Delineation and Characterization of Drainage Areas

On and Adjacent to

White Sands Missile Range, New Mexico

Prepared for

Commander White Sands Missile Range
STEWS-NRES-E
U.S. Army White Sands Missile Range
New Mexico 88002-5048

Attention: David Holdermann

Submitted by

Patricia Mehlhop, Teri Bennett,
Keith Elliott, and Jessica Preston
New Mexico Natural Heritage Program
Biology Department, University of New Mexico,
851 University SE, Albuquerque, NM 87131
505-272-5345, ext. 222, pmehlhop@unm.edu

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Introduction

White Sands Missile Range (White Sands) is developing an Integrated Natural Resource Management Plan (INRMP) that will: 1) meet natural resource stewardship needs through ecosystem management; 2) enhance quality of life; and 3) support the operational mission of the Missile Range. The INRMP will provide ecosystem strategies to achieve appropriate management of its natural resources over the long term.

The purpose of the current effort is to designate natural management units for INRMP planning and for management of White Sands natural resources. This process was begun under this contract by delineating and characterizing drainage areas and sub-watersheds within and adjacent to White Sands. The management units can then be refined during the INRMP planning development process through incorporation of ecological, geological and anthropomorphic information.

Watersheds are the natural unit for the analysis of fluvially-eroded landscapes (Summerfield, 1991) and have been used to define conservation priorities for freshwater species (Master et al. 1998). Small watersheds were also used in a Geographic Information System (GIS) model as initial planning units to describe various elements and conditions of the landscape (Davis et al. 1996, Church et al. 1998). The properties described within the watersheds were ultimately used to define biodiversity management areas. The model combined diverse elements of the landscape such as plant communities, species, and minimum areas required for survival of vulnerable species. In addition, the model also incorporated other conditions such as fragmentation and ownership boundaries.

White Sands includes a diverse group of landforms subjected to other erosional processes caused by wind (eolian) and gravitational forces. In addition, depositional environments related to hydrologic processes unique to arid environments, such as alkali flats, are important factors to consider in developing management units. Landscape form, vegetation cover, and watersheds are natural features of the landscape that are integral in forming management units. Human activities also play an important role in the hydrologic cycle by altering natural processes. On White Sands, this includes construction activities that divert the flow of waters or artificial containment. Military use and impacts also need to be considered in developing effective management units. Including species distribution and habitat requirements, such as those incorporated in Church et al. (1998), would help to ensure the viability of the diverse ecosystems on White Sands.

The management unit designations will enhance INRMP development, which is important for compliance with a number of laws, regulations and directives. All U.S. Army installations are required to develop an INRMP and to update it every five years to comply with: DoD Instruction 4715.*3 (Environmental Conservation Program*), DoD Directive 4700.4 (*Natural Resources -- Conservation and Management*), and Army Regulation 200-3 (Natural Resources: Land, Forest, and Wildlife Management). In

addition to these, developing an INRMP will ensure compliance with numerous laws that evoke conservation action (U.S. Army Environmental Center (AEC) Form 45, 1 February 93).

The final deliverable for this project includes 3 different formats of the report and 1 Arcview® project. The reports are: 1) hard copy, 2) Microsoft Word97 (.doc), and 3) Adobe Acrobat (.pdf). Embedded within the report documents are links to other files. These links are denoted by underlines in both the hard copy and digital files. These files can only be accessed by using the links; no hard copies are provided. They are on the CDROM under the directories: pdffiles and htmlfiles. Depictions in the hard copy document presented in black and white are in full color displays that are accessible in both the electronic documents, as well as the ArcView® project file. The ArcView® project contains several directories and sub-directories. The following is a list of the directories and structure on the CDROM. Arcview files are noted by an '*'.

C:\watershed
- export_files*
  - rf3_100.e00
- legends*
  - hu500.avl
  - wsmrhydro.avl
- projects*
  - watershed.apr (if files are on f:\)
  - watershed_c.apr (if files are on c:\)
  - watershed_d.apr (if files are on d:\)
- scripts
  - wsmrhydr100.ave
  - wsmrhydr500.ave
  - wsmrhydrhelp.ave
  - wsmrhydrhelptext.ave
- shapefiles* (all files contain at least .dbf, .shp, & .shx extenstions)
  - nmquad_100
  - nmstate
  - rf3_hydro
  - wsmr_bnd
  - wsmrbond
  - wsmrhuc_100
  - wsmrhuc_500
  - wsmrhydro
- tables*
  - class.dbf
  - class.inf
  - sum5class.dbf
  - sum5level.dbf
  - sumclass.dbf
  - sumlevel.aih

tables (continued)*
- sumlevel.ain
- sumlevel.dbf
- sumlevel.odb

textfiles
- watershed_rpt.doc
- pdffiles
  - dlg_standards.pdf
  - phasei.pdf
  - watershed_rpt.pdf
- htmlfiles
  - RF3technical.htm

tmpwd* (temporary workspace for ArcView project)

Location

White Sands Missile Range lies principally within the Tularosa Basin, an internally drained basin in South Central New Mexico (Figure 1). The northwest extent of the range is within the Jornada del Muerto and to the south and west is Jornada Draw. These are closed surface-water drainage basins. The study area encompasses the extension areas that expand into portions of the Western Estancia, Rio Grande-Albuquerque, Elephant Butte Reservoir, Caballo, and El Paso-Las Cruces watersheds. This study includes hydrologic data for the eight watersheds (Figure 1), although only portions of the watersheds lie within the study area. White Sands comprises approximately 2.2 million acres (886, 000 ha). Included within the study area are the extension areas that add an additional 1.5 million acres (635,000 ha).

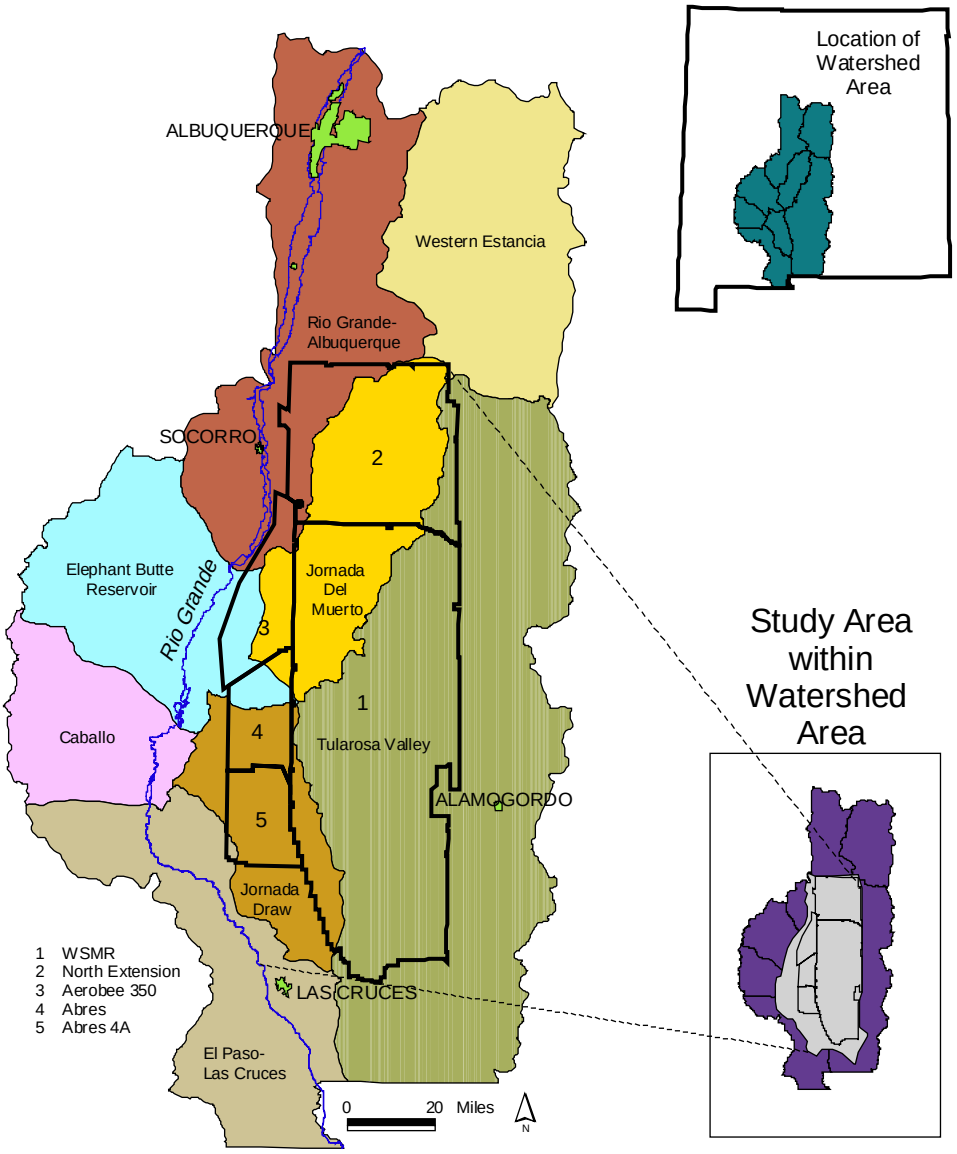

Figure 1. Study area

The study area of White Sands Missile Range and extension areas overlay watersheds delineated by the USGS 1:500,000 Hydrologic Unit Boundary map. Inset at lower right shows the study area within the Hydrologic Unit map.

Methods

The work was accomplished in three principal phases. In Phase 1, references were gathered and various GIS Clearinghouses were searched for data. In Phase 2, appropriate digital data were compiled and processed. The third phase was used to create an interactive ArcView project that contains relevant attributes of the management units as well as metadata supporting the products developed.

Phase I

A search was conducted of all available literature concerning delineating surface stream and basin hydrology. The search covered both mechanical (Chow et al. 1988, Bates and Jackson 1980, Strahler 1957) and digital processes (ESRI 1997, Radko 1997, Beven and Moore 1993, Martz and Garbrecht 1993, Jeton and Smith 1993, Jenson and Domingue 1988). In addition, information particular to the Tularosa Basin and White Sands was acquired (Boykin et al. 1996, Thompson et al. 1992, Thompson et al. 1996, Chapman 1990, Wilkins 1986). An initial search for geographically related digital data was compiled. Various state and federal GIS clearinghouse sources were queried for relevant hydrological data. Ancillary GIS data, including White Sands boundaries and roads were gathered from both White Sands and NMNHP GIS archives for geographic reference.

Phase II

Digital elevation models (DEMs) can be used to derive information about land surface morphology (Jenson and Domingue 1988). DEM is the terminology adopted by the United States Geological Survey (USGS) to describe terrain elevation data sets in a digital raster format. DEM's are created by gridding digital line graph (DLG) contours or the equivalent from USGS 1:100,000-scale maps. DEMs at the 1:100,000 scale were acquired and processed to create a seamless GIS coverage for the study area. Using ArcInfo® commands, morphological properties such as slope, drainage area, drainage divide, flow direction, and drainage network were created. These intermediate derivations of the DEM data were used to derive representations of streams and watersheds.

A Hydrologic Unit boundary (HU) digital map, created by the USGS at 1:500,000 scale was acquired and projected into the Universal Transverse Mercator (UTM) coordinate system, using the North American Datum 1927 (NAD27). Area calculations were applied to the data using ArcView®. The same processing steps were applied to the HU digital map having a scale of 1:100,000/1:250,000. The HU 1:100,000 scale map (sub-watershed) is in the Alpha stage and is not a final product. Some inconsistencies in the original data were corrected to accommodate the analyses for this project.

Two separate coverages were acquired that represent surface stream hydrology. The USGS Hydrology digital line graph (DLG), 1:100,000 scale, was projected into the UTM coordinate system, using the North American Datum 1927. The DLG comes with a series of major and minor codes that can be used in combination to derive a stream classification based on type of flow (perennial, intermittent, ephemeral, reservoir, etc,). Through a systematic and interactive process of visual interpretation, deciphering the codes, and referencing paper maps, stream reaches in the study area were classified by type. Attributes attached to the DLG were developed following the Standards for Digital Line Graphs (Appendices A and B, USGS Hydrologic Codes). Throughout this report they are referred to as "stream type". A second stream designation system developed by the Environmental Protection Agency (EPA) is named Reach File 3 (RF3-Alpha) and is currently in alpha development. It was created to establish hydrologic ordering, perform hydrologic navigation for modeling applications, and provide unique identifiers for surface water features. The hydrologic ordering of streams range from level zero to 16. Level 0 represents closed systems, such as playas, with no drainage to other orders. Level 1 represents first order rivers flowing into the oceans; the Rio Grande is a first order stream. Higher orders are at increasingly greater separation from the lower order streams, so that headwater streams tend to be higher order streams. Throughout this report, stream reach information classified in this way is referred to as “stream level”. Currently, 94 attributes characterize each ordered stream reach (Appendix C). RF3-Alpha was originally derived from USGS 1:100,000 DLGs and attributed by the EPA. These data were projected into the UTM/NAD27 coordinate system and processed using ArcInfo®. A subset of 9 attributes was extracted to create a new coverage for use in this study.

Three additional coverages were acquired to provide geographic reference and information: New Mexico 1:100,000 quadrangle boundaries, White Sands Boundary, and the New Mexico state boundary. These were projected into the UTM/NAD27 coordinate system. Maps were developed to assess the differences between the digitally derived data from DEMs that were processed using ArcInfo® Hydrologic Functions and USGS derived data.

Phase III

Using coverages created in Phase II, spatial analysis functions were performed. A relational database was created in the ArcView® environment. Three different calculations were executed at the watershed (1:500,000) and sub-watershed level (1:100,000): 1) minimum and maximum elevations, 2) stream type, and 3) stream level. These calculations were saved in various tables and included in the *project* file (watershed.apr). The project file contains all the GIS data, including views, tables, map layouts, and scripts.

