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area. The initial interception of groundwater, expressed as roof seeps, by the mine workings was approximately 3-½ acre ft/yr.

In 1989, a significant amount of water was encountered in the 1st North Section of the #1 Mine Blind Canyon Seam, expressed as roof drips and flowing from roof fractures. Mining eventually encountered the apparent source of this water, a significant channel sandstone, which traverses East-West along the North end of the #1 Mine. The exact dimensions and configuration of this channel is unknown. Isotopic dating of the water in this aquifer has indicated the water to be approximately 1,000 years old. It is anticipated that Co-Op will eventually dewater this aquifer. Surface and groundwater monitoring has indicated no hydraulic connection between this aquifer and any springs in the permit area. To date, no impacts as a result of this dewatering have been observed in any of the springs within the permit area. Additional discussion on this channel is given in Appendix 7-J.

Isotopic dating of Big Bear Springs, as well as chemical analysis, has indicated that the spring is not hydrologically to the mine water or the channel aquifer. Monitoring of Big Bear Springs, as well as Birch Spring and the other springs within the permit area will continue in order to ensure that no impacts due to mining occur. A description of the isotopic and chemical data of the mine water and springs is shown in Appendix 7-J. In 1998, surface wells SDH-2 and SDH-3 were sampled for baseline parameters and for isotopic dating. This information is discussed in Appendix 7-J.

Hydrologic information from monitor wells MW-114, 116, and 117 indicate that the uppermost tongue of the star point sandstone is unsaturated under Wild Horse Ridge. A detailed discussion of this aquifer is given in Appendix 7-J.

Aquifer Recharge

Snow at the higher elevations provides the greatest source of groundwater recharge. Deuterium analyses of groundwater in the region indicate that most, if not all, groundwater is derived from snowmelt (Danielson et. al., 1981). The percentage of water derived from snowmelt, which recharges the groundwater system versus that which runs off to stream flow is controlled by the surface relief, the permeability of exposed strata, the depth of snow pack, and the rate of snowmelt. Published precipitation contours for the area indicate annual precipitation of 17 to 18 in./yr for the permit area.

Evapo-transpiration is estimated to be on the order of three to four inches annually (Danielson, et. al., 1981). Surface runoff, based on a mean site elevation of 8200 ft and on the generally deeply incised nature of much of the permit area and the predominance of south, east and west-facing slopes, is estimated to be 11 to 12 in./yr. These values correspond to estimates by others for the general area (Intermountain Consultants, 1977).

Up to three inches average annual precipitation is thus available for recharge for the 1140-acre permit area, resulting in an equivalent 285-acre ft/yr. The large proportion of outcrop versus total surface area of most of the permit area makes outcrop areas and drainage channel

A discharge line was installed in 1991 to the approved discharge point located above the scale house (Plate 7-1C). A totalizing flow meter is installed to monitor flows. Flows are logged and reported to the Utah Division of Water Quality with the monthly Discharge Monitoring Reports (DMR). Copies of these reports will be included in the quarterly Water Monitoring Reports.

On March 30, 1989, the State of Utah, Department of Health, stated that "a permit is not required" for overflow from the Bear Canyon culinary system (Appendix 7-B). The culinary overflow is piped into culvert C-8U (Plate 7-1C).

Expected mine water is further discussed in the Probable Hydrologic Consequence Determination (PHC), Appendix 7-J. Currently, no water is discharged from the Tank Seam due to the lack of mine water inflow. Similar conditions are expected in both Seams within Wild Horse Ridge.

Site Selection

C. W. Mining has selected sites that have been developed for beneficial use, are the primary source of surface water systems, or contain large flows, for monitoring. The parameters tested for and the schedule followed are the ones determined to be adequate based on the study found in Appendix 7J. Three years of baseline data will be collected which exceeds the minimum required by law. The Division recommend list for baseline parameters will be followed which exceeds the minimum required by law. Additionally every five years baseline parameters will be collected. The rest of the time filed readings will be collected which includes flow data and enough parameters to determine an impact.

Water Uses

Most of the surface water from the drainage is diverted for use as crop irrigation. The only other major use is supply water to the Huntington Power plant. The reservoirs in the area have been built to supplement this use. Some water in the area, particularly springs, is issued for livestock watering or as culinary water.

Water rights have been obtained by Co-Op in sufficient quantities for all of the mine's needs. Table 7-6 contains a listing of water rights in the area and Plate ~~7-4~~ 7-12 indicates their various locations. Information on the water rights can be accessed on the Utah Division of Water Rights website at http://nrwrt1.nr.state.ut.us/wrinfo/query.asp. Additional information about the water rights owned by the Co-Op man can be found in Appendix 7-C. Appendix 7-D contains a copy of an agreement between Co-Op and Huntington City with regards to protection of Huntington City's Big Bear Creek Spring (Huntington Spring) water source.

Table 7-6 Area Water Rights

Water Right	Owner	Priority Date	Place of Use	Point of Diversion	Nature Of Use
91-251	ANR	0/0/1900	(1) S 215 ft W 120 ft from NE cor, Sec 12, T 20S, R 6E, SLBM	Surface	Irrigation/ Domestic
91-316	ANR	0/0/1875	spring located in SW4NE4 Sec 10, T18S, R5E, SLBM	Spring	Stockwater
93-116	U.S.F.S	0/0/1875	From a point in NE4SE4 Sec 08, T15S, R7E, SLBM, to a point in SE4SE4 Sec 09, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-129	Nevada Electric	0/0/1875	From a point in NW4NW4 Sec 15, T16S, R7E, SLBM, to a point in NW4NW4 Sec 15, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-130	U.S.F.S	0/0/1875	from a point in SW4NW4 Sec 15, T16S, R7E, SLBM, to a point in SE4NW4 Sec 22, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-131	C.O.P Coal	0/0/1875	from a point in NW4SE4 Sec 22, T16S, R7E, SLBM, to a point in SW4SE4 Sec 22, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-138	C.O.P Coal	0/0/1875	from a point in NE4NE4 Sec 15, T16S, R7E, SLBM, to a point in NE4SE4 Sec 22, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-139	U.S.F.S	0/0/1875	from a point in NW4NW4 Sec 11, T16S, R7E, SLBM, to a point in SE4SE4 Sec 10, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-140	Utah Trust Land	0/0/1875	from a point in NE4SW4 Sec 02, T16S, R7E, SLBM, to a point in SW4SW4 Sec 02, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-141	C.O.P Coal	0/0/1875	from a point in NW4NW4 Sec 14, T16S, R7E, SLBM, to a point in SE4NE4 Sec 15, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-142	Utah Trust Land	0/0/1875	from a point in NW4NW4 Sec 01, T16S, R7E, SLBM, to a point in NE4NW4 Sec 14, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-143	Nevada Electric	0/0/1875	Spring located in NW4SW4 Sec 26, T16S, R7E, SLBM	Spring	Stockwater
93-144	U.S.F.S	0/0/1875	from a point in SE4SE4 Sec 22, T16S, R7E, SLBM, to a point in SE4SE4 Sec 22, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-146	Nevada Electric	0/0/1875	from a point in SE4NE4 Sec 27, T16S, R7E, SLBM, to a point in SE4NE4 Sec 27, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-147	BLM	0/0/1860	from a point in NW4NW4 Sec 35, T16S, R7E, SLBM, to a point in NE4NW4 Sec 35, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-148	BLM	0/0/1902	from a point in SE4SW4 Sec 26, T16S, R7E, SLBM, to a point in SE4SW4 Sec 26, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-149	Nevada Electric	0/0/1875	from a point in SW4SW4 Sec 26, T16S, R7E, SLBM, to a point in SW4SW4 Sec 26, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-150	Nevada Electric	0/0/1875	from a point in NE4NW4 Sec 24, T16S, R7E, SLBM, to a point in NE4SE4 Sec 26, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-151	U.S.F.S	0/0/1875	from a point in NE4NW4 Sec 13, T16S, R7E, SLBM, to a point in SW4SW4 Sec 13, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-155	Utah Trust Lands	0/0/1902	from a point in NE4NW4 Sec 29, T16S, R8E, SLBM, to a point in SW4SW4 Sec 29, T16S, R8E, SLBM.	Point 2 Point	Stockwater
93-156	A.U. Mines INC.	0/0/1902	from a point in NW4NE4 Sec 29, T16S, R8E, SLBM, to a point in NW4NE4 Sec 29, T16S, R8E, SLBM	Point 2 Point	Stockwater
93-157	A.U. Mines INC.	0/0/1902	from a point in NW4SE4 Sec 20, T16S, R8E, SLBM, to a point in SW4SE4 Sec 20, T16S, R8E, SLBM	Point 2 Point	Stockwater
93-158	C.O.P Coal	0/0/1902	from a point in NE4NW4 Sec 20, T16S, R8E, SLBM, to a point in SE4NW4 Sec 20, T16S, R8E, SLBM.	Point 2 Point	Stockwater
93-160	C.O.P Coal	0/0/1902	from a point in SW4NW4 Sec 07, T16S, R8E, SLBM, to a point in SE4SW4 Sec 17, T16S, R8E, SLBM	Point 2 Point	Stockwater
93-161	C.O.P Coal	0/0/1902	spring located in NW4SE4 Sec 07, T16S, R8E, SLBM	Spring	Stockwater
93-163	C.O.P Coal	0/0/1902	from a point in Lot 4 Sec 06, T16S, R8E, SLBM, to a point in NE4NE4 Sec 15, T16S, R8E, SLBM.	Point 2 Point	Stockwater
93-165	Trust Lands	0/0/1902	from a point in SW4SW4 Sec 29, T16S, R8E, SLBM, to a point in SW4SW4 Sec 29, T16S, R8E, SLBM	Point 2 Point	Stockwater
93-166	U.S.F.S	0/0/1875	from a point in NE4NE4 Sec 19, T16S, R8E, SLBM, to a point in SE4NE4 Sec 30, T16S, R8E, SLBM	Point 2 Point	Stockwater
93-167	C.O.P Coal	0/0/1902	from a point in SW4NW4 Sec 18, T16S, R8E, SLBM, to a point in SW4SE4 Sec 18, T16S, R8E, SLBM	Point 2 Point	Stockwater
93-188	U.S.F.S	0/0/1875	from a point in SE4NW4 Sec 05, T16S, R7E, SLBM, to a point in SE4NW4 Sec 04, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-190	U.S.F.S	0/0/1875	from a point at 0 ft., to a point in NE4SE4 Sec 06, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-192	U.S.F.S	0/0/1875	from a point in NW4SE4 Sec 09, T16S, R7E, SLBM, to a point in NE4SE4 Sec 09, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-193	U.S.F.S	0/0/1875	from a point in SW4SE4 Sec 08, T16S, R7E, SLBM, to a point in NW4SE4 Sec 09, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-195	U.S.F.S	0/0/1875	from a point in NE4NE4 Sec 20, T16S, R7E, SLBM, to a point in NE4NW4 Sec 22, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-196	Hiatt, Marena Madden, et Al	0/0/1902	from a point in SW4SE4 Sec 17, T16S, R7E, SLBM, to a point in SW4SE4 Sec 17, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-199	UP&L	0/0/1902	from a point in NW4NW4 Sec 27, T16S, R7E, SLBM,to a point in SE4SW4 Sec 22, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-202	BLM	0/0/1902	from a point in SE4NE4 Sec 35, T16S, R7E, SLBM, to a point in SE4NE4 Sec 35, T16S, R7E, SLBM.	Point 2 Point	Stockwater

