

CHAPTER 6

GROUNDWATER HYDROLOGY

6.1 AQUIFER DELINEATION

The Navajo Mine is located on the western flank of the San Juan Structural Basin in northwestern San Juan County approximately 15 miles west of Farmington, New Mexico. The geologic formation dips gently to the east toward the center of the basin at an angle of one to two degrees and steepens toward the outcrop areas where a fairly abrupt monocline (Hogback) can be observed. A more thorough description of the regional and localized geology of Navajo Mine is provided in CHAPTER 5.

The mine and adjacent areas are underlain by the Pictured Cliffs Sandstone Formation, Fruitland-Kirtland Formation, and unconsolidated alluvial deposits in the valleys of the San Juan River, Chaco River, and the Chinde and Cottonwood Arroyos. A number of ground water monitoring wells have been completed (EXHIBIT 6-1) in the geologic formations on and near the permit area. These monitoring wells are described in APPENDIX 6-E. To obtain hydrologic information, a piezometer installation program was conducted throughout the mine area to estimate the water-bearing potential of the above geologic formations. Information on the water-bearing zones within these formations was obtained during drilling by monitoring fluid return, air injection pressure, and lithology.

Aquifers were delineated using two different methods. The first approach treated the individual coal seams in the Fruitland Formation as separate aquifers. This resulted in the potentiometric surface maps for the major coal seams (EXHIBITS 6-2 through 6-5). Since the coal seams are discontinuous through the formation, an alternate approach for delineation was considered which utilized United States Geological Survey (USGS) data and treated the coal seams and interbedded lithologic units of the Fruitland Formation as a single aquifer. The single aquifer approach was previously evaluated (Billings, 1987) A copy of the Billings (1987) report

Table 6.4.1 lists wells adjacent to the Navajo Mine, which are not owned by BHP. Limited information is available about these wells, particularly water quality data. However, some water quality data is available for well QACW-2B. The data indicate that the water in well QACW-2B is a sodium sulfate water type and that no seasonal quality fluctuations are discernable.

The likelihood of impacts to these wells from mining is minimal, due to their distance from active mining.

6.5 ALLUVIAL VALLEY FLOOR ASSESMENT

Major stream channels passing through the permit area were examined as part of a study by the New Mexico Bureau of Mines and Mineral Resources entitled “Identification of Alluvial Valley Floors in Strippable Coal Areas of New Mexico” (Love et al., 1981). In this report, the San Juan and Chaco river systems (among others) were investigated as part of a phase I study to distinguish

Table 6.4-1 Non-Navajo Mine wells adjacent to the Lease Boundary (See Exhibit 6-1 or Appendix 6E for locations)