In addition, ArcView® *scripts* were created to automate a number of functions to characterize White Sands basin hydrology. A script document is like a text editor and used to write *Avenue* code. These scripts allow tasks to be automated allowing new

capabilities or applications to be added to ArcView®. The linking capabilities embedded in the Avenue scripts (WSMRHydrology.Link.100, WSRMRHydrology.Link.500) are attached to the ArcView® project file.

To create a user-friendly environment, with point and click capabilities, a *Hot Link* tool was used. The *Hot Link* function calls up tabular data from a spatial reference, in this case maps of the study area and watersheds. *Hot Links* allow the user to point and click on a particular watershed on the screen, thereby receiving summary information about the hydrologic features within the watershed. Additional scripting was developed to view and print the tabular data. Functionality was built-in to create a map *layout* of the tabular data, thereby integrating it with the existing ArcView® mapping programs.

Documentation of geospatial data is the responsibility of individual government agencies. Executive Order 12906, *Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*, was signed on April 11, 1994, by President William Clinton. Section 3, *Development of a National Geospatial Data Clearinghouse*, paragraph (b) states: "Standardized Documentation of Data. Beginning 9months from the date of this order, each agency shall document all new geospatial data it collects or produces, either directly or indirectly, using the standard under development by the Federal Geographic Data Committee (FGDC), and make that standardized documentation electronically accessible to the Clearinghouse network. In accordance with the FGDC Standards (Federal Geographic Data Committee 1994), metadata were created for 7 shapefiles that are included in the ArcView® project file.

Results

Phase I

A comprehensive data search was made to determine the availability of GIS data that covered the study area. Also included in the search was literature that described the methodology behind mechanical and digital derivation of hydrologic networks and watershed delineation. Results of the search are documented in the Phase I deliverable (10 October, 1997). The Phase I deliverable was modified and updated and is given in Appendix A and reference section of this report.

Phase II

The datasets derived from the DEMs, using ArcInfo® GRID hydrologic functions, resulted in unsatisfactory depictions of both the hydrological network and watershed delineation. The poor results are due in part to the inherent errors in the DEM introduced in the surface generation process (Jenson and Domingue 1988). The most recognized errors are depressions that hinder attempts to determine hydrologic flow direction. The

FILL function in ArcInfo® is an attempt to correct this problem by 'filling' the depression and raising it to the lowest elevation value on the rim of the depression. The FILL function may have replaced some of the natural depressions in the landscape. The graphic representation of the hydrologic network did not appear to be a realistic depiction of streams following surface morphology on White Sands due to extreme linearity. Streams were nearly horizontal. In addition, the network was very dense, over-representing surface hydrology. This may be due to program limitations at the time of generation. More recent programs, developed for ArcView, allow the user to select a drainage density that may be more consistent with traditional properties represented on USGS DLGs (Tarboton et al 1993). The watershed delineation did not conform well to the USGS HU map. Again, this coverage resulted in extreme subdivision of watersheds, which would not be useful in developing watershed management units.

Hydrologic Unit Boundaries (HU) are subdivisions of the United States made by the USGS (1:500,000) to show major and minor river basins. The U.S. is divided and sub-divided into successively smaller hydrologic units that are classified into four levels: regions, sub-regions, accounting units, and cataloging units. The hydrologic units are arranged within each other, from the smallest (cataloging units) to the largest (regions). Each hydrologic unit is identified by a unique hydrologic unit code (HUC), consisting of eight digits - based on the four levels of classification in the hydrologic unit system. In addition to HUCs, each hydrologic unit has been assigned a name corresponding to the principal hydrologic feature(s) within the unit. In the absence of such features, the assigned name may reflect a cultural or political feature within the unit. The United States has 21 regions, 222 subregions, 352 accounting units, and 2,100 cataloging units.

River basins are delineated that have drainage area greater than 700 square miles (448,000 acres, 181,440 ha). The White Sands study area is within 8 cataloging units and lies within region 13. The cataloging units are listed in Table 1 and shown in Figure 1. The Tularosa Valley is the largest watershed and also has the greatest amount of relief.

Table 1. HU (1:500,000) Attribute Table

HU CODE	NAME	KM2	HECTARES	ACRES	MIN ELEV (m)	MAX ELEV (m)
13030101	Caballo	3175.7	317917.8	785592.0	1235	3052
13030102	El Paso-Las Cruces	5950.4	593680.1	1467015.6	1128	2760
13020211	Elephant Butte Reservoir	5467.7	548025.2	1354199.8	1303	3258
13020210	Jornada Del Muerto	4659.4	467063.2	1154138.5	1391	2620
13030103	Jornada Draw	3286.6	328436.2	811583.7	1306	2423
13020203	Rio Grande-Albuquerque	8295.8	833378.5	2059323.4	1374	3255
13050003	Tularosa Valley	17112.2	1710544.4	4226847.6	1189	3574
13050001	Western Estancia	6217.2	624701.3	1543670.7	1827	3052

The United States Department of Agriculture (USDA), National Resource Conservation Service (NRCS) has begun developing sub-watershed boundaries by state. As an extension of the 4 levels (2-, 4-, 6-, and 8-digit HUCs), NRCS has developed criteria for delineating and digitizing drainage boundaries for smaller sized drainages. The new levels are called: watershed (11-digit) and sub-watershed (14-digit). The 11-digit is typically 40,000 to 250,000 acres (16,200 to 101,250 ha) and the 14-digit is typically 10,000 to 40,000 acres (4,050 to 16,200 ha), with a minimum of 3,000 acres (1,215 ha). The study area completely contains 48 sub-watersheds and portions of an additional 16 (Figure 2, Table 2). The coverage is in the Alpha stage of development. Exterior boundaries differ slightly between the HU 1:500,000 and HU 1:100,000. This may be due to the finer resolution of the NRCS product. Changes made to the coverage, provided the best solution to develop a quantitative record, spatially related in the GIS database. These changes are reflected in Table 2 and are listed in the Name category as: one Unknown (HUC 13050001050) that had no name attached; a second Unknown (HUC 13050001090) was part of Gran Quivira, and a third Unknown (13020211100) was part of Red Lake. The boundaries of the first Unknown were not changed; those of the second and third were corrected.

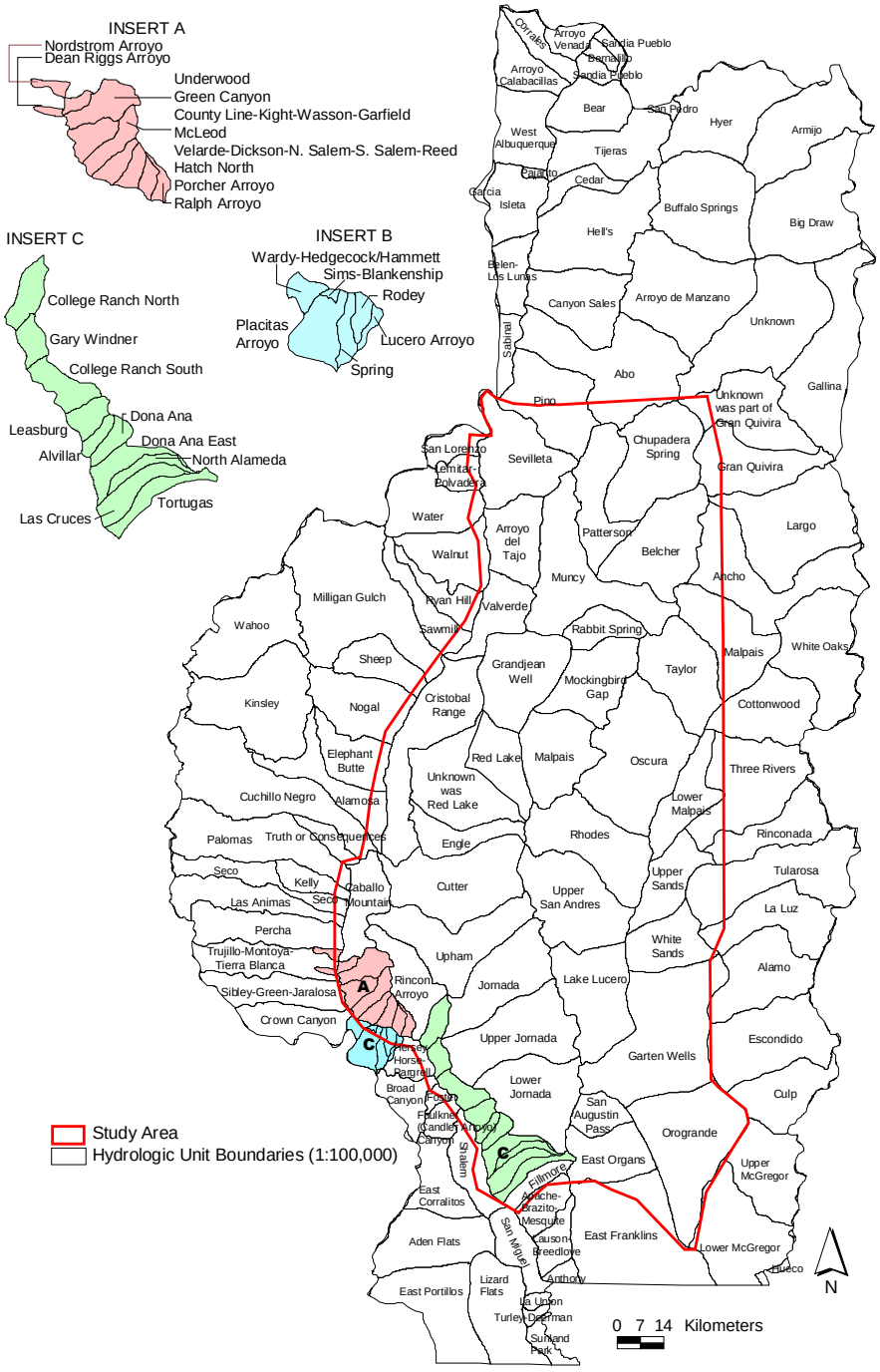

Figure 2. Study area and HUs (1:100,000)

Hydrologic Unit boundary names are shown for all 1:100,000 watersheds. The study area is delineated in red.

Table 2. HU (1:100,000) Attribute Table

HU CODE	NAME	KM2	HECTARES	ACRES	MIN ELEV	MAX ELEV
13020203150	Abo	918.65	91912.03	226943.30	1441	3078
13030102375	Aden Flats	502.95	50320.75	124248.77	1260	1678
13050003190	Alamo	543.60	54387.83	134290.94	1220	2908
13050004060	Alamo Mountain	454.06	45429.25	112170.98	1636	1664
13020211090	Alamosa	361.56	36174.51	89319.78	1303	2450
13030102300	Alvillar	27.15	2716.39	6707.14	1175	1639
13050003030	Ancho	758.97	75935.86	187495.95	1641	2385
13030102400	Anthony	52.04	5206.66	12855.96	1148	1537
13030102380	Apache-Brazito-Mesquite	172.16	17224.81	42530.41	1162	2140
13050001010	Armijo	652.34	65267.40	161154.07	1871	2253
13020203050	Arroyo Calabacillas	260.45	26058.34	64341.57	1550	1982
13020201060	Arroyo de la Jara	630.33	63065.27	155716.72	1997	2103
13050001070	Arroyo de Manzano	916.68	91714.93	226456.63	1854	3052
13020203230	Arroyo del Tajo	370.03	37021.95	91412.21	1379	1919
13020203030	Arroyo Venada	126.02	12608.45	31131.98	1532	1839
13020203060	Bear	318.12	31828.29	78588.36	1545	3153
13020210020	Belcher	630.75	63107.29	155820.48	1533	2145
13020203130	Belen-Los Lunas	214.53	21463.98	52997.49	1459	1710
13060001080	Beriero	586.25	58655.02	144827.20	2136	2251
13020203020	Bernalillo	46.99	4701.41	11608.41	1532	2550
13050001060	Big Draw	883.37	88382.23	218227.72	1849	2249
15040001070	Black	296.34	29649.17	73207.83	2596	3011
13060008050	Bonito	429.77	42999.00	106170.38	2561	3440
13020201080	Borrego	588.64	58894.14	145417.63	1534	1534
13030102240	Broad Canyon	206.46	20656.57	51003.88	1220	2019
13050001040	Buffalo Springs	802.40	80281.08	198224.90	1854	2451
13030101030	Caballo Mountain	286.73	28687.68	70833.78	1270	2306

HU CODE	NAME	KM2	HECTARES	ACRES	MIN ELEV	MAX ELEV
13020204060	Canada del Ojo	837.69	83811.89	206942.94	1747	1954
13020203140	Canyon Sales	492.99	49324.24	121788.25	1460	3018
13020203110	Cedar	146.15	14622.48	36104.90	1485	2302
13020210010	Chupadera Spring	694.34	69469.55	171529.75	1610	2226
13030102220	College Ranch North	74.30	7433.80	18355.07	1235	1360
13030102270	College Ranch South	86.03	8607.40	21252.85	1190	1616
15040001030	Corduroy	509.90	51016.11	125965.70	2341	2601
13020203040	Corrales	167.83	16791.59	41460.72	1532	1999
13050003060	Cottonwood	505.53	50578.88	124886.13	1379	2902
13050002005	Cougar	512.23	51249.23	126541.30	1935	1946
13030102070	County Line-Kight-Wasson-Garfield	58.54	5857.00	14461.72	1235	1650
13020211040	Cristobal Range	708.00	70836.25	174904.32	1323	2055
13030102090	Crown Canyon	318.63	31879.31	78714.36	1248	1958
13030101010	Cuchillo Negro	950.48	95096.66	234806.58	1290	2724
13050003240	Culp	402.29	40249.60	99381.72	1216	2302
13030103020	Cutter	753.55	75393.58	186156.99	1372	2363
13030102040	Dean Riggs Arroyo	9.25	925.47	2285.12	1297	1400
15040001060	Diamond	391.68	39188.05	96760.63	2697	2979
13030102310	Dona Ana	41.56	4158.13	10266.98	1175	1779
13030102320	Dona Ana East	75.92	7595.89	18755.28	1175	1525
13030202020	Donahue	473.02	47326.22	116854.86	2243	2681
13020208070	Durfee	739.50	73987.86	182686.08	2160	2853
13030102285	East Corralitos	295.24	29539.12	72936.09	1276	1642
13050003260	East Franklins	1033.57	103409.92	255333.13	1192	2320
13050003230	East Organs	356.73	35691.26	88126.58	1196	2715
13030102426	East Portillos	917.92	91839.00	226762.96	1193	1670
13050004020	El Paso Draw	513.91	51417.31	126956.33	1499	2104
13020211060	Elephant Butte	303.98	30413.56	75095.22	1323	2397
13050002015	Encino	825.26	82568.25	203872.23	1940	2135
13060005010	Encinoso	596.33	59663.53	147317.36	2062	2751
13030103010	Engle	251.32	25144.87	62086.09	1448	2423
13050003210	Escondido	699.66	70001.82	172844.01	1215	2803