93-203	Zions Bank& Frank A	0/0/1902	from a point in NW4NW4 Sec 02, T17S, R7E, SLBM, to a point in NE4SE4 Sec 35, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-210	Zionsl Bank & Frank A	0/0/1902	from a point in NW4SW4 Sec 35, T16S, R7E, SLBM, to a point in SE4SW4 Sec 35, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-214	Utah Power And Light	0/0/1902	from a point in SW4NW4 Sec 36, T16S, R7E, SLBM, to a point in SE4SE4 Sec 06, T17S, R8E, SLBM.	Point 2 Point	Stockwater
93-217	Utah Power And Light	0/0/1902	from a point in NW4SW4 Sec 01, T17S, R7E, SLBM, to a point in SW4SE4 Sec 36, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-219	HCIC	0/0/1875	(1) N 40 ft W 1520 ft from SE cor, Sec 34, T 15S, R 7E, SLBM, (2) N 1550 ft W 50 ft from SE cor, Sec 34, T 15S, R 7E, SLBM	Surface	Irrigation/Power/Industrial/Domestic/Minicipal/Stock Water
93-220	HCIC	0/0/1875	(1) S 1535 ft E 785 ft from NW cor, Sec 36, T 16S, R 7E, SLBM	Surface	Irrigation/Power/Industrial/Domestic/Minicipal/Stock Water
93-253	HCIC	0/0/1875	(1) N 2045 ft E 185 ft from S4 cor, Sec 26, T 16S, R 7E, SLBM	Surface	Stock Water/ Irrigation/ Domestic/ Municipal
93-254	HCIC	0/0/1875	(1) N 1750 ft W 95 ft from S4 cor, Sec 09, T 16S, R 7E, SLBM	Surface	Stock Water/ Irrigation/ Domestic/ Municipal
93-259	HCIC	0/0/1875	spring located in NW4SW4 Sec 17, T16S, R7E, SLBM	Spring	Stockwater
93-260	HCIC	0/0/1902	spring located in SW4SE4 Sec 17, T16S, R7E, SLBM	Spring	Stockwater
93-303	HCIC	0/0/1875	(1) S 2040 ft W 530 ft from NE cor, Sec 27, T 16S, R 7E, SLBM	Surface	Stock Water/ Irrigation/ Domestic/ Minicpal
93-304	HCIC	0/0/1875	(1) N 1060 ft E 685 ft from W4 cor, Sec 26, T 16S, R 7E, SLBM	Surface	Irrigation/ Domestic
93-309	HCIC	0/0/1875	(1) S 1770 ft W 980 ft from NE cor, Sec 27, T 16S, R 7E, SLBM	Surface	Irrigation/ Domestic/ Municipal/Stock Water
93-310	HCIC	0/0/1875	(1) N 2030 ft E 60 ft from SW cor, Sec 26, T 16S, R 7E, SLBM	Surface	Irrigation/Domestic/Municipal/ Stock Water
93-317	U.S.F.S	0/0/1875	spring located in SE4NW4 Sec 10, T18S, R5E, SLBM	Spring	Stockwater
93-390	Nevada Electric	0/0/1875	from a point in SW4SE4 Sec 22, T16S, R7E, SLBM, to a point in SW4SE4 Sec 22, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-508	ANR	0/0/1902	spring located in Lot 2 Sec 06, T16S, R8E, SLBM	Spring	Stockwater
93-509	C.O.P Coal	0/0/1875	spring located in SE4NW4 Sec 06, T16S, R8E, SLBM	Spring	Stockwater
93-510	C.O.P Coal	0/0/1902	spring from a point at 0 ft., to a point in NE4NE4 Sec 15, T16S, R8E, SLBM	Spring	Stockwater
93-511	IPA	0/0/1902	spring located in Lot 7 Sec 06, T16S, R8E, SLBM	Spring	Stockwater
93-512	ANR	0/0/1902	from a point in SE4NE4 Sec 05, T16S, R8E, SLBM, to a point in SE4NE4 Sec 09, T16S, R8E, SLBM	Point 2 Point	Stockwater
93-513	Utah Trust Lands	0/0/1902	from a point in SW4NW4 Sec 10, T16S, R8E, SLBM, to a point in NW4SW4 Sec 10, T16S, R8E, SLBM.	Point 2 Point	Stockwater
93-514	C.O.P Coal	0/0/1902	from a point in SW4SW4 Sec 10, T16S, R8E, SLBM, to a point in SW4SW4 Sec 10, T16S, R8E, SLBM	Point 2 Point	Stockwater
93-522	IPA	0/0/1902	(1) N 950 ft W 1430 ft from SE cor, Sec 06, T 16S, R 8E, SLBM	Surface	Mining/ Stock Water
93-565	Utah Trust Land	0/0/1902	from a point in NE4NW4 Sec 28, T16S, R8E, SLBM, to a point in NE4SE4 Sec 10, T17S, R8E, SLBM.	Point 2 Point	Stockwater
93-928	HCIC	0/0/1902	(1) N 1240 ft E 270 ft from SW cor, Sec 21, T 14S, R 6E, SLBM	Surface	Irrigation/ Power/ Industrial/ Fish Culture/ Stock Water/ Domestic
93-955	Utah Water Recources	8/8/1922	(1) N 1240 ft E 270 ft from SW cor, Sec 21, T 14S, R 6E, SLBM	Surface	Irrigation/ Stock Water
93-964	U.S. Fuel	8/17/1929	(1) S 1450 ft E 1400 ft from NW cor, Sec 05, T 16S, R 8E, SLBM	Surface	Industrial
93-970	ANR	4/10/1930	(1) N 1831 ft W 1012 ft from SE cor, Sec 08, T 16S, R 8E, SLBM	Surface	Industrial
93-1063	Utah Water Recources	3/30/1961	(1) N 1641 ft E 938 ft from SW cor, Sec 21, T 14S, R 6E, SLBM, (2) S 2220 ft W 2200 ft from NE cor, Sec 33, T 14S, R 6E, SLBM,(3) S 3272 ft W 282 ft from NE cor, Sec 33, T 14S, R 6E, SLBM, (4) N 165 ft W 750 ft from S4 cor, Sec 05, T 17S, R 8E, SLBM	Surface	Irrigation/ StockWater/ Domestic
93-1067	C.O.P Coal	1/20/1964	(1) N 79 ft E 75 ft from SW cor, Sec 24, T 16S, R 7E, SLBM	Surface	Irrigation/ Domestic/ Mining
93-1089	ANR	7/0/1910	(1) N 1500 ft W 85 ft from SE cor, Sec 08, T 16S, R 8E, SLBM	Under ground	Irrigation
93-1115	Utah Power And Light	12/10/1968	(1) S 1535 ft E 785 ft from NW cor, Sec 36, T 16S, R 7E, SLBM , (2) N 2350 ft W 500 ft from SE cor, Sec 10, T 17S, R 7E, SLBM	Surface	Irrigation/ Power/ Industrial
93-1129	Utah Trust Lands	0/0/1875	spring located at N3000 ft. E350 ft. from SW corner, Sec 10, T16S, R8E, SLBM	Spring	Stockwater
93-1139	HCIC	0/0/1890	(1) S 940 ft W 550 ft from N4 cor, Sec 28, T 14S, R 6E, SLBM	Surface	Irrigation/Power/Fish Culture/Industrial/Industrial /StockWater/Municipal/ Domestic
93-1182	Peabody Coal Co.	0/0/1902	from a point in NW4SE4 Sec 26, T16S, R7E, SLBM, to a point in SW4SE4 Sec 26, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-1183	Pacificorp UP&L	0/0/1902	from a point in NE4SW4 Sec 22, T16S, R7E, SLBM, to a point in NE4SW4 Sec 22, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-1187	U.S.F.S	0/0/1875	from a point in NE4SW4 Sec 20, T16S, R8E, SLBM, to a point in NE4SW4 Sec 20, T16S, R8E, SLBM.	Point 2 Point	Stockwater

