	29.35	SQ FT
DISCHARGE	73.21	CFS

***CALIBRATION**

FOR N(REV/T)<

0.68 V=

1.00 *N+

0

FOR N(REV/T)>

0.68 V=

1.00 *N+

0

FISH CREEK

CURRENT METER CALCULATIONS

LOCATION: In concrete outflow downstream of headgate- TIME START: 12:05 PM
 DATE: 4/30/2008 start of high line canal TIME END: 12:30 PM
 HYDROGRAPHER: ZL GAUGE START: -
 METER: Pygmy GAUGE END: -
 MEASUREMENT NO.: 2 of 3
 REMARKS: Current metering was done at the downstream edge of the concrete structure that houses the high line canal headgate. Head gate was supposed to be closed but willows/sticks were still letting water through. I couldn't get a CM reading right at the wall, but the velocity is assumed to be equal to or less than first spot away from each wall

STAFF GAUGE READING (ft):

TIME OF STAFF GAUGE READING: 12:30 PM

BuRec method:

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANG. CORR.	V1	V2	V SECT.	DELTA AREA	DELTA Q	SUM Q
1-Bank	1.10	0.15	59		50	1.000	1.18	NM	1.18	0.02	0.02	0.00
2	1.30	0.15	59		50	1.000	1.18	NM	1.18	0.03	0.04	0.04
3	1.50	0.15	77		50	1.000	1.54	NM	1.54	0.05	0.08	0.12
4	2.00	0.15	98		50	1.000	1.96	NM	1.96	0.11	0.22	0.34
5	3.00	0.20	110		50	1.000	2.20	NM	2.20	0.20	0.44	0.78
6	4.00	0.15	93		50	1.000	1.86	NM	1.86	0.15	0.28	1.06
7	5.00	0.20	119		50	1.000	2.38	NM	2.38	0.20	0.48	1.53
8	6.00	0.20	132		50	1.000	2.64	NM	2.64	0.20	0.53	2.06
9	7.00	0.15	123		50	1.000	2.46	NM	2.46	0.11	0.28	2.34
11	7.50	0.15	97		50	1.000	1.94	NM	1.94	0.06	0.12	2.46
12	7.85	0.15	109		50	1.000	2.18	NM	2.18	0.03	0.08	2.54
13-Bank	7.96	0.15	109		50	1.000	2.18	NM	2.18	0.01	0.02	2.55
AVG. VEL.											2.18	FPS
AREA											1.18	SQ FT
DISCHARGE											2.57	CFS

*CALIBRATION

FOR N(REV/T)<

0.68 V=

1.00 *N+

0

FOR N(REV/T)>

0.68 V=

1.00 *N+

0

FISH CREEK

CURRENT METER CALCULATIONS

LOCATION: Below the Hot Springs Ditch and Weir in main channel. TIME START: 12:55 PM
 DATE: 4/30/2008 TIME END: 1:32 PM
 HYDROGRAPHER: ZL GAUGE START: -
 METER: Pygmy GAUGE END: -
 MEASUREMENT NO.: 3 of 3
 REMARKS: Current metering was done downstream of weir, just upstream from property line fence that stretches across creek. See hand calcs for seepage into Hot Springs Ditch from faulty board placement.

STAFF GAUGE READING (ft): 1.52
 TIME OF STAFF GAUGE READING: 1:32 PM

BuRec method:

SECT.	DIST.	DEPTH	REV .6-2	REV .8	TIME SEC	ANG. CORR.	V1	V2	V SECT.	DELTA AREA	DELTA Q	SUM Q
1-RR Bank	2.60	0.00	0		50	1.000	0.00	NM	0.00	0.01	0.00	0.00
2	3.00	0.20	13		50	1.000	0.26	NM	0	0.14	0.00	0.00
3	4.00	0.25	35		50	1.000	0.70	NM	0.70	0.38	0.26	0.26
4	6.00	0.45	59		50	1.000	1.18	NM	1.18	0.90	1.06	1.32
5	8.00	0.80	58		50	1.000	1.16	NM	1.16	1.60	1.86	3.18
6	10.00	0.90	84		50	1.000	1.68	NM	1.68	1.80	3.02	6.20
7	12.00	1.25	101		50	1.000	2.02	NM	2.02	2.50	5.05	11.25
8	14.00	1.45	125		50	1.000	2.50	NM	2.50	2.90	7.25	18.50
9	16.00	1.50	124		50	1.000	2.48	NM	2.48	3.00	7.44	25.94
10	18.00	1.55	125		50	1.000	2.50	NM	2.50	3.10	7.75	33.69
11	20.00	1.55	123		50	1.000	2.46	NM	2.46	3.10	7.63	41.32
12	22.00	1.50	126		50	1.000	2.52	NM	2.52	3.00	7.56	48.88
13	24.00	0.95	129		50	1.000	2.58	NM	2.58	1.90	4.90	53.78
14	26.00	0.60	110		50	1.000	2.20	NM	2.20	1.20	2.64	56.42
15	28.00	0.40	109		50	1.000	2.18	NM	2.18	0.60	1.31	57.73
16	29.00	0.25	88		50	1.000	1.76	NM	1.76	0.19	0.33	58.06
17	29.50	0.05	0		50	1.000	0.00	NM	0.00	0.05	0.00	58.06
18-RL Bank	30.80	0.00	0		50	1.000	0.00	NM	0.00	0.01	0.00	58.06
AVG. VEL.											0.00	FPS
AREA											26.37	SQ FT

FISH CREEK**CURRENT METER CALCULATIONS**

LOCATION: Above Upper Crossing:
 DATE: 5/14/2008

TIME START: 10:20 AM

TIME END: 10:47 AM

HYDROGRAPHER: ZL
 METER: Pygmy

GAUGE START: -

GAUGE END: -

MEASUREMENT NO.: 1 of 6

REMARKS: Current metering was done at across section location staked out by ZL upstream of upper crossing
 Substrate is gravel, banks consist of gravel. Same location as 4/30/08 measurement.

UPPER C. STAFF GAUGE READING (ft): 1.11 = 61.2 CFS
 TIME OF STAFF GAUGE READING: 10:00 AM

BuRec method:

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANG. CORR.	V1	V2	V SECT.	DELTA AREA	DELTA Q	SUM Q
1-Bank	2.60	0.00	0		50	1.000	0.00	NM	0.00	0.01	0.00	0.00
2	3.00	0.10	0		50	1.000	0.00	NM	0.00	0.07	0.00	0.00
3	4.00	0.28	37		50	1.000	0.74	NM	0.74	0.42	0.31	0.31
4	6.00	0.50	56		50	1.000	1.12	NM	1.12	1.00	1.12	1.43
5	8.00	0.70	52		50	1.000	1.04	NM	1.04	1.40	1.46	2.89
6	10.00	0.85	82		50	1.000	1.64	NM	1.64	1.70	2.79	5.67
7	12.00	1.00	96		50	1.000	1.92	NM	1.92	2.00	3.84	9.51
8	14.00	1.22	119		50	1.000	2.38	NM	2.38	2.44	5.81	15.32
9	16.00	1.30	125		50	1.000	2.50	NM	2.50	2.60	6.50	21.82
10	18.00	1.35	149		50	1.000	2.98	NM	2.98	2.70	8.05	29.87
11	20.00	1.33	136		50	1.000	2.72	NM	2.72	2.66	7.24	37.10
12	22.00	1.40	115		50	1.000	2.30	NM	2.30	2.80	6.44	43.54
13	24.00	1.25	99		50	1.000	1.98	NM	1.98	1.88	3.71	47.26
14	25.00	1.10	92		50	1.000	1.84	NM	1.84	1.10	2.02	49.28
15	26.00	0.80	77		50	1.000	1.54	NM	1.54	0.80	1.23	50.51
16	27.00	0.55	70		50	1.000	1.40	NM	1.40	0.55	0.77	51.28
17	28.00	0.15	0		50	1.000	0.00	NM	0.00	0.12	0.00	51.28
18-Bank	28.60	0.00	0		50	1.000	0.00	NM	0.00	0.03	0.00	51.28