HU CODE	NAME	KM2	HECTARES	ACRES	MIN ELEV	MAX ELEV
13030102260	Faulkner (Candler Arroyo) Canyon	95.14	9518.87	23503.39	1200	1759
13030102360	Fillmore	105.60	10565.41	26087.42	1165	2562
13030102250	Foster	37.11	3712.90	9167.65	1205	1540
13050001080	Gallina	839.10	83952.96	207291.26	1872	2630
13060006010	Gallinas	858.97	85940.98	212199.95	2028	2133
13020204080	Garcia	476.85	47709.41	117801.02	1688	1750
13050003200	Garten Wells	1126.27	112684.67	278233.74	1189	2220
13030102230	Gary Windner	48.27	4829.47	11924.62	1210	1510
13050003010	Gran Quivira	1027.05	102757.58	253722.43	1873	2625
13020210070	Grandjean Well	580.22	58051.71	143337.55	1414	1628
13030102050	Green Canyon	89.23	8927.57	22043.38	1255	1843
13060005030	Hasparos	713.93	71429.55	176369.27	1949	2311
13030102130	Hatch North	33.48	3349.71	8270.90	1235	1661
13020203120	Hell's	780.74	78113.97	192874.01	1460	2929
13030102210	Hersey-Horse-Pargrell	128.01	12807.55	31623.59	1210	1850
15040001040	Hoyt	263.42	26355.49	65075.28	2452	2672
13050004120	Hueco	84.02	8406.30	20756.30	1600	1827
13050001020	Hyer	720.84	72120.91	178076.31	1889	2653
13030202200	Indian Basin	664.96	66530.05	164271.72	1538	1622
13020203100	Isleta	326.46	32662.71	80648.68	1485	1815
13030202175	Johnson Flats	432.12	43234.12	106750.92	1339	1463
13030103040	Jornada	532.38	53265.26	131519.16	1320	1956
13030101050	Kelly	133.23	13329.82	32913.14	1281	1947
13020211080	Kinsley	818.30	81871.90	202152.83	1587	3150
13020209070	La Jencia	769.30	76969.39	190047.87	1759	3001
13050003160	La Luz	481.99	48223.68	119070.81	1237	2881
13030102410	La Union	33.92	3393.74	8379.60	1135	1245
13050003180	Lake Lucero	609.44	60975.20	150556.06	1189	2500
13050003020	Largo	887.40	88785.43	219223.30	1688	2567
13030101070	Las Animas	369.80	36998.93	91355.39	1275	3052
13030102340	Las Cruces	86.10	8614.41	21270.14	1170	1576
13030102390	Lauson-Breedlove	156.64	15672.02	38696.35	1150	1900

HU CODE	NAME	KM2	HECTARES	ACRES	MIN ELEV	MAX ELEV
13030102290	Leasburg	53.70	5372.75	13266.05	1182	1600
13020203200	Lemitar-Polvadera	121.83	12189.24	30096.88	1412	2204
13030102428	Lizard Flats	494.15	49440.30	122074.82	1234	1312
13030103060	Lower Jornada	574.38	57467.41	141894.84	1306	2421
13050003080	Lower Malpais	338.50	33867.33	83623.04	1222	1569
13050003280	Lower McGregor	657.46	65779.66	162418.92	1250	1822
13030102170	Lucero Arroyo	10.59	1059.54	2616.15	1248	1609
13030202110	Macho	506.59	50684.94	125147.99	1638	2000
13050003050	Malpais	521.57	52183.70	128848.65	1426	2147
13020210080	Malpais	497.23	49748.46	122835.70	1413	2170
13020204120	Mariano	299.35	29950.33	73951.42	1437	1524
13030102080	McLeod	61.57	6160.15	15210.25	1235	1855
13020211010	Milligan Gulch	1272.96	127361.18	314472.04	1339	3258
13020210060	Mockingbird Gap	460.18	46041.56	113682.87	1428	2620
13020204090	Monte Belen	298.99	29914.31	73862.49	1575	1652
13020210040	Muncy	828.62	82904.43	204702.28	1450	2324
13020211050	Nogal	478.91	47915.52	118309.93	1323	3057
13030102020	Nordstrom Arroyo	17.16	1716.88	4239.21	1270	1405
13030102330	North Alameda	40.96	4098.10	10118.76	1183	1784
13050004070	North Shiloh	597.74	59804.60	147665.69	1642	1644
13050003250	Orogrande	872.94	87338.69	215651.10	1200	1602
13050003130	Oscura	974.33	97482.89	240698.48	1229	2725
13020203090	Pajarito	20.41	2042.04	5042.09	1490	1652
13060002010	Palma	884.64	88509.29	218541.47	2079	2237
13030101040	Palomas	666.65	66699.13	164689.22	1281	2957
13020204100	Pato	531.76	53203.23	131365.99	1572	1576
13020210030	Patterson	445.66	44588.82	110095.85	1532	2202
13030101080	Percha	430.55	43077.04	106363.07	1270	2998
13020203170	Pino	551.59	55187.24	136264.79	1437	2284
13030102140	Placitas Arroyo	86.95	8699.45	21480.13	1249	1901
13030102180	Porcher Arroyo	23.33	2334.19	5763.44	1235	1521
13020204050	Prieta	769.04	76943.37	189983.64	1966	1991
13020210050	Rabbit Spring	193.05	19314.88	47691.07	1435	2433

HU CODE	NAME	KM2	HECTARES	ACRES	MIN ELEV	MAX ELEV
13030101190	Ralph Arroyo	21.83	2184.12	5392.88	1235	1555
13020210090	Red Lake	891.14	89159.63	220147.23	1406	2284
13050003140	Rhodes	649.69	65002.26	160499.42	1200	2681
13030102200	Rincon Arroyo	304.49	30464.59	75221.21	1235	2256
13050003100	Rinconada	384.58	38477.69	95006.64	1265	3208
13020202040	Rio Salado	640.65	64097.80	158266.18	1990	1999
13020208060	Rock House	784.71	78511.18	193854.76	2180	2201
13030102160	Rodey	21.21	2122.09	5239.72	1250	1612
13060008030	Ruidoso	534.15	53442.35	131956.42	2300	3645
13020203250	Ryan Hill	193.59	19368.91	47824.47	1374	3065
13020203160	Sabinal	130.19	13025.67	32162.14	1437	1582
13050004010	Sacramento	628.61	62893.18	155291.81	2197	2902
13060008040	Salado	347.13	34730.77	85755.00	2099	2599
13050003220	San Augustin Pass	167.51	16759.58	41381.67	1194	2136
13020203190	San Lorenzo	137.13	13720.02	33876.60	1412	2181
13030102370	San Miguel	224.64	22475.50	55495.07	1146	1372
13020201100	San Pedro	641.51	64183.85	158478.63	1534	3254
13020203010	Sandia Pueblo	119.16	11922.10	29437.29	1532	3192
13020203270	Sawmill	245.99	24611.59	60769.37	1374	3252
13030101060	Seco	263.52	26365.49	65099.98	1275	2953
13020203180	Sevilleta	575.28	57557.45	142117.17	1403	2159
13030102280	Shalem	240.16	24028.30	59329.13	1165	1780
13020211020	Sheep	263.79	26392.51	65166.68	1365	2551
13050004080	Shiloh	653.16	65349.44	161356.65	1596	1682
13030102060	Sibley-Green-Jaralosa	342.12	34229.52	84517.32	1235	2357
13020209080	Silver	79.58	7962.07	19659.44	1431	1784
13060010030	Silver Springs	487.57	48781.96	120449.29	2500	2743
13030102120	Sims-Blankenship	4.28	428.22	1057.33	1235	1255
13030102150	Spring	28.34	2835.45	7001.11	1250	1863
13030102430	Sunland Park	85.54	8558.38	21131.80	1128	1409
13050003070	Taylor	547.80	54808.05	135328.51	1363	2627
13050003090	Three Rivers	713.76	71412.54	176327.27	1259	3574
13020203080	Tijeras	490.51	49076.11	121175.59	1486	2952

HU CODE	NAME	KM2	HECTARES	ACRES	MIN ELEV	MAX ELEV
13020209060	Tio Lino	283.51	28365.52	70038.31	1440	1525
13030102350	Tortugas	69.72	6975.57	17223.63	1165	2680
13030102030	Trujillo-Montoya-Tierra Blanca	358.13	35831.34	88472.44	1255	2760
13030101020	Truth or Consequences	96.62	9666.95	23869.00	1290	1751
13050003110	Tularosa	777.77	77816.82	192140.30	1234	2750
13030102420	Turley-Deerman	28.53	2854.46	7048.05	1132	1252
13030102010	Underwood	17.87	1787.91	4414.60	1255	1653
13050001050	Unknown	940.72	94120.16	232395.47	1827	2202
13050001090	Unknown was part of Gran Quivira	1027.05	102757.58	253722.43	1925	2582
13020211100	Unknown was part of Red Lake	891.14	89159.63	220147.23	1391	2322
13030103030	Upham	607.29	60760.09	150024.92	1331	2259
13030103050	Upper Jornada	657.12	65745.64	162334.92	1312	2380
13050003270	Upper McGregor	476.38	47662.39	117684.92	1228	1702
13030202010	Upper Mimbres	833.46	83388.67	205897.96	2602	2951
13060010010	Upper Rio Penasco	496.62	49687.43	122685.00	2608	2910
13050003150	Upper San Andres	693.28	69363.50	171267.89	1189	2349
13050003120	Upper Sands	326.56	32672.72	80673.38	1194	1291
13030202130	Uvas Valley	972.60	97309.80	240271.10	1365	1974
13020203260	Valverde	296.97	29712.20	73363.47	1374	1700
13030102100	Velarde-Dickson-N. Salem-S. Salem-Reed	39.14	3916.00	9669.15	1235	1802
13020211070	Wahoo	676.98	67732.66	167241.14	1952	3114
13020203240	Walnut	375.75	37594.24	92825.28	1374	3200
13030102110	Wardy-Hedgecock/Hammett	26.85	2686.37	6633.02	1235	1353
13020203220	Water	436.24	43646.34	107768.73	1395	3255
13020203070	West Albuquerque	380.57	38076.49	94016.01	1490	1855
13050003040	White Oaks	716.86	71722.70	177093.09	1572	3011
13050003170	White Sands	352.86	35304.07	87170.53	1190	1251
13020202050	Zia Pueblo	494.60	49485.32	122185.98	1658	2004

Stream types that were classified for the study area are shown in Figure 3 and listed in Table 3. The class numbers in the table are the labels assigned to the stream reaches in the GIS that coincide with stream type shown in Figure 3. A key to classify the streams was developed using boolean operators (Table 3).