93-1408	U.S.F.S	0/0/1875	spring located in NW4NE4 Sec 06, T16S, R7E, SLBM	Spring	Stockwater
93-1411	U.S.F.S	0/0/1875	spring located in NE4SW4 Sec 09, T16S, R7E, SLBM	Spring	Stockwater
93-1425	U.S.F.S	0/0/1875	spring located in SE4SW4 Sec 21, T16S, R8E, SLBM	Spring	Stockwater
93-1426	U.S.F.S	0/0/1875	spring located in SW4NW4 Sec 21, T16S, R8E, SLBM	Spring	Stockwater
93-1427	U.S.F.S	0/0/1875	spring located in NE4NE4 Sec 20, T16S, R8E, SLBM	Spring	Stockwater
93-1428	U.S.F.S	0/0/1875	spring located in NE4NE4 Sec 19, T16S, R8E, SLBM	Spring	Stockwater
93-1429	U.S.F.S	0/0/1875	spring located in NE4SE4 Sec 13, T16S, R7E, SLBM	Spring	Stockwater
93-1430	U.S.F.S	0/0/1875	spring located in SE4SE4 Sec 12, T16S, R7E, SLBM	Spring	Stockwater
93-1431	U.S.F.S	0/0/1875	spring located in NE4SE4 Sec 12, T16S, R7E, SLBM	Spring	Stockwater
93-1432	U.S.F.S	0/0/1875	spring located in SE4NE4 Sec 12, T16S, R7E, SLBM	Spring	Stockwater
93-1433	U.S.F.S	0/0/1875	spring located in NW4SE4 Sec 12, T16S, R7E, SLBM	Spring	Stockwater
93-1434	U.S.F.S	0/0/1875	spring located in NW4SW4 Sec 11, T16S, R7E, SLBM	Spring	Stockwater
93-1435	U.S.F.S	0/0/1875	spring located in NE4SE4 Sec 10, T16S, R7E, SLBM	Spring	Stockwater
93-1436	U.S.F.S	0/0/1875	spring located in NW4NW4 Sec 11, T16S, R7E, SLBM	Spring	Stockwater
93-1437	U.S.F.S	0/0/1875	spring located in NE4NW4 Sec 01, T16S, R7E, SLBM	Spring	Stockwater
93-1438	U.S.F.S	0/0/1875	spring located in NE4NW4 Sec 01, T16S, R7E, SLBM	Spring	Stockwater
93-2193	HCIC	0/0/1879	(1) N 1750 ft W 95 ft from S4 cor, Sec 09, T 16S, R 7E, SLBM	Surface	Irrigation/ Domestic/ Municipal/ StockWater
93-2194	HCIC	0/0/1884	(1) N 1750 ft W 95 ft from S4 cor, Sec 09, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater
93-2195	HCIC	0/0/1888	(1) N 1750 ft W 95 ft from S4 cor, Sec 09, T 16S, R 7E, SLBM	Surface	Irrigation/ StockWater
93-2196	HCIC	0/0/1879	(1) N 1060 ft E 685 ft from W4 cor, Sec 26, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2197	HCIC	0/0/1884	(1) N 1060 ft E 685 ft from W4 cor, Sec 26, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2198	HCIC	0/0/1888	(1) N 1060 ft E 685 ft from W4 cor, Sec 26, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2199	HCIC	0/0/1879	(1) N 2045 ft E 185 ft from S4 cor, Sec 26, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2200	HCIC	0/0/1884	(1) N 2045 ft E 185 ft from S4 cor, Sec 26, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2201	HCIC	0/0/1888	(1) N 2045 ft E 185 ft from S4 cor, Sec 26, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2202	HCIC	0/0/1879	(1) S 2040 ft W 530 ft from NE cor, Sec 27, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2203	HCIC	0/0/1884	(1) S 2040 ft W 530 ft from NE cor, Sec 27, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2204	HCIC	0/0/1888	(1) S 2040 ft W 530 ft from NE cor, Sec 27, T 16S, R 7E, SLBM	Surface	Irrigation/ Stockwater
93-2205	HCIC	0/0/1879	(1) S 1770 ft W 980 ft from NE cor, Sec 27, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2206	HCIC	0/0/1884	(1) S 1770 ft W 980 ft from NE cor, Sec 27, T 16S, R 7E, SLBM	Surface	Irrigation/ Stockwater
93-2207	HCIC	0/0/1888	(1) S 1770 ft W 980 ft from NE cor, Sec 27, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2208	HCIC	0/0/1879	(1) N 2030 ft E 60 ft from SW cor, Sec 26, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2209	HCIC	0/0/1884	(1) N 2030 ft E 60 ft from SW cor, Sec 26, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2210	HCIC	0/0/1888	(1) N 2030 ft E 60 ft from SW cor, Sec 26, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2220	HCIC	0/0/1879	(1) N 40 ft W 1520 ft from SE cor, Sec 34, T 15S, R 7E, SLBM (2) N 1550 ft W 50 ft from SE cor, Sec 34, T 15S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2221	HCIC	0/0/1884	(1) N 40 ft W 1520 ft from SE cor, Sec 34, T 15S, R 7E, SLBM (2) N 1550 ft W 50 ft from SE cor, Sec 34, T 15S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2222	HCIC	0/0/1888	(1) N 40 ft W 1520 ft from SE cor, Sec 34, T 15S, R 7E, SLBM (2) N 1550 ft W 50 ft from SE cor, Sec 34, T 15S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic
93-2223	HCIC	0/0/1879	(1) S 1535 ft E 785 ft from NW cor, Sec 36, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic/ Power/ Industrial
93-2224	HCIC	0/0/1884	(1) S 1535 ft E 785 ft from NW cor, Sec 36, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic/ Power/ Industrial
93-2225	HCIC	0/0/1888	(1) S 1535 ft E 785 ft from NW cor, Sec 36, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic/ Power/ Industrial

93-3033	HCIC	0/0/1875	from a point in NW4SW4 Sec 26, T16S, R7E, SLBM, to a point in NW4SW4 Sec 26, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-3033	North West Carbon Corp	0/0/1875	from a point in NW4SW4 Sec 26, T16S, R7E, SLBM, to a point in NW4SW4 Sec 26, T16S, R7E, SLBM.	Point 2 Point	Stockwater
93-3047	Utah Trust Lands	0/0/1860	spring located in SW4NE4 Sec 28, T16S, R8E, SLBM.	Spring	Stockwater
93-3171	North West Carbon Corp	0/0/1875	from a point in NW4SW4 Sec 26, T16S, R7E, SLBM, to a point in SW4SW4 Sec 26, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-3195	HCIC	2/28/1980	(1) S 940 ft W 550 ft from N4 cor, Sec 28, T 14S, R 6E, SLBM	Surface	Irrigation/ Industrial/ Power/ Fish Culture/ Stock Water/ Domestic/ Municipal
93-3207	BLM	0/0/1860	from a point in NE4NE4 Sec 27, T16S, R7E, SLBM, to a point in NE4NE4 Sec 27, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-3208	BLM	0/0/1860	from a point in SW4NW4 Sec 26, T16S, R7E, SLBM,to a point in SW4NW4 Sec 26, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-3209	BLM	0/0/1860	from a point in NE4SW4 Sec 26, T16S, R7E, SLBM, to a point in NE4SW4 Sec 26, T16S, R7E, SLBM	Point 2 Point	Stockwater
93-3524	ANR	4/10/1930	(1) N 1831 ft W 1012 ft from SW cor, Sec 09, T 16S, R 8E, SLBM	Surface	Industrial/ Municipal
93-3657	J. O Kingston	0/0/1875	(1) S 1725 ft W 1280 ft from NE cor, Sec 22, T 16S, R 7E, SLBM, (2) N 79 ft E 75 ft from SW cor, Sec 24, T 16S, R 7E, SLBM	Surface	Irrigation/ Stockwater
93-3725	HCIC	0/0/1875	(1) N 1060 ft E 685 ft from W4 cor, Sec 26, T 16S, R 7E, SLBM, (2) N 2030 ft E 60 ft from SW cor, Sec 26, T 16S, R 7E, SLBM, (3) S 1770 ft W 980 ft from NE cor, Sec 27, T 16S, R 7E, SLBM, (4) S 2040 ft W 530 ft from NE cor, Sec 27, T 16S, R 7E, SLBM	Surface	Irrigation/ Municipal/ StockWater/ Domestic/ Power/ Industrial
93-3739	ANR	7/00/1910	(1) N 1500 ft W 85 ft from SE cor, Sec 08, T 16S, R 8E, SLBM	Under ground	Irrigation
93-3745	IPA	4/10/1930	(1) N 1831 ft W 1012 ft from SE cor, Sec 08, T 16S, R 8E, SLBM	Surface	Industrial/ Municipal
93-3746	IPA	4/10/1930	(1) N 1831 ft W 1012 ft from SW cor, Sec 09, T 16S, R 8E, SLBM	Surface	Industrial/ Municipal