AVG. VEL.
 AREA
 DISCHARGE

2.11
 24.27
 51.28

FPS
 SQ FT
 CFS

*CALIBRATION
 FOR N(REV/T)<
 FOR N(REV/T)>

0.68 V= 1.00 *N+ 0
 0.68 V= 1.00 *N+ 0

FISH CREEK

CURRENT METER CALCULATIONS

LOCATION: In concrete outflow downstream of headgate-

TIME START: 12:03 PM

DATE: 5/14/2008 start of high line canal

TIME END: 12:30 PM

HYDROGRAPHER: ZL

GAUGE START: -

METER: Pygmy

GAUGE END: -

MEASUREMENT NO.: 2 of 6

REMARKS: Current metering was done at the downstream edge of the concrete structure that houses the high line canal headgate. Head gate was open, no resistance on gate. I couldn't get a CM reading right at the wall, but the velocity is assumed to be equal to or less than first spot away from each wall

STAFF GAUGE READING (ft):

TIME OF STAFF GAUGE READING: 12:30 PM

BuRec method:

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANG. CORR.	V1	V2	V SECT.	DELTA AREA	DELTA Q	SUM Q
1-Bank	1.10	1.50	196		50	1.000	3.92	NM	3.92	0.68	2.67	0.00
2	2.00	1.55	202		50	1.000	4.04	NM	4.04	1.47	5.95	5.95
3	3.00	1.25	278		50	1.000	5.56	NM	5.56	1.25	6.95	12.90
4	4.00	1.30	296		50	1.000	5.92	NM	5.92	1.30	7.70	20.59
5	5.00	1.35	245		50	1.000	4.90	NM	4.90	1.35	6.62	27.21
6	6.00	1.30	256		50	1.000	5.12	NM	5.12	1.30	6.66	33.87
7	7.00	1.25	207		50	1.000	4.14	NM	4.14	1.16	4.79	38.65
8	7.85	1.25	127		50	1.000	2.54	NM	2.54	0.60	1.52	40.18
9-Bank	7.96	1.25	127.00		50	1.000	2.54	NM	2.54	0.07	0.17	40.35

AVG. VEL. 4.69 FPS
 AREA 9.18 SQ FT
 DISCHARGE 43.02 CFS

*CALIBRATION

FOR N(REV/T)< 0.68 V= 1.00 *N+ 0
 FOR N(REV/T)> 0.68 V= 1.00 *N+ 0

FISH CREEK

CURRENT METER CALCULATIONS

LOCATION: Downstream of 2nd diversion that feeds gravity pipe to pivots, and culvert to Fish Creek

DATE: 5/14/2008 start of high line canal

HYDROGRAPHER: ZL

METER: Pygmy

MEASUREMENT NO.: 3 of 6

REMARKS: Current metering was done downstream of 2 intakes and 2 headgates on the High Line Canal. That diversion feeds the gravity line that runs to Doug's pivots, the excess dumps back into Fish Creek via a culvert.

TIME START: 1:25 PM
TIME END: 2:00 PM
GAUGE START: -
GAUGE END: -

STAFF GAUGE READING (ft):

TIME OF STAFF GAUGE READING: 2:00 PM

BuRec method:

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANG. CORR.	V1	V2	V SECT.	DELTA AREA	DELTA Q	SUM Q
1-Bank	1.00	0.00	0		50	1.000	0.00	NM	0.00	0.08	0.00	0.00
2	2.00	0.60	0		50	1.000	0.00	NM	0.00	0.60	0.00	0.00
3	3.00	1.55	0		50	1.000	0.00	NM	0.00	1.16	0.00	0.00
4	3.50	1.62	16		50	1.000	0.32	NM	0.32	0.81	0.26	0.26
5	4.00	1.80	44		50	1.000	0.88	NM	0.88	1.35	1.19	1.45
6	5.00	2.00	52	63	50	1.000	1.04	1.26	1.15	2.00	2.30	3.75
7	6.00	1.95	57		50	1.000	1.14	NM	1.14	1.95	2.22	5.97
8	7.00	1.85	61		50	1.000	1.22	NM	1.22	1.85	2.26	8.23
9	8.00	1.90	69		50	1.000	1.38	NM	1.38	1.90	2.62	10.85
10	9.00	1.90	63		50	1.000	1.26	NM	1.26	1.90	2.39	13.24
11	10.00	2.00	57	69	50	1.000	1.14	1.38	1.26	2.00	2.52	15.76
12	11.00	2.05	56	72	50	1.000	1.12	1.44	1.28	2.05	2.62	18.39
13	12.00	1.90	66		50	1.000	1.32	NM	1.32	1.90	2.51	20.90
14	13.00	1.85	47		50	1.000	0.94	NM	0.94	1.20	1.13	22.03
15	13.30	1.85	38		50	1.000	0.76	NM	0.76	0.46	0.35	22.38
16	13.50	1.90	39		50	1.000	0.78	NM	0.78	0.66	0.52	22.90
17	14.00	1.85	0		50	1.000	0.00	NM	0.00	0.93	0.00	22.90
18	14.50	0.40	0		50	1.000	0.00	NM	0.00	0.20	0.00	22.90
19-Bank	15.00	0.00	0.00		50	1.000	0.00	NM	0.00	0.03	0.00	22.90