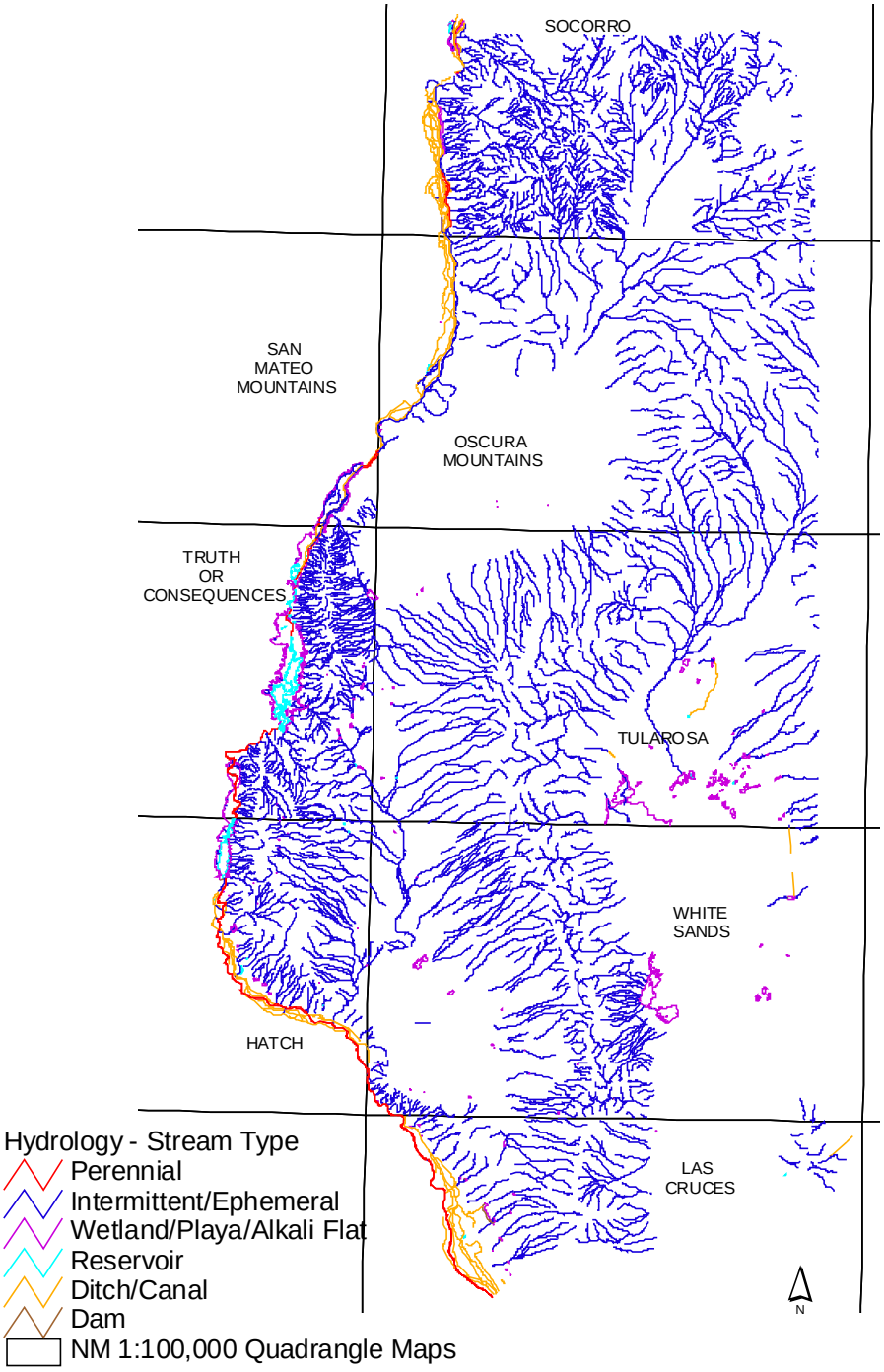

Figure 3. Surface hydrology - stream type

The map shows all stream types classified within the study area. BLM 1:100,000 quadrangle maps are depicted for geographic reference.

Table 3. Classification of stream types

Classification of aquatic systems within the study area. Code key is a set of boolean operators used to classify the stream reaches.

Class #	Type	Code Key
1	perennial	((min1(605 or 606)) or ((min1(200) and min2(605 or 606)) or (min1(412) and min2 (-99999))
2	intermittent/ephemeral	(min1(412) and min2(610)) or (min1(412) and min2(608)) or (min1(412) and min2(202) or (min1(420))
3	wetland/playa/alkali flat	(min1(200) and min2(610)) or (min1(204)) or (min1(203) and min2(-99999))
4	reservoir	(min1(200) and min2(-99999))
5	aqueduct/ditch/canal	(min1(414)) or (min2(601)) or (min4(601)) or (min1(202 and min2(-99999))
6	dam	min1(406)

Some of the codes labeled in the USGS GIS attribute table were inconsistent with stream type. In these cases, we used common sense and assigned an appropriate class name. Within the study area, intermittent and ephemeral streams comprise 82% of the stream types (Table 4). Wetland, playa and alkali flat each contribute to 6% of the variation in stream types.

Table 4. Length of streams by stream type

Table shows the length of streams by type within the study area.

Class #	Type	Kilometers	Miles
1	perennial	351	218
2	intermittent/ephemeral	9124	5666
3	wetland/playa/alkali flat	729	453
4	reservoir	221	137
5	aqueduct/ditch/canal	721	448
6	dam	8	5

Surface hydrology is depicted by stream level in a series of maps in Figures 4 through 8 that were derived from the EPA RF3-Alpha files. The ArcView® coverage is for the area encompassed by the entire 1:500,000 HUs; however, the figures were clipped to a size slightly larger than the study area to improve scale. Stream level 0 (Figure 4) depicts all drainages, such as playas and depressional wetlands, that are not connected to other stream reaches. Malpais Springs are represented as level 0. It also includes isolated backwater channels in the Rio Grande and other non-continuous drainages that may be connected in times of higher flows. Within the study area, level 0 drainages singly

comprise the greatest number of stream miles covering nearly 30% of all drainages (Table 5). The Rio Grande is in stream level 1, and its immediate tributaries are in level 2 (Figure 5). These stream levels do not occur within the White Sands boundary. The study area contains few level 3 streams, but several level 4, including Salt Creek and several ephemeral drainages within the alluvial fans of the San Andres and Oscura Mountains (Figure 6). Similarly, level 5 and 6 streams are associated with the mountains and are well represented on White Sands (Figure 7). Mound Springs are not resolvable at the 1:100,000 scale; however, drainages associated with Mound Springs are level 5 and 6 streams. The study area contains few streams that are at higher levels and none above level 12. The mountains do not have high relief or expansive extent that create development of multi-branched streams at higher levels like those in the San Mateo Mountains to the northwest of the study area (Figure 8).

The RF3-Alpha is useful in modeling because of the extensive attributes it contains for connectivity and flow direction for the individual stream reaches (Appendix C). For instance, the EPA Environmental Monitoring and Assessment Program used RF3-Alpha to define a monitoring framework for lakes throughout the U.S. and the EPA Office of Water currently uses RF3-Alpha to estimate the Total Waters for each state. The coverage was processed according to EPA instructions, and an ArcInfo® export file (rf3_100.e00) of the entire dataset is provided on the CDROM. In addition, the technical references for the Reach File 3-Alpha are also included on the CDROM and as a link to this document. This coverage can be used effectively in modeling and monitoring for compliance, and water assessment/quality issues relating to federal status because it can be linked to EPA databases using the unique Reach Codes. This coverage was converted to a shapefile, and attributes pertinent to the project were maintained (Appendices A and B). This coverage was then used to determine stream levels depicted on Figures 4 through 8. In addition to stream level, other attributes maintained with the coverage are: 8-digit cataloging unit, length of stream reach (meters), four unique ArcInfo® identifiers to link the file back to the original Reach File 3-Alpha data, name of stream (where given), and reachtype. EPA reach type, which is a brief characterization of the type of stream or lake shoreline, is defined in Appendix D. It adds to the functionality of analyses in the ArcView® project file, particularly in understanding level 0 and headwater stream reaches (Appendix C).

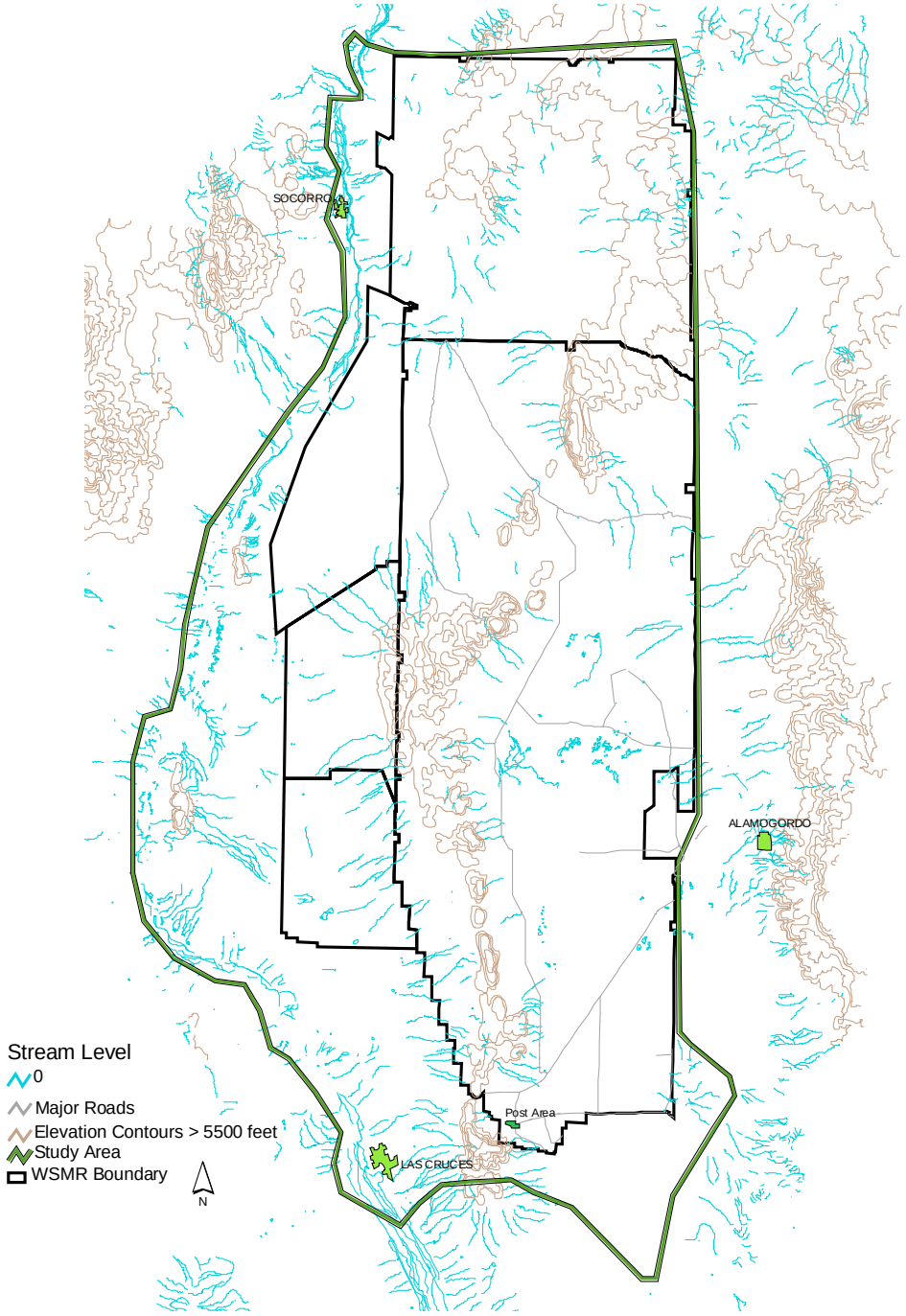

Figure 4. Surface hydrology - stream level 0

Stream level classes in Figures 4-8 are separated to illustrate the geographic distribution. Stream level 0 is isolated drainages that are not connected to other drainages.

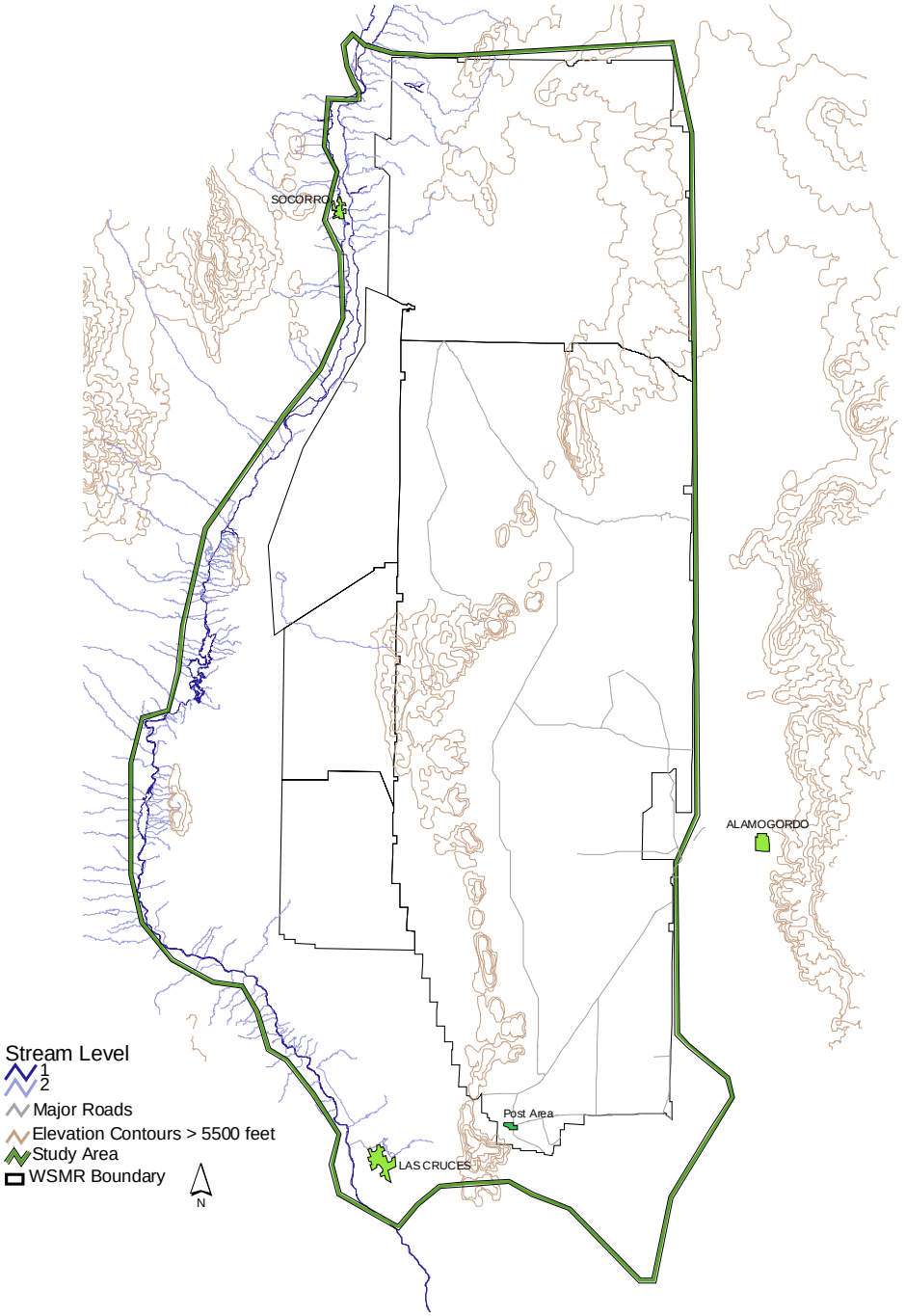

Figure 5. Surface hydrology - stream levels 1 and 2

Stream level classes in Figures 4-8 are separated to illustrate the geographic distribution. Stream levels 1 and 2 are the Rio Grande and connecting drainages.