Note: This table includes water rights on file with the Utah Division of Water Rights in or near the permit area.

Effects of Mining on Surface Water

The operation of Bear Canyon Mine by C. W. Mining is expected to have only a very minimal effect on surface water on the area. The quality of Bear Creek before passing through the mine plan area is poor. Generally, as the excess mine water is discharged into Bear Creek; the surface water quality is improved significantly after passing through the mine site. The potential impacts to surface waters are discussed in Appendix 7-J, section 9.1.2. The greatest potential impact of mining operations is probably an increase in sediment loading to Bear Creek. Controls and diversion structures have been constructed to prevent sediment-laden water from disturbed area from mixing with local surface water, to minimize the mining impacts on the receiving stream waters.

Site Selection

All perennial streams inside the permit area start within the permit area. Because of this the major groundwater sources feeding them are monitored. Surface monitoring sites have been selected at all major confluences and at other points of interest. Additionally sites were selected in all perennial streams as close as possible, based on accessiblity, to the edge of the permit boundary to detect any of site impacts. The parameters tested for and the schedule followed are the ones determined to be adequate based on the study found in Appendix 7J. Three years of baseline data will be collected which exceeds the minimum required by law. The Division recommend list for baseline parameters will be followed which exceeds the minimum required by law. Additionally every five years baseline parameters will be collected. The rest of the time filed readings will be collected which includes flow data and enough parameters to determine an impact.

724.300 Geologic Information

Geologic information for use in determining the probable hydrologic consequence of mining operations upon the quality and quantity of surface and ground water, whether reclamation can be accomplished, and whether the proposed operations have been designed to prevent material damage to the hydrologic balance outside the permit area is discussed in detail in Chapter 6 Geology (R645-301-624) and under numerous headings in this chapter.

R645-301-727 Alternate Water Source Information

No alternate water source is needed since we do not expect to impact any current water sources as explained in R645-301-724.100 and R645-301-724.200.

R645-301-728 Probable Hydrologic Consequence Determination

~~**See Appendix 7-J**~~**.** In 2001 C. W. Mining hired Mayo and Associates to do a detailed hydrologic study and a PHC of the current permit area and all areas of anticipated future mining. This study is included as Appendix 7J. The study area included the 2001 WHR permit expansion and the 2006 Federal Lease/Mohrland expansion areas. The study clearly identifies the areas during the introduction on page 1, and on the project area map on page 2. Additionally page 127 of the study states "This PHC determination is based on data and information presented in Sections 1-8 of this document." and "The hydrological evaluation presented in Section 1-8 of this report also includes the Mohrland area;" he continues by saying "however, C. W. Mining is not permitting the Mohrland area at this time." The last statement was correct at the time of the report, but is no longer correct since an application to add the Mohrland area was submitted to DOGM in 2005. This statement should be ignored when reading the document.

Additionally, at the time the report was done, no escarpment failure was planed in the left fork of Fish Creek, and the right fork of Fish Creek was not considered perennial where it flowed through the affected area. Because of this consequences related to these issues were not discussed in Appendix 7J.

728.100 PHC Determination

This is included in section 9.0 of Appendix 7J. For the left fork of Fish Creek there is one area where escarpment failure may reach the stream. This would cause a temporary increase in the sediment of the area. The impact would be short term and only affect the immediate area. Escarpment failure is discussed in detail in Appendix 5-C.

During field investigations conducted in 2006 it was determined that 4,000 feet of perennial stream in the right fork of Fish Creek exist in the affected area. Since fracturing of rocks is not

expected to extend more then 250 feet above the coal seam and the minimum overburden thickness is 900 feet, no impact is expected. Additionally if any fracturing did occur it would immediately be sealed by the surface soil. Protection and monitoring of this area is discussed in Appendix 5-C.

728.200 Baseline Information

This is discussed in Appendix 7J sections 3 through 7 and Appendix 7M and 7N.

728.310 Adverse Impacts to the Hydrologic Balance

This is discussed in section 9.1 of Appendix 7J

728.320 Acid/Toxic Forming Material

This is discussed in section 9.2 of Appendix 7J

728.330 Impacts of Proposed on:

728.331	Sediment Yield;	This is discussed in section 9.3 of Appendix 7J
728.332	Water Quality;	This is discussed in section 9.4 of Appendix 7J
728.333	Stream Flow Alteration;	This is discussed in section 9.5 of Appendix 7J
728.334	Water Availiabity;	This is discussed in section 9.6 of Appendix 7J

728.340-350 Affects on Water Resources and Water Rights

This is discussed in section 9.7 of Appendix 7J

R645-301-729 Cumulative Hydrologic Impact Assessment

See Appendix 7-L.

R645-301-730 Operation Plan

R645-301-731 General Requirements

731.100 Hydrologic Balance Protection

Affects of Mining on Groundwater Balance

Mining operations in the permit area will be confined to the coal bearing strata within the basal part of the Blackhawk formation. The coal strata are generally dry throughout most of the permit area, with the Tank Seam being dry throughout the entire property, and are part of an undeveloped aquifer system, which consists of a series of generally discontinuous perched water zones within the Blackhawk formation. Overlying formations are not uniformly saturated. The Star Point Sandstone is unsaturated in the Southern and Eastern parts of the permit area, and saturated in all three tongues on the Northwestern end of the permit area. The potential groundwater impacts are discussed in detail in Appendix 7-J, section 9.0. The potential impacts can be categorized into two basic sections: 1.) Potential impacts to groundwater quantity and 2.) Potential impacts to groundwater quality.

Quantity

Mining affects on water quantities consist of interceptions of local perched zones, and the interception of a larger perched aquifer at the North end of the Blind Canyon Seam workings. Investigations have shown that this aquifer is not hydraulically connected to Big Bear or Birch Spring (Appendix 7-N), so dewatering of this aquifer will have no impact on the quantity of these springs. These waters are collected in sumps within the mine and either diverted for culinary water and dust control or it is discharged into Bear Creek. Groundwater surveys are conducted and submitted annually to the Division. Groundwater is also removed as moisture within the coal itself, as evaporation in the mine ventilation air discharge, and in dust suprresion. ~~As discussed in the PHC, the estimated volume of water removed in this manner is 22 acre-feet per~~

Water Consumed During Production
Inherent Coal Moisture = 6% Mine Run Moisture = 7% Max Yearly Production = 2,500,000 tons
water loss = ((0.07-0.06)*2,500,000 Tons)*(2,000 lbs/1 TON)*(1 gal/8.33 lbs)*(1acre-ft/32,850 gal)
water loss = 18.42 acre-ft/year

Surface Dust Suppression
Average water used for road watering = 600,000 gallons Average water used for stockpiles = 2 gallons/Ton
water loss = 600,000+(2 gal/Ton*2,500,000 Tons) = 6,043,371 gal/yr = 18.55 acre-ft/year

Ventilation Loss
p_b = barometric pressure = 29.88 in. HG t_d = dry bulb temperature = 40°F ,45°F
t_w = wet bulb temperature = 38°F , 43°F Q = Ventilation quantity = 160,250 inlet, 191,540 outlet
*p_s'=sat. vapor press., wet bulb (in. Hg) = 0.18079*e^((17.27*t_w - 552.64) / (t_w +395.14))* = 0.023, 0.279

p_v = actual vapor pressure (in. Hg) = p_s'-[((p_b - p_s')(t_d - t_w)) / (2800-1.3*t_w))] = 0.208, 0.257*
W = specific humidity (lb/lb dry air) = 0.622(p_v / (p_b-p_v)) W_I =0.0043 W_E =0.0054*
p_a =partial pressure of air (in. Hg) = p_b – p = 29.67 inlet, 29.62 oulet
*v = specific volme (ft^3/lb) = (0.754 * (t_d +460)) / p_a = 12.71 inlet, 12.85 oulet*
*G = weight flow-rate (lb/h) = 60 * Q / v = 756,756 inlet, 894,071 outlet Average = 825,414*
water loss =G (lb/h)(W_E – W_I)* .016018 (ft^3/lb)*8766 (h/yr) / 43560(ft^3/acre-ft) = 2.77 acre-ft/year*

Total Maximum Water Loss = 18.42 + 18.55+ +2.77 = 40 acre-ft/year

The affects of subsidence in the permit area, on regional or local groundwater flow, are expected to be minor and of short duration. Localized diversions or interceptions of short duration only are expected due to the plastic flow of shaley units and to both development and tightening of existing fractures which occur due to unbalanced compressive-tensile forces associated with subsidence. The reclamation plan proposes to control post-mining subsidence which is expected to be a maximum of 5.5 feet assuming all three seams are mined, with no subsidence to occur in a varying 100 to 200 ft wide corridor from outcrop areas and permit boundary areas, as well as under escarpments.