AVG. VEL. 0.99 FPS
AREA 23.03 SQ FT
DISCHARGE 22.90 CFS

*CALIBRATION

FOR N(REV/T)< 0.68 V= 1.00 *N+ 0
FOR N(REV/T)> 0.68 V= 1.00 *N+ 0

FISH CREEK

CURRENT METER CALCULATIONS

LOCATION: Fish Creek main channel, below highline culvert spill
DATE: 5/14/2008
HYDROGRAPHER: ZL
METER: Pygmy
MEASUREMENT NO.: 4 of 6
REMARKS: Measurement was taken in the main Fish Creek channel below high line canal return spill flow.

TIME START: 2:05 PM
TIME END: 2:35 PM
GAUGE START: -
GAUGE END: -

STAFF GAUGE READING (ft):

TIME OF STAFF GAUGE READING: 2:35 PM

BuRec method:

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANG. CORR.	V1	V2	V SECT.	DELTA AREA	DELTA Q	SUM Q
1-Bank	1.60	0.00	0		50	1.000	0.00	NM	0.00	0.02	0.00	0.00
2	2.00	0.40	0		50	1.000	0.00	NM	0.00	0.18	0.00	0.00
3	2.50	0.70	31		50	1.000	0.62	NM	0.62	0.35	0.22	0.22
4	3.00	0.60	36		50	1.000	0.72	NM	0.72	0.45	0.32	0.54
5	4.00	0.90	34		50	1.000	0.68	NM	0.68	0.90	0.61	1.15
6	5.00	1.00	47		50	1.000	0.94	NM	0.94	1.00	0.94	2.09
7	6.00	1.20	51		50	1.000	1.02	NM	1.02	1.20	1.22	3.32
8	7.00	1.40	52		50	1.000	1.04	NM	1.04	1.40	1.46	4.77
9	8.00	1.45	48		50	1.000	0.96	NM	0.96	1.45	1.39	6.17
10	9.00	1.50	22		50	1.000	0.44	NM	0.44	1.50	0.66	6.83
11	10.00	1.40	13		50	1.000	0.26	NM	0.26	1.40	0.36	7.19
12	11.00	1.22	9		50	1.000	0.18	NM	0.18	1.10	0.20	7.39
13	11.80	1.05	8		50	1.000	0.16	NM	0.16	0.47	0.08	7.46
14-Bank	11.90	0.00	0.00		50	1.000	0.00	NM	0.00	0.01	0.00	7.46
AVG. VEL.											0.65	FPS
AREA											11.43	SQ FT
DISCHARGE											7.46	CFS

*CALIBRATION

FOR N(REV/T)<

0.68 V=

1.00 *N+

0

FOR N(REV/T)>

0.68 V=

1.00 *N+

0

FISH CREEK

CURRENT METER CALCULATIONS

LOCATION: Fish Creek below High Line ditch diversion, in Fish Creek
DATE: 5/14/2008 channel, headboards leaking.
HYDROGRAPHER: ZL
METER: Pygmy
MEASUREMENT NO.: 5 of 6
REMARKS: Measurement taken in Fish Creek channel just below check structure that is adjacent to the high line canal check structure. This measurement is the leaky leaky that is flowing under the boards that are in the check structure just upstream.