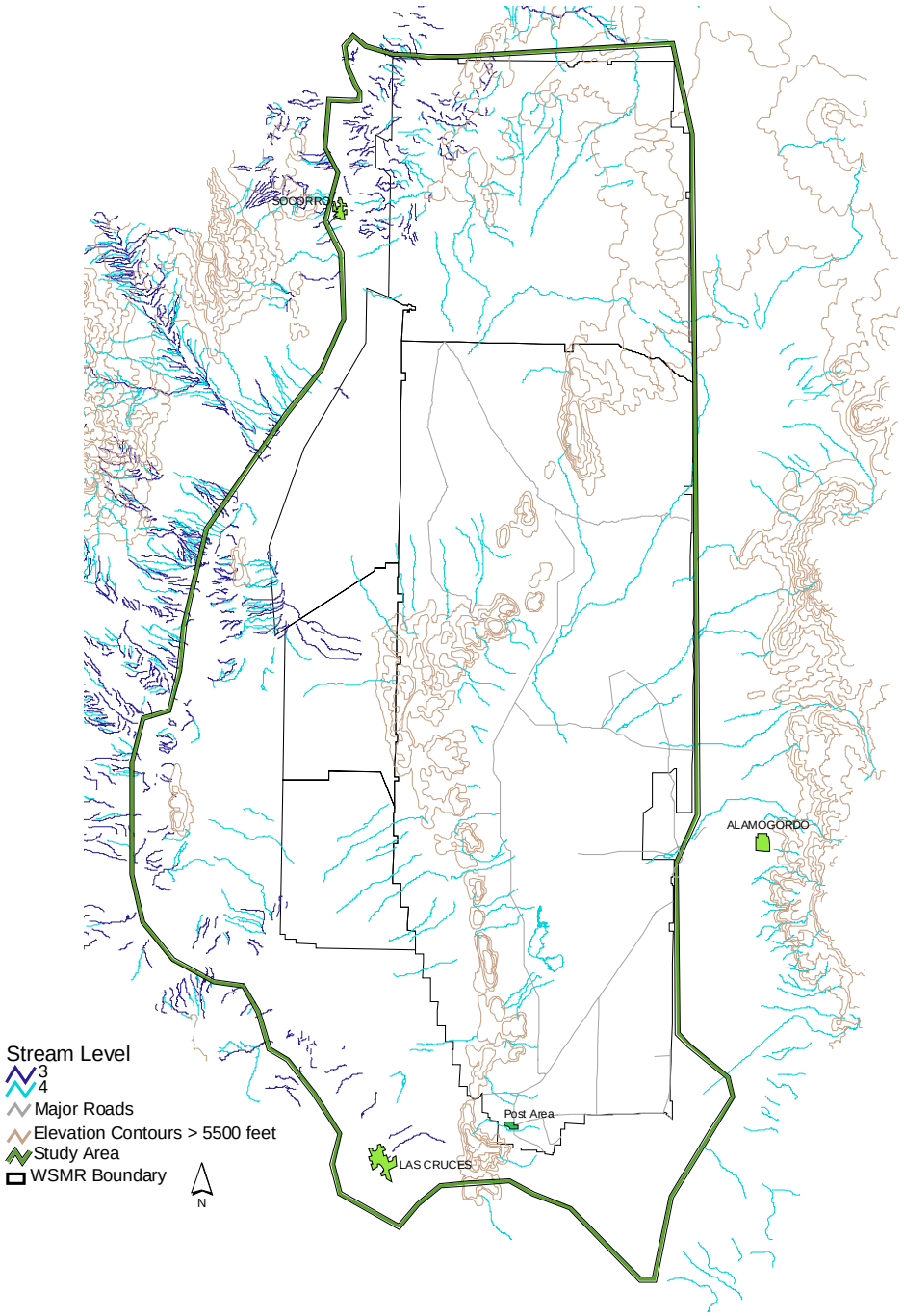

Figure 6. Surface hydrology - stream levels 3 and 4

Stream level classes in Figures 4-8 are separated to illustrate the geographic distribution. Stream level 3 is principally outside the range. Stream level 4 is ephemeral drainages within the alluvial fan of the San Andres Mountains.

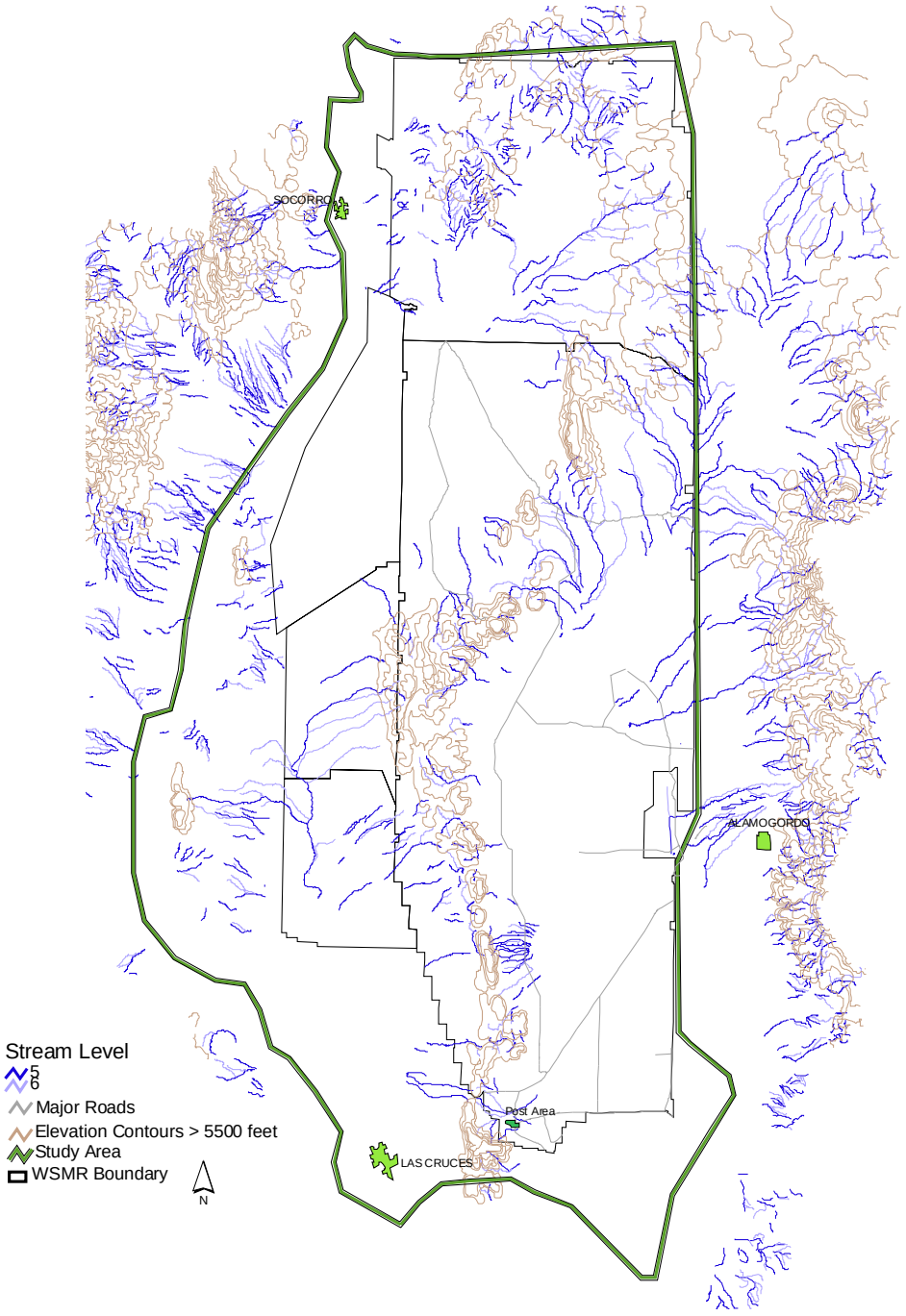

Figure 7. Surface hydrology - stream levels 5 and 6

Stream level classes in Figures 4-8 are separated to illustrate the geographic distribution. Stream levels 5 and 6 are associated with the mountains and are numerous within the range.

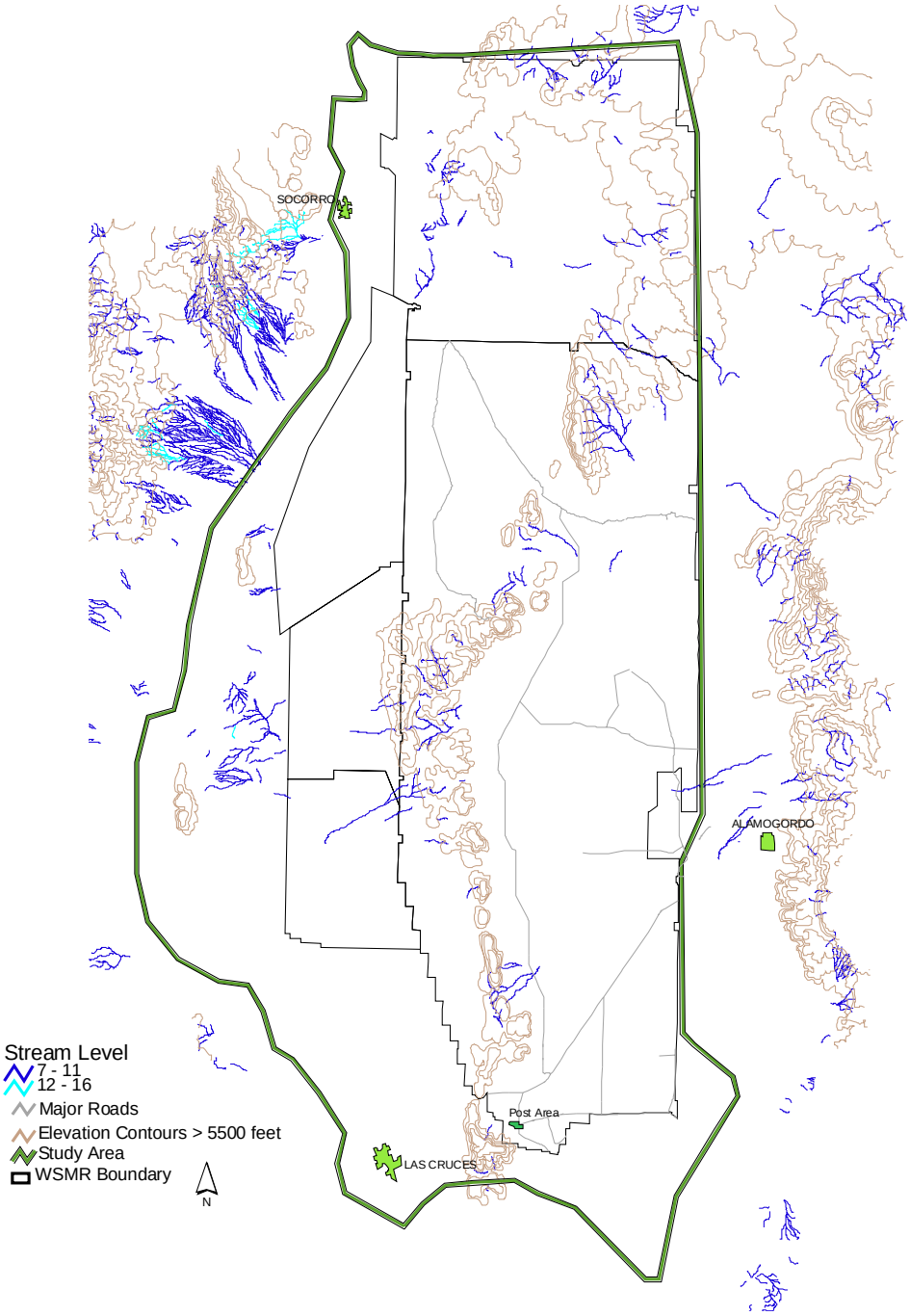

Figure 8. Surface hydrology - stream levels 7 - 16

Stream level classes in Figures 4-8 are separated to illustrate the geographic distribution. Stream level classes 7-11 are at higher elevations on the range. Stream level classes above 11 are not represented on the range.

Table 5. Length of streams by stream level

The length of streams by level is given for streams and drainages within the study area.

Level	Kilometers	Miles
0	3235	2009
1	639	397
2	835	518
3	751	466
4	1651	1025
5	1777	1103
6	1093	679
7	481	299
8	200	124
9	105	65
10	57	35
11	18	11
12	3	2

Phase III

A relational database within a GIS was developed to summarize hydrologic and geographic elements within the major watersheds and sub-watersheds. In addition, an interactive ArcView® project, using *Hot Link* capabilities and Avenue ™ scripting, was developed to provide a user-friendly interface. Attribute tables for all shapefiles created (Appendix A), can be queried with the spatial tools provided in ArcView®. Options to display, print, or make a map layout of the basin hydrologic characteristics are displayed after selecting a watershed of interest, which can be either the HU 1:500,000 or 1:100,000 scale. Figure 9 shows an example of the attributes that are shown using the *Hot Link* tool upon querying the 1:500,000 and 1:100,000 HUs, respectively.

As discussed previously, all information extracted using the *Hot Link* tool is dependent on geographic extent of the coverages it queries. The stream type summaries will be limited to the study area (Figure 3). All other data covers the full extent of the 1:500,000 HUs that contain the study area.