In the portion of Federal Lease U-024316 to be permitted, mining will take place in the ~~Tank~~Blind Seam only, ~~which will limit any subsidence to a maximum of 1.9 feet.~~ In the event mining reaches far enough ~~North~~ to mine at an elevation below Bear Creek, an adequate barrier will be left to completely prevent any impact on Bear Creek. This barrier is shown on Plate 5-3 and described in Appendix 5-C.

Quality

The potential impacts to water quality include contamination of water due to rock dust usage, abandoned equipment, the usage of hydrocarbons, and contamination from road salting. These potential water quality impacts are discussed in detail in Appendix 7-J, Section 9.0 (PHC) and Appendix 7-P.

Rock dust which is used for the suppression of coal dust may potentially impact the groundwater flowing through the mine by the dissolution of the rock dust constituents into the water. This could result in increase concentrations of TDS or sulfates. Gypsum rock dust has been known to result in high TDS concentrations; therefore Co-Op has implemented the use of limestone rock dust. Mine water discharged into Bear Creek is monitored for TDS, as well as the

As discussed in Appendix 7-J, section 9-1, hydrocarbons in the form of oil and fuel are stored at the mine site. A spill prevention control and counter measures plan is maintained onsite-outlining controls to prevent and mitigate any hydrocarbon spills. Within six months of the implementation of the Wild Horse Ridge facilities construction, this plan will be updated to reflect the controls for the new facilities. If any state appropriated water rights are impacted in the future C. W. Mining will meet with the water right holder and the Division and develop a site specific water replacement plan.

Water Monitoring

Groundwater Monitoring Plan

Monitoring activities are designed to determine water levels, discharge and water quality fluctuations in relevant aquifers or groundwater occurrences in the mine area. Data is collected from mine sumps, from monitoring wells within the mine, observation wells on the surface, and springs. The objectives are to identify potential impacts during and after mining and, provide continuing data on the areas aquifer characteristics and groundwater occurrences. A recommended water-monitoring program is included in Appendix 7-J, section 10.0. The current approved water monitoring program is shown in Table 7-14.

Springs below the mine will be sampled to determine discharge and water quality parameters and their possible variation with time. These springs include SBC-14, Big Bear Springs, COP Development Springs, and Birch Springs (Plate 7-4). Periodic checks will be made of the mine area to determine any impact not currently expressed at the surface. This data will be used to estimate seasonal fluctuations, aquifer recharge and consistent long-term changes

and to ensure that no impacts occur. Springs above the mine will be monitored for field parameters, since the potential for impact to these springs is quantity rather than quality. SBC-9A and SBC-4 will be monitored for lead quality.

Groundwater monitoring will follow the ground water sampling guidelines as shown in Table 7-12 using the water quality parameter list in Table 7-13. These tables follow the recommendations presented in Appendix 7-J. New significant occurrences within the present permit area will be promptly included in the sampling program, as specified by state requirements. Operational ground water monitoring will continue through reclamation to Bond Release.

The sampling matrix for each of the existing monitoring stations during the operational phase of mining is included in Table 7-14. ~~No baseline data is available for SBC-17, but will be collected in 2000 and 2001, prior to mining occurring within the vicinity of this spring.~~ Baseline samples were collected for SBC-14, SBC-15, SBC-16, SBC-17, MW-114 and MW-117 in 2001. Three years of baseline will be collected on all additional sites added after 2001.

Temporary Drill Hole Seals. Within 30 days of completion, drill holes utilized for groundwater monitoring will be sealed in a nonpermanent fashion by installing PVC surface casing with a threaded cap for access.

Annual Report. An Annual Report evaluating all data collected for the year will be submitted to DOGM as required.

Table 7-12 Ground Water Sampling

	Baseline Monitoring	Operational Monitoring	Post-mining Monitoring
Type of Sampling site	Springs, In-Mine Flows, Boreholes, Observation Wells.	Springs, In-Mine Flows, Boreholes, Observation Wells.	Springs, Observation Wells, Mine discharge points.
Field Measurements and Parameters (Table 7.1-7)	Water levels and/or flow and water quality	Water levels and/or flow and water quality	Water levels and/or flow and water quality
Sample Frequency Each site	Quarterly Adequate to describe seasonal variation. Monthly recommended for more accurate description of seasonal variation.	Quarterly samples springs and wells; In-mine flows at initial interception, quarterly after 1st 30 days until diminished. From sumps and/or mine discharge points quarterly or as required by UPDES.	Quarterly based on potential impact; or once per annum (spring sampling at low flow).
Sampling Duration	Three ~~Two~~ years (~~one complete year of data before submission of PAP~~Prior to mining in the are).	Every year until two years after surface reclamation activities have ceased.	Until termination of bonding.
Type of Data Collected and Reported	Wells and Boreholes: Water quality, water level of flow logs, collar elevation; ground elevations; screened interval; formation where completed; depth. Springs: Water quality, location, and flow.	Wells and boreholes: Water quality, water level or flow. Springs: Flow and water quality with one sample taken at low flow.	Wells and Boreholes: Water quality, water level or flow. Springs: Flow, water quality with one sample taken at low flow. Phase I: Whether pollution of surface and subsurface water is occurring, the probability of future occurrence, and estimated cost of abatement. Phase II: After revegetation has been established and contributing suspended solids to streamflow or runoff outside the premit area is not excess of the requirements set by UCA 40-10-17(j) of the Act and by R645-301-751. Phase III: Until reclamation requirements of the Act and the permit are fully met.
Comments	Springs and seeps should be measured from source at high and low flow periods.	During the year preceding re-permitting. Springs, one water quality sample at low flow for baseline parameters. Other sites, one sample for baseline parameter.	

Table 7-14 Water Monitoring Matrix: Operational Phase of Mining

Location	Jan	Feb	Mar	Apr	May	June	July	Aug[3]	Sept	Oct	Nov	Dec
Streams												
BC-1 (Upper Bear Creek)		oper			oper	field	field	oper.	field	oper		
BC-2 (Lower Bear Creek)		oper			oper	field	field	oper.	field	oper		
BC-3 (Lower Rt Fork Bear Creek)		oper			oper	field	field	oper.	field	oper		
BC-4 (Upper Rt Fk. Bear Creek)		oper			oper.	field	field	oper.	field	oper		
CK-1 (Upper Cedar Creek)		oper			oper.	field	field	oper.	field	oper		
CK-2 (Lower Cedar Creek)		oper			oper.	field	field	oper.	field	oper		
MH-1 (McCadden Hollow Creek)					field [5]		field	field		field		
FC-1 (Lower Left Fork Fish Creek)[7]					field [5]		field	field		field		
FC-2 (Lower Right Fork Fish Creek)[7]					field [5]		field	field		field		
FC-3 (Right Fork Fish Creek Property Line)[7]					field [5]		field	field		field		
FC-4 (Upper Right Fork Fish Creek)[7]					field [5]		field	field		field		
FC-5 (Mud Spring)[7]					field [5]		field	field		field		
FC-6 (Upper Left Fork Fish Creek)[7]					field [5]		field	field		field		
FC-7 (Water Right Upper LF FC)					field [5]		field	field		field		
FC-8 (Water Right Upper LF FC)					field [5]		field	field		field		
Springs												
SBC-3 (Creek Well)		oper			oper			oper.		oper		
SBC-4 (Big Bear Springs) [4]		oper			oper			oper.		oper		
SBC-5 (Birch Spring) [4]		oper			oper.			oper.		oper		
SBC-9A (Hiawatha Seam)		oper			oper			oper		oper		
SBC-12 (16-7-13-1)					field. [5]		field	field		field		
SBC-14 (WHR-6)		oper			oper.			oper.		oper		
SBC-15 (WHR-5)					field[5]		field	field		field		
SBC-16 (WHR-4)[6]					field[5]		field	field		field		
SBC-16A					field[5]		field	field		field		
SBC-16B					field[5]		field	field		field		
SBC-17 (16-7-24-4)		oper			oper.			oper.		oper		
SBC-18 (WHR-2) [7]					field[5]		field	field		field		
SBC-20 (16-8-16-4)[7]					field[5]		field	field		field		
SBC-21 (16-8-18-1)[7]					field[5]		field	field		field		
SBC-22 (Stockwater Trough)					field[5]		field	field		field		
SCC-1 (16-8-20-1					field[5]		field	field		field		
SCC-2 (16-8-15-5)[7]					field[5]		field	field		field		
SCC-3 (Mohrland Portal)					field[5]		field	field		field		
SCC-5 (16-8-7-3)					field[5]		field	field		field		
SMH-1 (FBC-6)					field. [5]		field	field		field		
SMH-2 (FBC-5)					field [5]		field	field		field		
SMH-3 (FBC-13)					field. [5]		field	field		field		
SMH-4 (FBC-4)					field [5]		field	field		field		
SMH-5 (Stockwater Trough)					field [5]		field	field		field		
Wells												
SDH-2 (Well, Sec. 11, T16S, R7E)					level [5]		level	level	level	level		
SDH-3 (Well, Sec. 10, T16S, R7E)					level [5]		level	level	level	level		
MW-114 (Well, Sec 18, T16S, R8E)					level [5]		level	level	level	level		
MW-117 (Well, Sec 12, T16S, R8E)					level [5]		level	level	level	level		