Well Name	Owner	Distance from Lease Boundary (mi)	Total Depth (ft)	Completion	Construction	Primary Use	Water Quality Data
13-4-7	Unknown	2	16	Alluvial	Hand dug w/ windmill	Stock Water	NA
W-0607	Unknown	5.46	25	Alluvial	Windmill	Stock Water	NA
46	Navajo	10.25	9	Alluvium	Dug Well	Unknown	Available
51	Navajo	5.38	8	Alluvium	Dug Well	Unknown	NA
70	Navajo	(inside lease)	9	Alluvium	Dug Well	Unknown	Available
13-5-1 (Stevenson, 13-15-2)	Unknown	(inside lease)	Unknown	Alluvium	5" steel casing; well cap welded shut	Unknown	NA
W-0343	Navajo Trust	(inside lease)	Unknown	Alluvium	NA	Stock Water	NA
13-AW (13T-513)	Unknown	4.89	530	Alluvium - Artesian	NA	OG well converted to Livestock	Available
13-15-4	Unknown	4.24	11	Chaco Alluvium	Concrete collar; wooden lid, bucket operated	Unknown	NA
G5	Unknown	10.27	Unknown	Chaco Alluvium	NA	Unknown	Available
GM-32 (13-15-7)	Unknown	5.8	9	Chaco Alluvium	Block & Concrete dug well, formerly hand pump operated; 10'x10' concrete pad	Monitoring/Livestock	NA
W-0202	Navajo Trust	5.69	7	Chaco Alluvium	NA	Stock Water	NA
W-0203 (13-15-5)	Navajo Trust	6.32	8	Chaco Alluvium	NA	Stock Water	NA
W-0204 (13-15-6)	Navajo Trust	6.06	14	Chaco Alluvium	Dug well; 8'x8' concrete pad; sides eroding into well	Stock Water	NA
W-0519 (13R-31 #17, G4)	Navajo Trust	5.21	16	Chaco Alluvium	NA	Stock Water	Available
W-0645 (13R-29)	Navajo Trust	5.52	16	Chaco Alluvium	NA	Stock Water	Available
W-0691 (13-15-8)	Navajo Trust	6.09	Unknown	Chaco Alluvium	Dug well, 5'x5' concrete pad; equipped w/hand pump	Stock Water	NA
46 (W-0618,13R-28)	Navajo Trust	3.76	16	Cottonwood Alluvium	NA	Stock Water	NA
W-0644 (13R-28A, QACW-2B, CWAP-1)	BIA	0.59	11	Cottonwood Alluvium	Hand dug w/ hand pump	Stock Water	Available
GM-18 (QAWC-2)	Unknown	1.15	15	Cottonwood Alluvium	Dug well - previously equipped with hand pump - cinder block collar	Monitoring/Livestock	Available
GM-22 (13R-38)	Unknown	6.04	47	Pinabete Alluvium	Dug well w/concrete pad & windmill	Monitoring/Livestock	NA
W-0344	Navajo Trust	(inside lease)	9	Pinabete Alluvium	NA	Stock Water	Available
W-0345 (13R-48, 13-15-3)	Navajo Trust	(inside lease)	10	Pinabete Alluvium	Dug well; concrete well head; wooden cover	Stock Water	NA
W-0348 (13-8-1)	Navajo Trust	1.81	13	Pinabete Alluvium	Open well; concrete well head	Stock Water	NA
45	Navajo	4.54	8	Pinabete/Chaco Alluvium	NA	Unknown	NA
W-0346 (13R-37, 13-8-4)	Navajo Trust	(inside lease)	8	Pinabete Alluvium	Dug well w/ concrete pad over well; hand pump operable	Stock Water, Use Unknown	NA
57	Navajo	10	27	San Juan Alluvium	Drilled	Unknown	Available
146	Unknown	2.18	9	San Juan Alluvium	NA	Unknown	Available
R.A. French	Unknown	7.98	37	San Juan Alluvium	NA	Unknown	Available
SJ 00248 (G7)	Unknown	14.95	35	San Juan Alluvium	NA	DOM	Available
SJ 00264	Unknown	13.53	35	San Juan Alluvium	NA	Stock Water	NA
USGS SJ-3	Unknown	12.69	8	San Juan Alluvium	NA	Unknown	Available
W-0695 (G-2)	Navajo Trust	12.51	Unknown	San Juan Alluvium	NA	Stock Water	Available
Wesleyan Navajo Mission	Unknown	2.78	19	San Juan Alluvium	NA	Unknown	Available
41	Unknown	6.42	60	Kirtland (Farmingt.)	NA	Unknown	NA
SJKF84 #5	Navajo Nation	0.36	181	Coal Seam #8	PVC	Monitoring	NA
38	Navajo	13.14	1505	PCS	NA	Unknown	Available
44	Navajo	13.14	804	PCS	NA	Unknown	Available
90	Navajo	4.82	131	PCS	NA	Stock, Domestic	NA
13-7-2	Unknown	5.02	Unknown	PCS	7" steel casing w/ windmill on 8'x8' concrete pad	Unknown	NA
13-14-6	Unknown	1.75	Unknown	Unknown	Hand dug w/ hand pump	Stock Water	NA
13-7-4	Navajo Trust	3.32	Unknown	Unknown	Hand dug w/ hand pump	Unknown	NA
GM-35	Unknown	4.02	Unknown	Unknown	Dug well w/concrete pad operated by portable hand pump	Unknown	NA
GM-36 (13-7-5)	Unknown	3.44	Unknown	Unknown	Dug well w concrete well head; bucket operated	Livestock & Monitoring	NA
W-0146	Navajo Trust	7.44	Unknown	Unknown	NA	Stock Water	NA
W-0147	Navajo Trust	4.96	Unknown	Unknown	NA	Stock Water	NA
W-0148	Navajo Trust	7.94	Unknown	Unknown	NA	Stock Water	NA
W-0313	Navajo Trust	2.36	Unknown	Unknown	NA	Stock Water	NA
W-0342	Navajo Trust	7.07	Unknown	Unknown	NA	Stock Water	NA
W-0517	Navajo Trust	14.5	Unknown	Unknown	NA	Stock Water	NA
W-0520 (G-3)	Unknown	5.61	Unknown	Unknown	NA	Stock Water	Available
W-0593	Navajo Trust	2.29	Unknown	Unknown	Windmill	Stock Water	NA
W-0603	Navajo Trust	0.51	Unknown	Unknown	Windmill	Stock Water	NA
W-0606 (13-15-1)	Navajo Trust	(inside lease)	Unknown	Unknown	5" steel casing w/ 8' x 8' concrete pad; Windmill	Stock Water	NA
W-0686	Navajo Trust	15.51	Unknown	Unknown	Windmill	Stock Water	NA
W-0768 (#10)	Navajo Trust	15.79	Unknown	Unknown	Windmill	Stock Water	NA

NA - Not Available
 PCS - Pictured Cliffs Sandstone
 OG - Oil & Gas

“possible alluvial valley floors” from “lands clearly not alluvial valley floors” using guidelines released by OSM. No potential or possible alluvial valley floors were found in the permit area. Chinde Wash and Cottonwood Wash, the two largest drainages crossing the permit area, were specifically examined and found to be “clearly not alluvial valley floors”. Adjacent drainages, including Pinabete Wash and Chaco Wash, were also found not to contain alluvial valley floors. OSM June 3, 1992, approved BHP’s April 14, 1992 submittal for a negative determination for the two Washes. The only potential alluvial valley floors found near the permit area were along the San Juan River.

Most of the stream channels that pass through the permit area do not have adjacent alluvial deposits. Those few channels that do, such as Chinde Wash and Cottonwood Arroyo, are deeply incised, which acts to drain their adjacent alluvium of any groundwater. Surface flows in all of these streams are infrequent and typically occur only after precipitation events. Those flows that do occur are poor in quality with excessive levels of suspended and dissolved solids. Because of these factors, none of the streams within the permit area are considered to be capable of supporting any agricultural activity and therefore do not warrant any further study as potential alluvial valley floors. This finding is consistent with the conclusions of a phase I alluvial valley floor assessment done by Love et al. (1981) for the State of New Mexico.