WSMR HUC 1:500,000

HUC Name: Jornada Draw
HUC Code: 13030103
Square Kilometers: 3287
Hectares: 328436
Acres: 811584
Minimum Elevation: 1306
Maximum Elevation: 2423
Subbasins:
Cutter 13030103020
Engle 13030103010
Jornada 13030103040
Lower Jornada 13030103060
Upham 13030103030
Upper Jornada 13030103050
Stream length by class:
Intermittent/Ephemeral: 994.69 mi
Reservoir: 3.56 mi
Wetland/Playa/Alkali Flat: 30.74 mi
Stream length by level:
00: 323.09 mi
02: 0.78 mi
03: 0.37 mi
04: 153.22 mi
05: 207.52 mi
06: 141.72 mi
07: 67.4 mi
08: 27.86 mi
09: 16.77 mi
10: 12.01 mi
11: 7.78 mi
12: 2.04 mi

WSMR HUC 1:100,000

HUC Name: Jornada
HUC Code: 13030103040
Square Kilometers: 532.38
Hectares: 53265.3
Acres: 131519
Minimum Elevation: 1320
Maximum Elevation: 1956
Stream length by class:
Intermittent/Ephemeral: 157.92 mi
Wetland/Playa/Alkali Flat: 8.73 mi
Stream length by level:
0: 56.16 mi
4: 44.55 mi
5: 36.73 mi
6: 10.96 mi
7: 3.56 mi

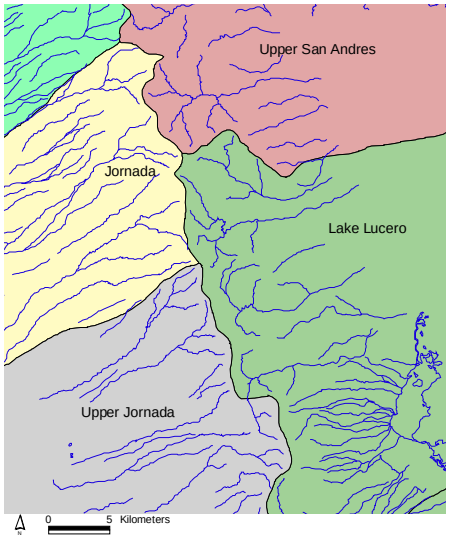

Figure 9. Sample display of hydrologic characteristics

A screen view similar to the image at the bottom of the figure is used with the *Hot Link* tool (point and click) to generate these lists of watershed and sub-watershed characteristics.

In accordance with the FGDC Standards, metadata were compiled for the seven shapefiles (Appendix B). These data track the lineage and geospatial data pertinent to the GIS files delivered in the ArcView® project file. The metadata are provided in text file format (Appendix B), ready for Clearinghouse dissemination.

Discussion

The hydrologic data layers developed in this project will serve as an important basis for natural resource management on White Sands and in the landscape in which White Sands resides in the northern Chihuahuan Desert. The data will be particularly important in planning and implementing management for processes and elements that tend to follow drainages. These include soil erosion, migration of toxic chemicals, fire movement, dispersal of some types of seeds, and movement of certain types of wildlife.

However, for full management capability, the surface hydrology and watershed layers should be used in combination with other existing data layers in the White Sands GIS. These include layers for both natural and human generated features. Because similar landforms and vegetation communities, as natural features, tend to respond in similar ways, in general, they need similar management. Thus, it will be important to include them in defining natural management units. In addition, roads can serve to help define boundaries or obstacles to movement, or they can serve as corridors that encourage movement. When roads serve as barriers to movement, such as for fire or soil erosion, they can be good boundaries for management units. However, when they serve as corridors for wildlife movement, they may serve better as inclusions in management units. Data layers showing sites of high and low disturbance can also be useful in delineating management units. Management units with low disturbance may be managed differently than units with high disturbance for purposes such as beneficial fires, habitat protection and soil erosion.

As part of natural resource management planning, it is important to ensure compliance with laws, regulations and policies. Most of the data layers processed as part of this project were developed originally to assist land and water managers in compliance with the federal Clean Water Act. Data compiled and processed under this project can serve White Sands well in planning and implementing compliance with that act. In some instances, this will lead to actions involving entire watersheds, even when they cross onto adjacent properties. The data layers were intentionally extended beyond the White Sands boundaries and, in most cases, beyond the study area that included lands adjacent to White Sands, to the entire 1:500,000 HUs that contain White Sands to facilitate planning and management both under the act and for landscape level ecosystems.

Glossary

Alkali flat	A level area or plain in an arid or semiarid region, due to evaporation and poor drainage, becomes encrusted with alkali salts (Bates and Jackson 1980).
Canal	An artificial watercourse, larger than a ditch that connects two or more bodies of water (Bates and Jackson 1980)
Closed basin	An enclosed area having no drainage outlet, from which water escapes only by evaporation (Bates and Jackson 1980).
Dam	An artificial barrier constructed across a watercourse to create a pond or lake for storage of water (Bates and Jackson 1980).
Drainage area (basin, watershed)	A region or area bounded by a drainage divide and occupied by a drainage system. Water originates as precipitation and contributes it to a particular stream channel or system of channels, or to a lake, reservoir, or other body of water (Bates and Jackson 1980).
Ditch	An artificially excavated waterway, channel, or trench to convey water for drainage or irrigation, smaller than a canal (Bates and Jackson 1980).
Drainage divide (watershed boundary)	The boundary between adjacent drainage basins, a divide (Bates and Jackson 1980).
Drainage network	The configuration or arrangement in plan view of the natural stream courses in an area. It is related to local geologic and geomorphologic features and history (Bates and Jackson 1980).
Ephemeral stream	A stream or reach of a stream that flows briefly only in direct response to precipitation in the immediate locality and whose channel is at all times above the water table (Bates and Jackson 1980).
Intermittent stream	A stream or reach of a stream that flows only at certain times of the year, as when it receives water from springs or from some surface source (Bates and Jackson 1980).
Playa lake	A shallow, intermittent lake in an arid or semiarid region, covering or occupying a playa in the wet season by drying up in summer. Upon evaporation leaves or forms a playa (Bates and Jackson 1980).

Perennial stream	A stream or reach of a stream that flows continuously throughout the year and whose upper surface generally stands lower than the water table (Bates and Jackson 1980).
Reservoir	An artificial or natural storage place for water, such as a lake or pond, from which the water may be withdrawn as for irrigation, municipal water supply, or flood control (Bates and Jackson 1980).
Stream level	The hierarchical relationship between streams and tributaries in a given drainage network. A tributary to a given stream is always one level higher than the stream into which it flows. For instance, the Rio Grande is a one level stream (Environmental Protection Agency).
Stream type	Classification of streams based on USGS hydrologic codes. These include six classes: (1) perennial, (2) intermittent/ephemeral, (3) wetland/playa/alkali flat, (4) reservoir, (5) ditch/canal, (6) dam.
Sub-watershed	A smaller unit within the larger drainage area, identified by naturally occurring boundaries or divides, having an outlet to a closed basin (Tularosa Basin) or outlet that eventually drains to a lake or ocean (Rio Grande).
Wetland	A general term for a group of wet habitats that includes areas that are either permanently or intermittently wet (Bates and Jackson 1980).

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Appendix A. GIS Shapefiles and Data Tables

Additional explanations of attributes are given in the metadata (Appendix B).

Name	Source	Scale	Type	Attributes	Phase
Hydrologic Unit Boundaries - (1:500,000) **wsmrhuc_500**	USGS/ RGIS	1:500,000	shapefile	area perimeter huc_code reg subreg act_Unit cat_Unit name km2 ha ac min_elev max_elev	II/III
Hydrologic Unit Boundaries- (1:100,000) **wsmrhuc_100**	NM-NRCS	1:250,000 - 1:100,000	shapefile	area perimeter huc_code name number huc1 huc6 huc7 km2 ha ac huc_500000 min_elev max_elev	II/III
White Sands Hydrology - **wsmrhydro**	USGS (DLGs)	1:100,000	shapefile	length class	II
New Mexico Quadrangle Maps (1:100,000) **nmquad_100**	TIGER/ RGIS	1:100,000	shapefile	area perimeter usgs_qd-id quad_name date_pub	II
White Sands Boundary **wsmr_bnd wsmrbond**	White Sands	Unknown	shapefile	area perimeter attribute ha ac	II
New Mexico	RGIS		shapefile	area	II

Name	Source	Scale	Type	Attributes	Phase
Boundary **nmstate**				perimeter name	
Reach File 3 Hydrology **rf3_hydro**	EPA/ USGS	1:100,000	shapefile	length (meters) cu reachtype level (LEV) pname	II
class	NMNHP	na	table	id class description	III
sumclass	NMNHP	na	table	count sum_length class huc_code class_desc length_mil	III
sum5class	NMNHP	na	table	count sum_length_mil class_desc hycode	III
sumlevel	NMNHP	na	table	count sum_length huc_code level length_mil	III
sum5level	NMNHP	na	table	count sum_length_mil level hycode	III

Appendix B. Metadata

Hydrologic Unit Boundaries (1:500,000)

```
  Citation
    Citation_Information
      Originator: New Mexico Natural Heritage Program
      Publication_Date: 19980630
      Title: Hydrologic Unit Boundaries (1:500,000)
      Geospatial_Data_Presentation_Form: Map
      Publication_Information
        Publication_Place: Albuquerque
        Publisher: New Mexico Natural Heritage Program
      Larger_Work_Citation
        Citation_Information
          Originator: United States Geological Survey(USGS)
          Publication_Date: 1994
          Title: Hydrologic Unit Boundaries of the Conterminous
            United States
          Publication_Information
            Publication_Place: unknown
            Publisher: United States Geological Survey (USGS)
          Other_Citation_Details:
  Description
    Abstract:
      Hydrologic Unit Codes (HUCs) are watershed boundaries
      based on Hydrologic Unit Maps published by the USGS that list
name
      of region, subregion, accounting units, and cataloging units.
Other
      attributes have been added by NMNHP: km2, hectares, acres,
minimum
      elevation, and maximum elevation.
    Purpose:
      The data are to support watershed analysis at the 1:500,000
scale.
  Time_Period_of_Content
    Time_Period_Information
      Range_of_Dates/Times
        Beginning_Date: 19980630
        Ending_Date: 19980630
    Currentness_Reference: 1998
  Status
    Progress: Complete
    Maintenance_and_Update_Frequency: unknown
  Spatial_Domain
    Bounding_Coordinates
      West_Bounding_Coordinate: 232354.6413
      East_Bounding_Coordinate: 443352.5468
      North_Bounding_Coordinate: 3920870.2862
      South_Bounding_Coordinate: 3517239.9157
  Keywords
    Theme
      Theme_Keyword_Thesaurus: None
      Theme_Keyword: HUC
      Theme_Keyword: Hydrologic Unit Codes
      Theme_Keyword: Hydrology
```

```
      Theme_Keyword: Watershed
      Theme_Keyword: Basin
    Place
      Place_Keyword_Thesaurus: None
      Place_Keyword: WSMR
      Place_Keyword: Tularosa Basin
      Place_Keyword: South-central New Mexico
  Access_Constraints: none
  Use_Constraints: none
  Point_of_Contact
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization:   New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd SE Suite 101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Native_Data_Set_Environment
    ArcView version 3.0a
    c:\wsmrbasin\shapefiles\utm\wsmrhuc_500.shp

DATA_QUALITY_INFORMATION

  Attribute_Accuracy
    Attribute_Accuracy_Report:
      Original coverage was digitized at scales of
      1:250,000, 1:100,000, and 1:2,000,000 scale.  Since data were
derived
      at different scales, a nominal scale of 1:500,000 was chosen to
      approxiate scale.  Area attributes were calculated using ArcView
tools.
      Elevations were derived using 1:100,000 DEMs.
  Logical_Consistency_Report:
      Unknown
  Completeness_Report:
      unknown
  Positional_Accuracy
    Horizontal_Positional_Accuracy
      Horizontal_Positional_Accuracy_Report:
        unknown
    Vertical_Positional_Accuracy
      Vertical_Positional_Accuracy_Report:
        N/A
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Range_of_Dates/Times:
            Beginning_Date: 19980630
            Ending_Date: 19980630
```

```
        Source_Currentness_Reference: unknown
      Source_Citation_Abbreviation: NMNHP
    Process_Step
      Process_Description:
        Data re-projected into UTM, NAD27
      Process_Date: 1998
      Process_Contact
        Contact_Information
          Contact_Person_Primary
            Contact_Organization: New Mexico Natural Heritage Program
            Contact_Person: Teri Bennett
          Contact_Position: GIS Analyst
          Contact_Address
            Address_Type: mailing and physical address
            Address: 851 University Blvd SE #101
            City: Albuquerque
            State_or_Province: NM
            Postal_Code: 87131
            Country: USA
          Contact_Voice_Telephone: 505-272-3545 x230
          Contact_Facsimile_Telephone: 505-272-3544
          Contact_Electronic_Mail_Address: tbennett@unm.edu
          Hours_of_Service: 8:00am - 5:00pm
    Process_Step
      Process_Description:
        Calculated and added attributes:
        Area calculations for km2, hectares, and acres were derived
using
        ArcView tools.  Minimum and maximum elevations were derived for
each of       the HUCs. A digital elevation model, 1:100,000 scale was
used to derive      elevations.
      Process_Date: 1998

SPATIAL_DATA_ORGANIZATION_INFORMATION

  Direct_Spatial_Reference_Method: Vector
  Point_and_Vector_Object_Information
    SDTS_Terms_Description
      SDTS_Point_and_Vector_Object_Type: GT-polygon composed of chains
      Point_and_Vector_Object_Count: 8

SPATIAL_REFERENCE_INFORMATION

  Horizontal_Coordinate_System_Definition
    Planar
      Grid_Coordinate_System
        Grid_Coordinate_System_Name: Universal Transverse Mercator
        Universal_Transverse_Mercator:
          UTM_Zone_Number: 13
          Transverse_Mercator
            Scale_Factor_at_Central_Meridian:
            Longitude_of_Central_Meridian:
            Latitude_of_Projection_Origin:
            False_Easting:
            False_Northing:
      Planar_Coordinate_Information
        Planar_Coordinate_Encoding_Method: Coordinate pair
```

```
        Coordinate_Representation:
          Abscissa_Resolution:
          Ordinate_Resolution:
        Planar_Distance_Units: Meters
    Geodetic_Model
      Horizontal_Datum_Name: North American Datum 1927
      Ellipsoid_Name: Clarke 1866
      Semi-major_Axis: 6378206.4
      Denominator_of_Flattening_Ratio: 294.98

ENTITY_AND_ATTRIBUTE_INFORMATION

  Detailed_Description
    Entity_Type
      Entity_Type_Label: wsmrhuc_500.dbf
      Entity_Type_Definition: Shapefile Attribute Table
      Entity_Type_Definition_Source: None
    Attribute
      Attribute_Label: Area
      Attribute_Definition: Area of polygon
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 3179177507.800
          Range_Domain_Maximum: 17105443548.000
    Attribute
      Attribute_Label: Perimeter
      Attribute_Definition: Perimeter of polygon
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 261523.076
          Range_Domain_Maximum: 755365.449
    Attribute
      Attribute_Label: Hydcode
      Attribute_Definition: 8-digit Hydrologic Unit Code
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 13020203
          Range_Domain_Maximum: 13050003
    Attribute
      Attribute_Label: Reg
      Attribute_Definition: Region number
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 13
          Range_Domain_Maximum: 13
    Attribute
      Attribute_Label: Subreg
      Attribute_Definition: Subregion number
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 2
          Range_Domain_Maximum: 5
```

```
Attribute
  Attribute_Label: Act_unit
  Attribute_Definition: Accounting unit number
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Range_Domain
      Range_Domain_Minimum: 0
      Range_Domain_Maximum: 2
Attribute
  Attribute_Label: Cat_unit
  Attribute_Definition: Cataloging unit number
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Range_Domain
      Range_Domain_Minimum: 1
      Range_Domain_Maximum: 11
Attribute
  Attribute_Label: Name
  Attribute_Definition: Name of HUC
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Unrepresentable_Domain: Character field
Attribute
  Attribute_Label: Km2
  Attribute_Definition: Area of HUC in square kilometers
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Range_Domain
      Range_Domain_Minimum: 3175.727
      Range_Domain_Maximum: 17112.151
Attribute
  Attribute_Label: Ha
  Attribute_Definition: Area of HUC in hectares
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Range_Domain
      Range_Domain_Minimum: 317917.751
      Range_Domain_Maximum: 1710544.355
Attribute
  Attribute_Label: Ac
  Attribute_Definition: Area of HUC in acres
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Range_Domain
      Range_Domain_Minimum: 785591.953
      Range_Domain_Maximum: 4226847.595
Attribute
  Attribute_Label: min_elev
  Attribute_Definition: HUC Minimum elevation in meters
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Range_Domain
      Range_Domain_Minimum: 1128
      Range_Domain_Maximum: 1827
Attribute
  Attribute_Label: max_elev
  Attribute_Definition: HUC Maximum elevation in meters
```

```
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 2423
          Range_Domain_Maximum: 3574

DISTRIBUTION_INFORMATION

  Distributor
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd. SE #101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 x230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Resource_Description:
       Hydrologic Unit Code 1:500,000 scale, WSMR
       Watershed project
  Distribution_Liability:
       NMNHP assumes no liability for the misuse of data.

  Standard_Order_Process
    Digital_Form
      Digital_Transfer_Information
        Format_Name:shape
      Digital_Transfer_Option
        Offline_Option
          Offline_Media: CDROM
          Recording_Format: ISO 9660
            Compatibility_Information: ISO 9660 format allows the CDROM
            to be read by most computer operating systems.
    Fees: Contact NMNH

METADATA_REFERENCE_INFORMATION

  Metadata_Date: 19980630
  Metadata_Review_Date: 19980630
  Metadata_Contact
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd SE #101
        City: Albuquerque
```

```
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 ext. 230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Metadata_Standard_Name: FGDC CSDGM
  Metadata_Standard_Version: 19940608

METADATA_REFERENCE_INFORMATION

  Metadata_Date: 19980630
  Metadata_Review_Date: 19980630
  Metadata_Contact
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd SE #101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 ext. 230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Metadata_Standard_Name: FGDC CSDGM
  Metadata_Standard_Version: 19940608
```