Notes:
1. See Tables 7-13 and 7-17 for listing of water quality monitoring parameters.
2. oper. = operational base. = baseline
3. Baseline parameters taken in August of year 5 prior to each permit renewal.
4. SBC-4 and SBC-5 shall also be tested for oil and grease.
5. First sample to be taken in May or June, when Gentry Mountain is accessible.
6. A comment will be made regarding the level of the pond feeding the spring
7. Weekly monitoring to begin one month prior to mining in area and continue until one month after. Monthly monitoring will then be done for an additional six months.

Table 7-15 Past ~~and existing~~ monitoring sites

Site ID	Description	Status
Springs		
SBC-1	Under Ground Seep[1]	Dried up early 1988, and monitoring was discontinued.
SBC-2	Portal Well[2]	Dry from 1987. Caved in, lost (2) quarters and relocated in 1991.
~~SBC-3~~	~~Creek Well~~	~~Active~~
~~SBC-4~~	~~Huntington Spring~~	~~Active~~
~~SBC-5~~	~~Birch Spring~~	~~Active~~
SBC-6	COP Development Spring[3]	Dried up in 1987, with no flow through 2000. Monitoring discontinued in 2000.
~~SBC-12~~	~~Bear Creek Source (16-7-13-1)~~	~~Active~~
~~SBC-14~~	~~Right Fork Spring WHR-6~~	~~Active~~
~~SBC-15~~	~~Right Fork Spring WHR-5~~	~~Active~~
~~SBC-16~~	~~Fish Creek Spring WHR-4~~	~~Active~~
~~SBC-17~~	~~Upper Bear Spring 16-7-24-4~~	~~Active~~
~~SMH-1~~	~~MH Left Fork Spring (FBC-6)~~	~~Active~~
~~SMH-2~~	~~MH Water Trough (FBC-5~~	~~Active~~
~~SMH-3~~	~~MH/Trail Ridge Spring (FBC-13)~~	~~Active~~
~~SMH-4~~	~~MH Right Fork Spring (FBC-4)~~	~~Active~~
In-Mine Sources		
SBC-7	Sump #1	Dried up and discontinued in 2000.
SBC-8	Sump #2	Dried up and discontinued in 2000.
SBC-9	Sump #3[4 6]	Abandoned in 1999 due to retreat mining and replaced by SBC-13.
~~SBC-9A~~	~~Hiawatha Seam 1st North~~	~~Activated in Oct. 2002 when a borehole was drilled up to the old SBC9 site.~~
SBC-10	Sump #4	Flow first measured Dec. 1991. Monitoring initiated Jan. 1992. In July, 1995, retreat mining progressed passed this sump, making it inaccessible. Monitoring was discontinued in August 1995. Flows from this area have subsequently flowed through the pillared area and out of the 1st East pillared section.
SBC-11	Hiawatha Seam 1st North	Abandoned in April 2002 due to a roof fall. Water flows to SBC-9A
SBC-13	1st East Pillared Section[5]	Abandoned in April 2002 due to retreat mining and replaced by SBC-9A
Wells		
DH-1A	2nd W. Monitor Well	Abandoned in 2001 due to retreat mining.
DH-2	3rd W. Monitor Well6	Abandoned in 1999 due to retreat mining.
DH-3	1st E. Monitor Well6	Abandoned in 1993 due to retreat mining and was replaced by DH-4.
DH-4	3rd W. Bleeder Monitor Well6	Abandoned in 1999 due to retreat mining.
~~SDH-2~~	~~Well, Sec. 11, T16S, R7E~~	~~Active~~
~~SDH-3~~	~~Well, Sec. 10, T16S, R7E~~	~~Active~~
~~MW-114~~	~~Wild Horse Ridge Monitor Well~~	~~Active~~
~~MW-117~~	~~Gentry Mtn. Monitor Well~~	~~Active~~
MW-116	Gentry Mtn. Monitor Well	The side caved in and the well was lost

SDH-1, SDH-2, SDH-3. These three monitoring wells were installed in 1995 from the surface (Plate 7-4). These wells are completed in the Spring Canyon tongue of the Star Point Sandstone, with SDH-1 and SDH-2 located to monitor the potentiometric surface in conjunction with the DH wells discussed previously. SDH-3 was installed West of the Blind Canyon fault (western boundary of the permit area) in order to observe the relationship of the Spring Canyon aquifer on each side of the fault. Completion diagrams of these wells are included in Appendix 7-A. The initial baseline data is included in Appendix 7J-A. Based on these baseline levels, a potentiometric surface for the Spring Canyon aquifer was developed. This is shown in Appendix 7-J, Figure 13b, and on Plate 7J-2.

In 1996, SDH-1 well plugged and was lost while attempting to unplug the well. SDH-2 and SDH-3 are monitored for water levels as shown in Table 7-14.

MW-114, ~~MW-116,~~ MW-117. These ~~three~~Two wells were drilled in 1991 by Cyprus/Plateau, and are located North of the Wild Horse Ridge expansion area. Both~~All three~~ wells are located East of the Bear Canyon fault. MW-114 is located immediately North of and adjacent to the permit area. These wells were also completed in the Spring Canyon member of the Starpoint Sandstone. Baseline water levels for these wells are included in Appendix 7J-A, and well completion diagrams are included in Appendix 7-A. Water age dating and chemical information will be collected from these wells to verify that the hydrologic patterns in the Wild Horse Ridge area are consistent with the patterns discussed in the PHC which have been found in the existing permit area. This information will also be collected from any new wells installed within or adjacent to the Wild Horse Ridge area.

Additional Monitor Wells. A minimum of one additional drillhole will be installed in the northern portion of the Wild Horse Ridge area, shown as DH-5 on Plate 5-1C. If necessary, additional wells may be installed following the installation and evaluation of DH-5 in order to adequately characterize the groundwater aquifers of the lower Blackhawk and upper Star point formations. DH-5 and any additional drillholes will be tested using the same methodology, which was used in the previous in-mine wells, described in Appendix 7-N. The holes will then be completed as monitor wells in the same manner as described in Appendix 7-N.

Springs above the mine have also been selected based on the conclusion of Appendix 7J and 2006 field investigations that included regulating agencies and interested parties. Because these springs are above the coal seam water quality impacts are not a major concern, however flow quantity impacts are. Sites were selected because they were either major contributors to surface water systems, or they were springs that have been developed for beneficial use or have water rights on them. The major contributors to surface water systems are SMH-3, SMH-4, SBC-12, SBC-18, SBC-20, SBC-21, SCC-1, SCC-3, and SCC-5. Perennial portions of the streams feed by sites SCC-5, SCC-2, SBC-20, and SBC-21 will be undermined. Because of this these sites will be monitored for flow weekly starting one month prior to undermining and continuing until one month after undermining at which time they will be monitored monthly for six months before returing back to their normal monitoring shcedule. The ground water sites selected because they were developed or had water rights are SMH-1, SMH-2, SMH-5, SBC-15, SBC-16, SBC-16A, SBC-16B, and SBC-22. The actual start time will be determined based on continual underground surveying that is required by MSHA. During the monitoring weekly reports will be sent to the Division via email.

Measuring the flow from springs and seeps is almost always difficult because flows tend to be dispersed and rarely concentrate into well-defined channels amenable to discharge measurement.
The most accurate method of measuring small discharges, and the method that will be used, is by observing the time required to fill a container of known capacity, or the time required to partly fill a calibrated container. The basic equipment is a stopwatch and a calibrated container.

Purchased pre-calibrated containers may be used or containers will be calibrated by either adding known volumes of water by increments and measuring the depth of water in the container, or by weighing the container with varying amounts of water in it, noting the depth in the container, and using the formula: $V = (W2-W1)/w$; where: V = volume of water in the container, $W2$ = weight of container with water, $W1$ = weight of empty container, and w = unit weight of water.