TIME START: 3:20 PM
TIME END: 3:45 PM
GAUGE START: -
GAUGE END: -

STAFF GAUGE READING (ft):

TIME OF STAFF GAUGE READING: 3:45 PM

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANG. CORR.	V1	V2	BuRec method:			
									V SECT.	DELTA AREA	DELTA Q	SUM Q
1-Bank	1.30	0.00	0		50	1.000	0.00	NM	0.00	0.02	0.00	0.00
2	2.00	0.20	0		50	1.000	0.00	NM	0.00	0.37	0.00	0.00
3	2.50	0.30	0		50	1.000	0.00	NM	0.00	0.15	0.00	0.00
4	3.00	0.40	7		50	1.000	0.14	NM	0.14	0.22	0.03	0.03
5	3.60	0.65	62		50	1.000	1.24	NM	1.24	0.33	0.40	0.43
6	4.00	0.65	74		50	1.000	1.48	NM	1.48	0.29	0.43	0.87
7	4.50	0.75	91		50	1.000	1.82	NM	1.82	0.38	0.68	1.55
8	5.00	0.75	113		50	1.000	2.26	NM	2.26	0.38	0.85	2.40
9	5.50	0.80	104		50	1.000	2.08	NM	2.08	0.40	0.83	3.23
10	6.00	0.80	114		50	1.000	2.28	NM	2.28	0.40	0.91	4.14
11	6.50	0.80	46		50	1.000	0.92	NM	0.92	0.40	0.37	4.51
12	7.00	0.70	0		50	1.000	0.00	NM	0.00	0.53	0.00	4.51
13	8.00	0.30	0		50	1.000	0.00	NM	0.00	0.31	0.00	4.51
14-Bank	9.05	0.00	0.00		50	1.000	0.00	NM	0.00	0.04	0.00	4.51

AVG. VEL. 1.07 FPS
AREA 4.20 SQ FT
DISCHARGE 4.51 CFS

*CALIBRATION
FOR N(REV/T)< 0.68 V= 1.00 *N+ 0
FOR N(REV/T)> 0.68 V= 1.00 *N+ 0

FISH CREEK**CURRENT METER CALCULATIONS**

LOCATION: Hot Springs Ditch Weir- right on weir crest

DATE: 5/14/2008

HYDROGRAPHER: ZL

METER: Pygmy

MEASUREMENT NO.: 6 of 6

REMARKS: Current metering was done at the weir crest of the hot springs ditch weir.
I stood there and did it, not much flow. Lawrence helped me with this measurement.

TIME START: 4:03 PM

TIME END: 4:25 PM

GAUGE START: -

GAUGE END: -

Upper C. STAFF GAUGE READING (ft):

1.15

TIME OF STAFF GAUGE READING:

4:48 PM

BuRec method:

SECT.	DIST.	DEPTH	REV .6-2	REV .8	TIME SEC	ANG. CORR.	V1	V2	V SECT.	DELTA AREA	DELTA Q	SUM Q
1-RR Bank	0.65	0.20	58		50	1.000	1.16	NM	1.16	0.04	0.05	0.00
2	1.00	0.32	66		50	1.000	1.32	NM	1.32	0.22	0.29	0.29
3	2.00	0.32	85		50	1.000	1.70	NM	1.70	0.32	0.54	0.83
4	3.00	0.32	85		50	1.000	1.70	NM	1.70	0.32	0.54	1.37
5	4.00	0.32	78		50	1.000	1.56	NM	1.56	0.32	0.50	1.87
6	5.00	0.32	73		50	1.000	1.46	NM	1.46	0.32	0.47	2.34
7	6.00	0.32	67		50	1.000	1.34	NM	1.34	0.32	0.43	2.77
8	7.00	0.32	81		50	1.000	1.62	NM	1.62	0.32	0.52	3.29
9	8.00	0.32	79		50	1.000	1.58	NM	1.58	0.26	0.40	3.69
10	8.60	0.32	49		50	1.000	0.98	NM	0.98	0.10	0.10	3.79
11-RL Bank	8.65	0.32	0		50	1.000	0.00	NM	0.00	0.01	0.00	3.79

Measurement # :

AVG. VEL.
AREA1.51
2.54FPS
SQ FT

FISH CREEK**CURRENT METER CALCULATIONS**

LOCATION: Above Upper Crossing:

TIME START: 9:05 AM

DATE: 11/4/2008

TIME END: 9:35 AM

HYDROGRAPHER: ZL

GAUGE START: -

METER: Pygmy

GAUGE END: -

MEASUREMENT NO.: 1 of 2

REMARKS: Current metering was done at across section location staked out by ZL upstream of upper crossing
Substrate is gravel, banks consist of gravel.