Hydrologic Unit Boundaries (1:100,000)

```
  Citation
    Citation_Information
      Originator: New Mexico Natural Heritage Program
      Publication_Date: 19980630
      Title: Hydrologic Unit Boundaries (1:100,000)
      Geospatial_Data_Presentation_Form: Map
      Publication_Information
        Publication_Place: Albuquerque
        Publisher: New Mexico Natural Heritage Program
      Larger_Work_Citation
        Citation_Information
          Originator: USDA Natural Resources Conservation Service
          Publication_Date: unknown
          Title: Hydrologic Unit Boundaries (1:100,000)
          Publication_Information
            Publication_Place: Albuquerque
            Publisher: NRCS
          Other_Citation_Details:
          NRCS Albuquerque is the Originator for this coverage.
  Description
    Abstract:
      Sub-watershed delineations derived from digitized 1:100,000
      to 1:24,000 scale maps.  The map is in-development and is
preliminary.
      The 8-digit Hydrologic Unit Code and Sub-basin codes are
attributed.
      Minimum and maximum elevations for watersheds are also
attributed.
    Purpose:
      The data are to support watershed analysis at the 1:100,000
scale.
  Time_Period_of_Content
    Time_Period_Information
      Range_of_Dates/Times
        Beginning_Date: 19980630
        Ending_Date: 19980630
    Currentness_Reference: unknown
  Status
    Progress: In work
    Maintenance_and_Update_Frequency: in-development
  Spatial_Domain
    Bounding_Coordinates
      West_Bounding_Coordinate: 232354.6413
      East_Bounding_Coordinate: 443352.5468
      North_Bounding_Coordinate: 3920870.2862
      South_Bounding_Coordinate: 3517239.9157
  Keywords
    Theme
      Theme_Keyword_Thesaurus: None
      Theme_Keyword: HUC
      Theme_Keyword: Hydrologic Unit Code
      Theme_Keyword: Hydrology
```

```
    Place
      Place_Keyword_Thesaurus: None
      Place_Keyword: WSMR
      Place_Keyword: White Sands Missile Range
      Place_Keyword: Tularosa Basin
      Place_Keyword: South-central New Mexico
  Access_Constraints: none
  Use_Constraints: none
  Point_of_Contact
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization:   New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd SE Suite 101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Native_Data_Set_Environment
    ArcView version 3.0a
    c:\wsmrbasin\shapefiles\utm\wsmrhuc_100.shp

DATA_QUALITY_INFORMATION

  Attribute_Accuracy
    Attribute_Accuracy_Report:
      Coverage is in development.  Attribute names
      that begin with 'Unknown' have been modified from the original
data.
      Attributes for area were derived using ArcView tools.  Elevation
ranges
      were derived using 1:100,000 DEMs.
  Logical_Consistency_Report:
      Unknown
  Completeness_Report:
      Data is not complete.  Digitizing and associated attributes
      will be updated.  At present 11-digit and 14-digit codes are
included.
      Some data are missing.  Some boundaries may change.
  Positional_Accuracy
    Horizontal_Positional_Accuracy
      Horizontal_Positional_Accuracy_Report:
        unknown
    Vertical_Positional_Accuracy
      Vertical_Positional_Accuracy_Report:
        N/A
  Lineage
    Source_Information
      Source_Citation
        Citation_Information
```

```
          Originator: USDA Natural Resource Conservation Service
          Publication_Date: unknown
          Title: Hydrologic Unit Boundaries (1:100,000)
          Edition: unknown
          Geospatial_Data_Presentation_Form: map
          Publication_Information
            Publication_Place: unknown
            Publisher: USDA Natural Resource Conservation Service
      Source_Scale_Denominator: 1:100,000
      Type_of_Source_Media: electronic mail format
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Range_of_Dates/Times:
            Beginning_Date: 19980630
            Ending_Date: 19980630
        Source_Currentness_Reference: 1998
      Source_Citation_Abbreviation: NMNHP
      Source_Contribution:
         New Mexico Natural Heritage Program
    Process_Step
      Process_Description:
        Data re-projected into UTM, NAD27
      Process_Date: 1998
    Process_Step
      Process_Description:
        Hydrologic Unit boundaries were altered for two sub-basins.
        One basin falls within the WSMR study area and is now split,
new
        Area is referred to as: 'Unknown was part of Gran Quivira'.
The other
        basin, outside the study area is now referred to as: 'Unknown
was part
        of Red Lake.'  One other basin had no name and also falls just
outside
        of the study area, it is referred to as 'Unknown'.  The basins
were
        altered because they fell within 2 separate watersheds at the
1:500,000     level.
      Process_Date: 1998
    Process_Step
      Process_Description:
        Areas were calculated using ArcView tools.
        Minimum and maximum elevations were derived using 1:100,000
DEMS.
      Process_Date: 1998

SPATIAL_DATA_ORGANIZATION_INFORMATION

  Direct_Spatial_Reference_Method: Vector
  Point_and_Vector_Object_Information
    SDTS_Terms_Description
      SDTS_Point_and_Vector_Object_Type: GT-polygon composed of chains
      Point_and_Vector_Object_Count: 186

SPATIAL_REFERENCE_INFORMATION

  Horizontal_Coordinate_System_Definition
```

```
    Planar
      Grid_Coordinate_System
        Grid_Coordinate_System_Name: Universal Transverse Mercator
        Universal_Transverse_Mercator:
          UTM_Zone_Number: 13
          Transverse_Mercator
            Scale_Factor_at_Central_Meridian:
            Longitude_of_Central_Meridian:
            Latitude_of_Projection_Origin:
            False_Easting:
            False_Northing:
      Planar_Coordinate_Information
        Planar_Coordinate_Encoding_Method: Coordinate pair
        Coordinate_Representation:
          Abscissa_Resolution:
          Ordinate_Resolution:
        Planar_Distance_Units: Meters
    Geodetic_Model
      Horizontal_Datum_Name: North American Datum 1927
      Ellipsoid_Name: Clarke 1866
      Semi-major_Axis: 6378206.4
      Denominator_of_Flattening_Ratio: 294.98

ENTITY_AND_ATTRIBUTE_INFORMATION

  Detailed_Description
    Entity_Type
      Entity_Type_Label: wsmrhuc_100.dbf
      Entity_Type_Definition: Shapefile Attribute Table
      Entity_Type_Definition_Source: None
    Attribute
      Attribute_Label: Area
      Attribute_Definition: Area of polygon
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 51830726.712
          Range_Domain_Maximum: 1029429665.400
    Attribute
      Attribute_Label: Perimeter
      Attribute_Definition: Perimeter of polygon
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 31777.367
          Range_Domain_Maximum: 141088.391
    Attribute
      Attribute_Label: Huc_code
      Attribute_Definition: 11-digit code
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Unrepresentable_Domain: Character field
    Attribute
      Attribute_Label: Name
      Attribute_Definition: Watershed/sub-watershed name
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
```

```
    Unrepresentable_Domain: Character field
Attribute
  Attribute_Label: Number
  Attribute_Definition: end part of 14-digit code
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Range_Domain
      Range_Domain_Minimum: 289
      Range_Domain_Maximum: 676
Attribute
  Attribute_Label: Huc1
  Attribute_Definition: region code
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Unrepresentable_Domain: Character field
Attribute
  Attribute_Label: Huc6
  Attribute_Definition: 6-digit code
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Unrepresentable_Domain: Character field
Attribute
  Attribute_Label: Huc7
  Attribute_Definition: 7-digit code
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Unrepresentable_Domain: Character field
Attribute
  Attribute_Label: Km2
  Attribute_Definition: Area of watershed in square kilometers
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Range_Domain
      Range_Domain_Minimum: 52.04
      Range_Domain_Maximum: 1033.57
Attribute
  Attribute_Label: Ha
  Attribute_Definition: Area of watershed in hectares
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Range_Domain
      Range_Domain_Minimum: 5206.66
      Range_Domain_Maximum: 103409.92
Attribute
  Attribute_Label: Ac
  Attribute_Definition: Area of watershed in acres
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Range_Domain
      Range_Domain_Minimum: 12855.96
      Range_Domain_Maximum: 255333.13
Attribute
  Attribute_Label: huc_500000
  Attribute_Definition: 8-digit HUC number
  Attribute_Definition_Source: User Defined
  Attribute_Domain_Values
    Range_Domain
```

```
          Range_Domain_Minimum: 13030102
          Range_Domain_Maximum: 13050003
    Attribute
      Attribute_Label: min_elev
      Attribute_Definition: Minimum elevation in meters
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 1146
          Range_Domain_Maximum: 1192
    Attribute
      Attribute_Label: max_elev
      Attribute_Definition: Maximum elevation in meters for watersheds
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 1372
          Range_Domain_Maximum: 2320

DISTRIBUTION_INFORMATION

  Distributor
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd. SE #101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 x230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Resource_Description:
       Hydrologic unit boundaries for NRCS 1;100,000
       HUCs.  Part of WSMR Watershed project.
  Distribution_Liability:

  Standard_Order_Process
    Digital_Form
      Digital_Transfer_Information
        Format_Name:shape
      Digital_Transfer_Option
        Offline_Option
          Offline_Media: CDROM
          Recording_Format: ISO 9660
            Compatibility_Information: ISO 9660 format allows the CDROM
            to be read by most computer operating systems.
    Fees: Contact NMNH

METADATA_REFERENCE_INFORMATION
```

```
Metadata_Date: 19980630
Metadata_Review_Date: 19980630
Metadata_Contact
  Contact_Information
    Contact_Organization_Primary
      Contact_Organization: New Mexico Natural Heritage Program
      Contact_Person: Teri Bennett
    Contact_Position: GIS Analyst
    Contact_Address
      Address_Type: mailing and physical address
      Address: 851 University Blvd SE #101
      City: Albuquerque
      State_or_Province: New Mexico
      Postal_Code: 87131
      Country: USA
    Contact_Voice_Telephone: 505-272-3545 x230
    Contact_Facsimile_Telephone: 505-272-3544
    Contact_Electronic_Mail_Address: tbennett@unm.edu
    Hours_of_Service: 8:00am - 5:00pm
Metadata_Standard_Name: FGDC CSDGM
Metadata_Standard_Version: 19940608
```