The basic field procedure will consists of interrupting the flow and collecting the water. Temporary earth dams may be constructed to divert the water through a small diameter pipe for capture. Or it may be possible to place a trough or half of a stove pipe against the spring or seep to carry the water to the calibrated container. Cloths, clay, or other materials will be used to temporarily seal cracks and force the water to go into the calibrated container. Where flows come out of the ground in a number of distinct sources or if they are scattered over a broad area, the results of several different measurements will be added together.

731.220 Surface Water Monitoring

In the past, C. W. Mining has monitored three stations on Bear Creek, one above (north) the mine plan area, one at the right-hand tributary (center) and one below the mine area (southwest). The monitoring location above the mining area is approx 3000 ft upstream from where the mine road crosses Bear Creek in the mine plan area. The monitoring location at the right-hand tributary of Bear Creek is located just above its confluence with the main Bear Creek. Two additional monitoring locations will be added to this tributary for mining in Wild Horse Ridge, one above the disturbed area (northeast), as well as a spring located in the drainage (SBC-14, see section 7.1). The monitoring location downstream is near the Ballpark topsoil storage pile. Monitoring stations are shown on Plate 7_4 and listed below. Monitoring points have also been added to the Fish Creek and McCadden Hollow drainages to monitor for water quantity impacts.

Streams

1. Upper Bear Creek - BC-1
2. Lower Bear Creek - BC-2
3. Lower Right Fork Bear Creek - BC-3
4. Upper Right Fork Bear Creek - BC-4
5. McCadden Hollow Creek - MH-1
6. Fish Creek Left Fork - FC-1
7. Fish Creek Right Fork - FC-2
8. Fish Creek RF Property Line - FC-3
9. Upper Fish Creek Right Fork - FC-4
10. Fish Creek Past Mud Spring - FC-5
11. Upper Fish Creek Left Fork - FC-6
12. Upper Fish Creek LF Water Right- FC-7
13. Upper Fish Creek LF Water Right- FC-8
14. Upper Cedar Creek - CK-1
15. Lower Cedar Creek - CK-2

Surface monitoring will follow the surface water sampling guidelines as shown in Table 7-16, using the water quality parameter list in Table -16. Monthly sampling matrix for each of the existing monitoring stations are included in Table 7-14. Operational surface water monitoring will continue through reclamation to bond release.

Table 7-16 Surface Water Sampling

	Baseline Monitoring	Operational Monitoring	Post-mining Monitoring
Type of Sampling Site	Surface Water Bodies.	Surface Water Bodies.	Surface Water Bodies.
Field Measurements and Parameters (Table 7.1-7)	Performed during water level/flow measurements.	Performed during water level/flow measurements.	Performed during water level/flow measurements.
Sample Frequency	Quarterly for lakes, reservoirs and impoundments (water level and quality); monthly flow measurements and quarterly water quality measurements (one sample at low flow and high flow each) for perennial streams. Monthly flow and water quality measurements during period of flow for intermittent streams. Sampling for ephemeral streams determined at pre-design conference.	Quarterly for lakes, reservoirs and impoundments (water level and quality); monthly flow measurements and quarterly water quality measurements (one sample at low flow and high flow each) for perennial streams. Monthly flow and water quality measurements during period of flow for intermittent streams. Sampling for ephemeral streams determined at pre-design conference.	Two per annum for perennial streams (high & low flow); two per annum during snowmelt and rainfall for intermittent streams.
Sampling Duration	~~Two~~Three years (~~one complete year of data before submission of PAP~~Prior to mining in the area).	Every year until two years after surface reclamation activities have ceased.	Every year until termination of bonding.
Type of Data Collected and Reported	Flow and/or water levels and water quality.	Flow and/or water levels and water quality.	Flow and/or water levels and water quality per operational parameters.
Comments	All field measurements should be performed concurrently with water level/flow measurements.	All field measurements should be performed concurrently with water level/flow measurements.	All field measurements should be performed concurrently with water level/flow measurements.
Additional Comments		For every fifth year preceding re-permitting, one sample at low flow and high flow each should be taken for baseline water quality parameters. The construction monitoring program will be conducted on a site-specific basis in addition to the operational monitoring.	

Flows will be determined by direct measurement (depth times width times 2/3 velocity), by use of portable or stationary weirs or flumes, or, whenever feasible, by timed filling of a unit volume container. Measurements will be taken by qualified personnel following standard procedures with calibrated instruments.

Stream monitoring sites were selected based on the conclusion of Appendix 7J and 2006 field investigations that included regulating agencies and interested parties.

Annual Report. An Annual Report evaluating all data collected for the year will be submitted to DOGM as required.

Quarterly Data Submission. All water monitoring data will be submitted to DOGM on a quarterly basis within 30 days following the end of the quarter.

Discharge Permit and Reporting. All discharge report forms filed to meet Government requirements will be submitted to DOGM in the quarterly Water Monitoring Report. A copy of the mine discharge permit is included in Appendix 7-B.

Post-Mining Portal Discharge. No gravity discharges are expected from the Bear Canyon No. 3 or No. 4 mines during or following reclamation. Any post-mining portal discharge that occurs will be monitored quarterly for operational parameters shown on Table 7-16. No water will be discharged into the mine during or following reclamation.

Undermining of Perennial Streams. There are two areas where perennial streams will be undermined. They are the upper reaches of the right fork and left fork of Fish Creek.

The left fork is fed by one watershed and several springs. FC-7 and FC-6 are surface monitoring sites in this watershed, however flow has only been observed at these points during major storm events and spring runn-off. Most of the year the streams above the confluence of the major springs feeding it. These springs are SBC-18, SBC-20, and SBC-21, with SBC-21 being the largest. The confluence of these springs with the main stream channel is inaccessible.

The right fork of Fish creek has two splits and is fed by three watersheds. The left split of the stream channel has base flow fed by SCC-5. This point also marks the start of the perennial section. The center split base flow is fed by SCC-2 which also marks the start of the perennial section for the center split. The right split is dry except during spring run-off or large storm events. However during wet years water may flow from site FC-5 (Mudd Spring). Because of this FC-5 was selected as the start of the perennial section of the right split. Monitoring site FC-4 was selected because it is the confluence of the three splits. Site FC-3 marks the property line between private and federal property, and site FC-2 was selected to monitoring off site impacts.

In these areas C. W. Mining will increase the monitoring of these sites to a weekly bases one month prior to mining in the area. This weekly monitoring will continue until one month after mining has left the area. Monitoring will then be reduced to once a month for an additional 6 months at which time it will resume its normal schedule. This increased monitoring will include the sites FC-2, FC-3, FC-4, FC-5, and SCC-2 for the right fork of Fish Creek, and FC-1, FC-6, SBC-18, SBC-20, and SBC-21 for the left fork of Fish Creek. The actual start time will be determined based on continual underground surveying that is required by MSHA. During the monitoring weekly reports will be sent to the Division via email.

731.300 Acid and Toxic Forming Materials

All provisions of R645-301-731.300 will be followed when dealing with acid or toxic forming material

.