STAFF GAUGE READING (ft): **0.23**
TIME OF STAFF GAUGE READING: **9:35 AM**

BuRec method:

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANG. CORR.	V1	V2	V SECT.	DELTA AREA	DELTA Q	SUM Q
1-Bank	6.50	0.00	0		50	1.000	0.00	NM	0.00	0.00	0.00	0.00
2	7.00	0.00	0		50	1.000	0.00	NM	0.00	0.00	0.00	0.00
3	7.50	0.05	0		50	1.000	0.00	NM	0.00	0.03	0.00	0.00
4	8.00	0.15	7		50	1.000	0.14	NM	0.14	0.11	0.02	0.02
5	9.00	0.20	15		50	1.000	0.30	NM	0.30	0.20	0.06	0.08
6	10.00	0.25	17		50	1.000	0.34	NM	0.34	0.25	0.09	0.16
7	11.00	0.30	25		50	1.000	0.50	NM	0.50	0.30	0.15	0.31
8	12.00	0.40	23		50	1.000	0.46	NM	0.46	0.40	0.18	0.49
9	13.00	0.42	15		50	1.000	0.30	NM	0.30	0.42	0.13	0.62
10	14.00	0.45	27		50	1.000	0.54	NM	0.54	0.45	0.24	0.86
11	15.00	0.60	30		50	1.000	0.60	NM	0.60	0.60	0.36	1.22
12	16.00	0.70	34		50	1.000	0.68	NM	0.68	0.70	0.48	1.70
13	17.00	0.70	29		50	1.000	0.58	NM	0.58	0.70	0.41	2.11
14	18.00	0.70	42		50	1.000	0.84	NM	0.84	0.70	0.59	2.69
15	19.00	0.72	43		50	1.000	0.86	NM	0.86	0.72	0.62	3.31
16	20.00	0.72	44		50	1.000	0.88	NM	0.88	0.72	0.63	3.95
17	21.00	0.78	44		50	1.000	0.88	NM	0.88	0.78	0.69	4.63
18	22.00	0.72	42		50	1.000	0.84	NM	0.84	0.72	0.60	5.24
19	23.00	0.70	43		50	1.000	0.86	NM	0.86	0.66	0.57	5.81
20	23.90	0.70	40		50	1.000	0.80	NM	0.80	0.53	0.42	6.23
21	24.50	0.55	0		50	1.000	0.00	NM	0.00	0.30	0.00	6.23
22	25.00	0.45	0		50	1.000	0.00	NM	0.00	0.34	0.00	6.23
23	26.00	0.30	0		50	1.000	0.00	NM	0.00	0.32	0.00	6.23
24-Bank	27.10	0.00	0		50	1.000	0.00	NM	0.00	0.12	0.00	6.23

AVG. VEL. 0.62 FPS
AREA 10.07 SQ FT
DISCHARGE **6.23 CFS**

***CALIBRATION**

FOR N(REV/T)< 0.68 V= 1.00 *N+ 0
FOR N(REV/T)> 0.68 V= 1.00 *N+ 0

FISH CREEK

CURRENT METER CALCULATIONS

LOCATION: In concrete outflow downstream of headgate-

DATE: 11/4/2008 start of high line canal

HYDROGRAPHER: ZL

METER: Pygmy

MEASUREMENT NO.: 2 of 2

REMARKS: Current metering was done at the downstream edge of the concrete structure that houses the high line canal headgate, same location as 2 other current meter measurements were made previously this year by ZL.

TIME START: 10:05 AM

TIME END: 10:35 AM

GAUGE START: -

GAUGE END: -

STAFF GAUGE READING (ft):

TIME OF STAFF GAUGE READING: 10:35 AM

BuRec method:

SECT.	DIST.	DEPTH	REV .6-.2	REV .8	TIME SEC	ANG. CORR.	V1	V2	V SECT.	DELTA AREA	DELTA Q	SUM Q
1-Bank	1.00	1.00	35		50	1.000	0.70	NM	0.70	0.25	0.18	0.00
2	1.50	1.00	45		50	1.000	0.90	NM	0.90	0.50	0.45	0.45
3	2.00	1.00	54		50	1.000	1.08	NM	1.08	0.50	0.54	0.99
4	2.50	1.00	53		50	1.000	1.06	NM	1.06	0.50	0.53	1.52
5	3.00	1.00	54		50	1.000	1.08	NM	1.08	0.50	0.54	2.06
6	3.50	1.00	52		50	1.000	1.04	NM	1.04	0.50	0.52	2.58
7	4.00	1.00	50		50	1.000	1.00	NM	1.00	0.50	0.50	3.08
8	4.50	1.00	47		50	1.000	0.94	NM	0.94	0.50	0.47	3.55
9	5.00	1.00	45		50	1.000	0.90	NM	0.90	0.50	0.45	4.00
10	5.50	1.00	47		50	1.000	0.94	NM	0.94	0.50	0.47	4.47
11	6.00	1.00	49		50	1.000	0.98	NM	0.98	0.50	0.49	4.96
12	6.50	1.00	36		50	1.000	0.72	NM	0.72	0.50	0.36	5.32
13	7.00	1.00	17		50	1.000	0.34	NM	0.34	0.50	0.17	5.49
14	7.50	1.00	7		50	1.000	0.14	NM	0.14	0.45	0.06	5.55
15-Bank	7.90	1.00	5		50	1.000	0.10	NM	0.10	0.20	0.02	5.57

AVG. VEL.
AREA

0.00
6.90

FPS
SQ FT

*CALIBRATION

FOR N(REV/T)< 0.68 V= 1.00 *N+ 0

FOR N(REV/T)> 0.68 V= 1.00 *N+ 0

Appendix D
Irrigation Recharge Calculation

FISH CREEK MONTHLY ESTIMATE OF CONSUMPTIVE USE AND IRRIGATION RECHARGE

Delivery data from watermaster 1994-2004 (missing 1995, 1997, and 2000)

Irrigated area delineated utilizing 1987 aerial photo (2004 also consulted)

All values in acre-feet.

Delivery records from watermaster daily books, monthly summaries, storage + decreed natural flow

Recharge = Delivery - Crop C.U.

Crop C.U. = Precipitation deficit (Pdef) from Allen & Robison (2007), Picabo Station,
Alfalfa (less frequent cuttings)