731.400 Transfer of Wells

This was addressed in R645-301-731.210

731.500 Discharges

C. W. Mining's discharge permit is located in Appendix 7-B.

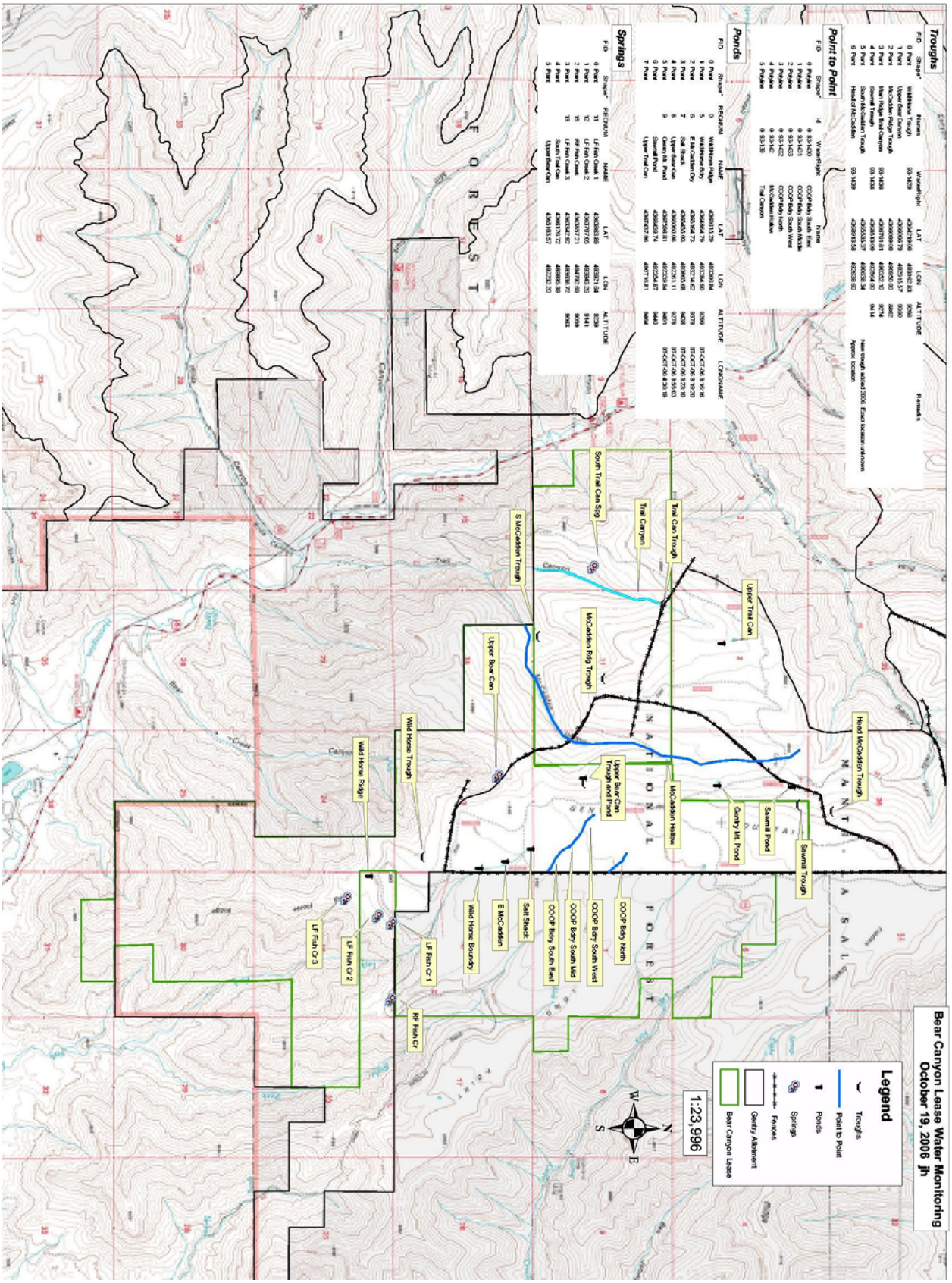
731.530 Water Rights and Replacement

If a state appropriated water supply is impacted by mining and/or mining related activities, C. W. Mining will replace it as required under R645-301-731.530 of the Utah State Code. Also in accordance with federal lease stipulation 21, if any water resource that has been identified for protection is impacted, C. W. Mining will replace the water resource. State appropriated water rights with points of diversions within the permit area are shown on Plate 7-12. All water resources identified for protection by the U. S. Forest Service are shown on Figure 5C-3. All water resources identified for monitoring are shown on Plate 7-4. These sites were identified in 2006 during several field surveys that included representatives from the following agencies at one or more of the surveys.

shown on Plate 7-4. The relationship between the water monitoring points and the names identified on figure 7-0 is outlined below.

F. S. Name	Monitoring Name	Location
LF Fish Cr 3	SBC-16	Inside subsidence zone
LF Fish Cr 2	SBC-16A	Inside subsidence zone
LF Fish Cr 1	SBC-16B	Inside subsidence zone
RF Fish Cr	SBC-18	Inside subsidence zone
Wild Horse Ridge	SBC-22	Inside subsidence zone
Wild Horse Boundary	none (Inspected with FC-6)	Outside subsidence zone
E McCadden	none (Inspected with FC-6)	Outside subsidence zone
Salt Shack	none (Inspected with FC-6)	Outside subsidence zone
S McCadden Trough	SMH-1 I	Outside subsidence zone
McCadden Rdg Trough	SMH-2	Inside subsidence zone
Upper Bear Can Trough	SMH-5	Outside subsidence zone
COOP Bdry South East	none (Inspected with FC-7)	Outside subsidence zone
COOP Bdry South Mid	none (Inspected with FC-7)	Outside subsidence zone
COOP Bdry South West	none (Inspected with FC-7)	Outside subsidence zone
COOP Bdry North	none (Inspected with FC-8)	Inside subsidence zone
McCadden Hollow	none (Inspected with SMH-4)	Inside subsidence zone
Gentry Mt Pond	none	Outside permit area
Sawmill Pond	none	Outside permit area
Sawmill Trough	none	Outside permit area
Head McCadden Trough	none	Outside permit area
Upper Trail Can	none	Outside permit area
Trail Can Trough	FBC-1	Outside subsidence zone
Trail Canyon	none	Outside subsidence zone
South Trail Can Spg	FBC-8	Outside subsidence zone

Figure 7-0 Forest Service Protected Water Resources



State appropriated water rights with points of diversions within the permit area are shown on Plate 7-12. All water resources identified for protection by the U. S. Forest Service are shown on Figure 5C-3. All water resources identified for monitoring are shown on Plate 7-4. These sites were identified in 2006 during several field surveys that included representatives from the following agencies at one or more of the surveys.

C. W. Mining Company
Utah Division of Oil Gas and Mining
State of Utah Water Rights Division
United States Forest Service
United States Department of the Interior - Bureau of Land Management
United States Department of the Interior - Office of Surface Mining
C. O. P. Coal Development Company
ANR Inc.
Huntington Cleveland Irrigation Company
Huntington Cattle Association

The primary water rights owners that may be impacted are C. O. P Coal Development, ANR Inc., United States Forest Service, and Huntington Cleveland Irrigation Company. Following is a discussion of the water usage of the entities and probable water replacement methods.

C. O. P. Coal Development

C.O.P Coal Development is the land owner and federal lease holder of all land being mined by C. W. Mining Company. They are a controlling entity of C. W. Mining in is much as they can dictate mining areas and methods through their lease requirements. Their water rights include stock watering, residential, and industrial. Stock water rights are associated with springs located above the mine within the subsidence area. These lands and water are leased to cattlemen who use the water for stock watering. The springs they use for residential use are located outside of the permit area near the old Trail Canyon Mine and inside the Bear Canyon #1 Mine. No impact is expected to these springs based on the investigation included in appendix 7J. These springs also provide the industrial water

used for the mining operations conducted by C. W. Mining Company.

C. W. Mining has agreed to work with C. O. P Development on the replacement of any water rights.

ANR Inc.

ANR is affiliated with C. W. Mining in that they are both controlling entities of Hiawatha Coal Company. ANR Inc. is the private land owner and the federal lease holder for all lands mined by Hiawatha Coal. C. W. Mining is the LMU holder for all federal leases held by ANR Inc. Their water rights include stock watering, municipal, industrial, irrigation and residential. The only water rights located within the affected area are the ones used for stock watering. They also lease land and water to cattlemen.

C. W. Mining has agreed to work with ANR Inc. on the replacement of any water rights.

United States Forest Service

The U. S. Forest Service owns stock watering rights within the subsidence area. These water rights are used by wildlife and cattlemen who are leasing the land and water from the Forest Service.

Because of the nature of their use if these water rights were impacted the Forest Service would need the water to be restored to the original location. If the impact was a cracked stream or pond C. W. Mining would use pond liners, grouting, or other technologies available to repair the cracks. If the impact was a displaced spring C. W. Mining would install guzzlers, wells or other available technology to restore the water. Based on the experiences of other mines these methods have been acceptable.

Huntington Cleveland Irrigation Company

Huntington Cleveland Irrigation Company (HCIC) has water rights for stock watering, irrigation, and municipal uses. HCIC's points of diversion for their state appropriated water rights are located downstream of the subsidence area. Because of this, the stock-watering and irrigation uses for HCIC may not require replacement right at the source. They do require that the same quantity of water flows downstream to their points of diversion. For municipal use they have two springs of concern located outside, but near the permit area. These are Birch spring and Big Bear Spring. These springs are discussed in depth in Appendix 7J on pages 116 through 126. If these springs were impacted HCIC would require the same quantity of flow at a quality that meets drinking water standards.

If stock watering or irrigation water were impacted C. W. Mining would transfer or retire enough of their shares in HCIC to cover the lost water, or any course of action agreed upon between C. W. Mining and HCIC. Based on the study included in Appendix 7J showing that the springs are recharged locally, no impact to Birch Spring and Big Bear Spring is expected. However members of HCIC have expressed concern that the faults C. W. Mining will mine up against maybe recharge areas for these springs. In the extremely unlikely event that one of these springs is impacted, C. W. Mining would replace the lost flow with equivalent flow from existing springs which it currently holds water rights on. The replacement of either of the springs would most likely be development of new sources that meet the required standards, or the transfer of water from a source, that meets the standards, owned by C. W. Mining to the culinary water system impacted. Details regarding the replacement would be negotiated with HCIC and the municipalities impacted.

The requirement to replace water would be contingent upon the finding from Utah Division of Oil Gas and Mining that a state appropriated water supply or protected water resource was contaminated, diminished, or interrupted by underground coal mining and reclamation activities conducted after October 24, 1991.

731.600 Stream Buffer Zones

Anywhere that mining and reclamation activities are conducted within 100 feet of a perennial stream runoff and sediment control structures exist to protect water quality. These areas are designated as “Stream Buffer Zone do not Disturb”.

731.700 Cross Sections and Maps

Plate 7-4 shows the water monitoring locations. Plates 7-1 show the hydrology of the disturbed area and water systems. Plate 7-10 shows in mine water surveys.