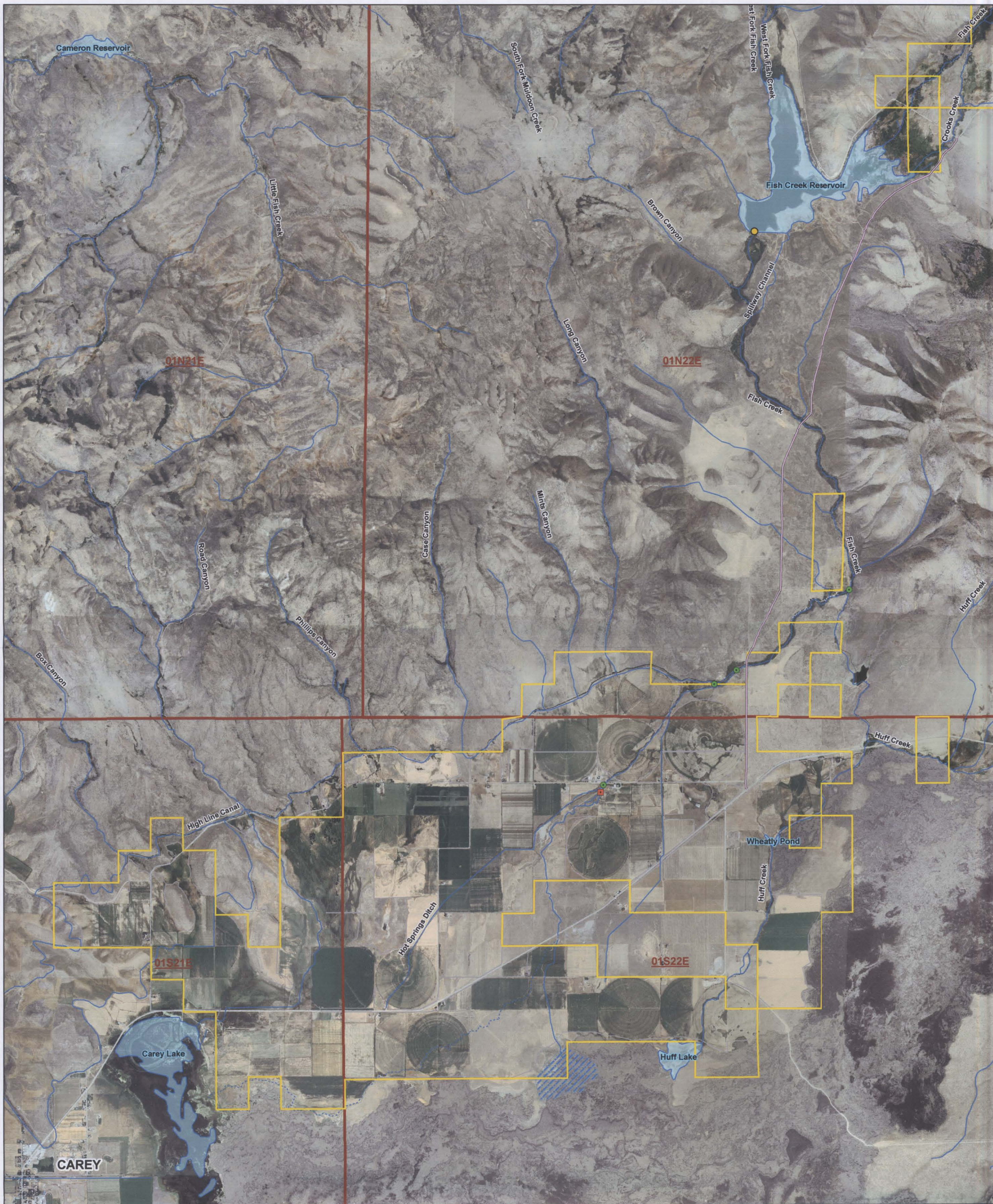
Irrigated acres 6746 acres

Month	Days	Crop C.U.*		
		(mm/day)	(inches)	(ac-ft)
April	15	0.76	0.45	252
May	31	3.1	3.78	2127
June	30	5.95	7.03	3951
July	31	5.3	6.47	3636
August	31	5.42	6.61	3719
September	30	2.91	3.44	1932
October	31	1.27	1.55	871
Total			29.33	16489

Month	1994		1996		1998		1999	
	Delivery	Recharge	Delivery	Recharge	Delivery	Recharge	Delivery	Recharge
April	738.3	486	0.0	0	0.0	0	0.0	0
May	1595.9	0	1871.2	0	926.5	0	0.0	0
June	2043.2	0	3735.1	0	1159.8	0	2444.9	0
July	1196.1	0	4366.7	730	3973.9	338	4029.3	393
August	47.8	0	3177.8	0	4139.8	421	3605.8	0
September	64.3	0	1283.3	0	2063.6	131	1649.3	0
October	79.7	0	190.2	0	691.2	0	220.6	0
TOTAL	5765.2	485.9	14624.3	730.3	12954.8	890.1	11949.8	392.9

Month	2001		2002		2003		2004	
	Delivery	Recharge	Delivery	Recharge	Delivery	Recharge	Delivery	Recharge
April	59.5	0	3.6	0	0.0	0	0.0	0
May	1958.3	0	1385.3	0	795.0	0	957.4	0
June	1573.1	0	1514.1	0	2313.4	0	1484.6	0
July	772.6	0	1430.1	0	1804.4	0	1216.7	0
August	256.7	0	304.3	0	202.3	0	609.9	0
September	99.8	0	89.9	0	105.3	0	136.7	0
October	45.6	0	96.2	0	26.2	0	125.4	0
TOTAL	4765.6	0.0	4823.4	0.0	5246.6	0.0	4530.7	0.0

Average Annual Recharge 312.4 acre-feet



0 0.25 0.5 1 1.5 2 Miles

FISH CREEK RESERVOIR COMPANY PLATE 1 - AQUIFER RECHARGE PLAN NAIP 2006 AERIAL

BROCKWAY ENGINEERING, PLLC.
 ALR - JUNE 1, 2007

- 37-1162_rec_pod
- Fish_Creek_Reservoir_Road
- Proposed Measuring Weir
- Lower Area Irrigation
- Rec_pou_37-1162
- Recharge Area (Approx.)
- Township-Ring
- Irrigation Diversion from Fish Cr