WSMR Hydrology (1:100,000)

```
Citation
  Citation_Information
    Originator:  New Mexico Natural Heritage Program
    Publication_Date:  19980630
    Title: WSMR Hydrology (1:100,000)
    Geospatial_Data_Presentation_Form: Map
    Publication_Information
      Publication_Place:  Albuquerque, NM
      Publisher:  New Mexico Natural Heritage Program (NMNHP)
    Larger_Work_Citation
      Citation_Information
        Originator: United States Geological Society
        Publication_Date: unknown
        Title: Hydrology 1:100,000 Digital Line Graph
        Publication_Information
          Publication_Place: unknown
          Publisher:  United States Geological Society
        Other_Citation_Details:
Description
  Abstract:
    Hydrology coverage developed using USGS
    1:100,000 DLGs.  Area clipped for WSMR study area includes
    area west to Rio Grande and extends to end of 1:100,000 quads
    that include WSMR boundary and extension areas.  A classification
    was created to represent 'types' of drainages derived from USGS
    major and minor codes.
  Purpose:
    Developed to show types of drainages.  These
    are hydrologic characteristics of the basins included in the
    area of interest for WSMR.
Time_Period_of_Content
  Time_Period_Information
    Range_of_Dates/Times
      Beginning_Date: na
      Ending_Date: na
  Currentness_Reference: 19980630
Status
  Progress: Complete
  Maintenance_and_Update_Frequency: none planned
Spatial_Domain
  Bounding_Coordinates
    West_Bounding_Coordinate: 283095.2500
    East_Bounding_Coordinate: 408150.8750
    North_Bounding_Coordinate: 3818879.2500
    South_Bounding_Coordinate: 3541325.2500
Keywords
  Theme
    Theme_Keyword_Thesaurus: None
    Theme_Keyword: hydrology
    Theme_Keyword: WSMR
  Place
    Place_Keyword_Thesaurus: None
```

```
      Place_Keyword: WSMR
      Place_Keyword: Chihuahuan Desert
      Place_Keyword: Tularosa Basin
  Access_Constraints: none
  Use_Constraints: none
  Native_Data_Set_Environment
    ArcView version 3.0a
    c:\wsmrbasin\shapefiles\utm\wsmrhydro.shp

DATA_QUALITY_INFORMATION

  Attribute_Accuracy
    Attribute_Accuracy_Report:
      Attributes were derived from
      the USGS major and minor codes.  Combinations of these
      codes were used to develop a classification for the purposes
      of WSMR.  Accuracies are dependent on delineations from
      the original dataset compiled by USGS.
  Logical_Consistency_Report:
      Unknown
  Completeness_Report:
      The 'type' definitions used to create the
      classification for the attributes is at a finer level than
offered by
      the USGS 1:100,000 paper maps.
  Positional_Accuracy
    Horizontal_Positional_Accuracy
      Horizontal_Positional_Accuracy_Report:
        Accuracy is
        related to the original USGS DLGs.  Only one projection was
        made from the original data.
    Vertical_Positional_Accuracy
      Vertical_Positional_Accuracy_Report:
        N/A
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Range_of_Dates/Times:
            Beginning_Date: 19980630
            Ending_Date: 19980630
        Source_Currentness_Reference: publication date
      Source_Citation_Abbreviation: NMNHP
    Process_Step

SPATIAL_DATA_ORGANIZATION_INFORMATION

  Direct_Spatial_Reference_Method: Vector
  Point_and_Vector_Object_Information
    SDTS_Terms_Description
      SDTS_Point_and_Vector_Object_Type: Complete Chain
      Point_and_Vector_Object_Count: 6619

SPATIAL_REFERENCE_INFORMATION

  Horizontal_Coordinate_System_Definition
    Planar
      Grid_Coordinate_System
        Grid_Coordinate_System_Name: Universal Transverse Mercator
```

```
        Universal_Transverse_Mercator:
          UTM_Zone_Number: 13
          Transverse_Mercator
            Scale_Factor_at_Central_Meridian:
            Longitude_of_Central_Meridian:
            Latitude_of_Projection_Origin:
            False_Easting:
            False_Northing:
      Planar_Coordinate_Information
        Planar_Coordinate_Encoding_Method: Coordinate pair
        Coordinate_Representation:
          Abscissa_Resolution:
          Ordinate_Resolution:
        Planar_Distance_Units: Meters
    Geodetic_Model
      Horizontal_Datum_Name: North American Datum 1927
      Ellipsoid_Name: Clarke 1866
      Semi-major_Axis: 6378206.4
      Denominator_of_Flattening_Ratio: 294.98

ENTITY_AND_ATTRIBUTE_INFORMATION

  Detailed_Description
    Entity_Type
      Entity_Type_Label: wsmrhydro.dbf
      Entity_Type_Definition: Shapefile Attribute Table
      Entity_Type_Definition_Source: None
    Attribute
      Attribute_Label: Fnode_
      Attribute_Definition: From-node identifier of linear feature
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 24
          Range_Domain_Maximum: 15930
    Attribute
      Attribute_Label: Tnode_
      Attribute_Definition: To-node identifier of linear feature
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 1
          Range_Domain_Maximum: 15927
    Attribute
      Attribute_Label: Lpoly_
      Attribute_Definition: Internal number of polygon to left of arc
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 1
          Range_Domain_Maximum: 9
    Attribute
      Attribute_Label: Rpoly_
      Attribute_Definition: Internal number of polygon to right of arc
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
```

```
          Range_Domain_Minimum: 2
          Range_Domain_Maximum: 9
    Attribute
      Attribute_Label: Length
      Attribute_Definition: Length of line
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 5.590
          Range_Domain_Maximum: 23380.119
    Attribute
      Attribute_Label: Class
      Attribute_Definition: Stream type:classes 1-6.  See Mehlhop et
al. 1998,
            "Delineation and Characterization of Drainage Areas on and
Adjacent
            to White Sands Missile Range, New Mexico".
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 1
          Range_Domain_Maximum: 6

DISTRIBUTION_INFORMATION

  Distributor
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd. SE #101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 ext 230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Resource_Description:
  Distribution_Liability: NMNHP assumes no responsibility for misuse of
the data.
  Standard_Order_Process
    Digital_Form
      Digital_Transfer_Option
        Format_Name: shape
      Digital_Transfer_Option
        Offline_Option
          Offline_Media: CDROM
          Recording_Format: ISO 9660
            Compatibility_Information: ISO 9660 format allows the CDROM
            to be read by most computer operating systems.
    Fees: Contact NMNH
```

```
METADATA_REFERENCE_INFORMATION

  Metadata_Date: 19980630
  Metadata_Review_Date: 19980630
  Metadata_Contact
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd SE #101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 ext. 230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Metadata_Standard_Name: FGDC CSDGM
  Metadata_Standard_Version: 19940608
```

New Mexico Quadrangle Maps (1:100,000)

```
Citation
  Citation_Information
    Originator: New Mexico Natural Heritage Program
    Publication_Date:  19980630
    Title: New Mexico 1:100,000 Quadrangles
    Geospatial_Data_Presentation_Form: Map
    Publication_Information
      Publication_Place:  Albuquerque, NM
      Publisher:  New Mexico Natural Heritage Program (NMNHP)
    Larger_Work_Citation
      Citation_Information
        Originator: U.S. Department of Commerce, Bureau of Census
        Publication_Date: unknown
        Title: New Mexico 1:100,000 Quadrangles
        Publication_Information
          Publication_Place: unknown
          Publisher: U.S. Department of Commerce, Bureau of Census
        Other_Citation_Details:

Description
  Abstract:
    Quadrangles for the state of New Mexico.  Data
    derived from Census Bureau, TIGER/Line files.
  Purpose:
    A coverage depicting 1:100,000 Quadrangles
    were developed to provide a cartographic reference.
Time_Period_of_Content
  Time_Period_Information
    Range_of_Dates/Times
      Beginning_Date: 19980630
      Ending_Date: 19980630
  Currentness_Reference: 1995
Status
  Progress: Complete
  Maintenance_and_Update_Frequency:  unknown
Spatial_Domain
  Bounding_Coordinates
    West_Bounding_Coordinate: 117981.3362
    East_Bounding_Coordinate: 688931.5899
    North_Bounding_Coordinate: 4102154.6933
    South_Bounding_Coordinate: 3433282.6929
Keywords
  Theme
    Theme_Keyword_Thesaurus: None
    Theme_Keyword: NM Quadrangles
    Theme_Keyword: Tiger/Line
  Place
    Place_Keyword_Thesaurus: None
    Place_Keyword: New Mexico
Access_Constraints: none
Use_Constraints: none
Point_of_Contact
```

```
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization:   New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd SE Suite 101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 ext 230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Native_Data_Set_Environment
    ArcView version 3.0a
    c:\wsmrbasin\shapefiles\utm\nmquad_100.shp

DATA_QUALITY_INFORMATION

  Attribute_Accuracy
    Attribute_Accuracy_Report:
      Accurate against Federal
      Information Processing Standards (FIPS).
  Logical_Consistency_Report:
      Automated tests were performed
      to ensure logical consistency.  Some codes were provided by
      the USGS.
  Completeness_Report:
      Reflect completeness for census
      standards as of 1995.
  Positional_Accuracy
    Horizontal_Positional_Accuracy
      Horizontal_Positional_Accuracy_Report:
        No better than the established National Map Accuracy
        standards for 1:100,000 maps from the USGS.
     Vertical_Positional_Accuracy
      Vertical_Positional_Accuracy_Report:
        N/A
  Lineage
    Source_Information
      Source_Citation
        Citation_Information
          Originator: New Mexico Natural Heritage Program
          Publication_Date: 19980630
          Title: New Mexico Quadrangles (1:100,000)
          Edition:
          Geospatial_Data_Presentation_Form: map
          Publication_Information
            Publication_Place: Albuquerque
            Publisher: New Mexico Natural Heritage Program
      Source_Scale_Denominator:
      Type_of_Source_Media:
      Source_Time_Period_of_Content:
        Time_Period_Information:
```

```
          Range_of_Dates/Times:
            Beginning_Date: 19980630
            Ending_Date: 19980630
        Source_Currentness_Reference: 1995
      Source_Citation_Abbreviation: Tiger/Line
      Source_Contribution: Tiger/Line
    Process_Step

SPATIAL_DATA_ORGANIZATION_INFORMATION

  Direct_Spatial_Reference_Method: Vector
  Point_and_Vector_Object_Information
    SDTS_Terms_Description
      SDTS_Point_and_Vector_Object_Type: GT-polygon composed of chains
      Point_and_Vector_Object_Count: 64

SPATIAL_REFERENCE_INFORMATION

  Horizontal_Coordinate_System_Definition
    Planar
      Grid_Coordinate_System
        Grid_Coordinate_System_Name: Universal Transverse Mercator
        Universal_Transverse_Mercator:
          UTM_Zone_Number: 13
          Transverse_Mercator
            Scale_Factor_at_Central_Meridian:
            Longitude_of_Central_Meridian:
            Latitude_of_Projection_Origin:
            False_Easting:
            False_Northing:
      Planar_Coordinate_Information
        Planar_Coordinate_Encoding_Method: Coordinate pair
        Coordinate_Representation:
          Abscissa_Resolution:
          Ordinate_Resolution:
    Geodetic_Model
      Horizontal_Datum_Name: North American Datum 1927
      Ellipsoid_Name: Clarke 1866
      Semi-major_Axis: 6378206.4
      Denominator_of_Flattening_Ratio: 294.98

ENTITY_AND_ATTRIBUTE_INFORMATION

  Detailed_Description
    Entity_Type
      Entity_Type_Label: nmquad_100.dbf
      Entity_Type_Definition: Shapefile Attribute Table
      Entity_Type_Definition_Source: None
    Attribute
      Attribute_Label: Area
      Attribute_Definition: Area of polygon
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 5111553786.100
          Range_Domain_Maximum: 5111553786.100
    Attribute
```

```
      Attribute_Label: Perimeter
      Attribute_Definition: Perimeter of polygon
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 295231.201
          Range_Domain_Maximum: 295231.201
    Attribute
      Attribute_Label: Usgs_qd_id
      Attribute_Definition: USGS Quadrangle ID
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Unrepresentable_Domain: Character field
    Attribute
      Attribute_Label: Quad_name
      Attribute_Definition: Quadrangle Name
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Unrepresentable_Domain: Character field
    Attribute
      Attribute_Label: Date_pub
      Attribute_Definition: Date quadrangle was published
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Unrepresentable_Domain: Character field

DISTRIBUTION_INFORMATION

  Distributor
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd. SE #101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 x230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Resource_Description:
       New Mexico coverage for 1:100,000
       Quadrangle Maps
  Distribution_Liability:
       NMNHP is not responsible for the misuse
       of data.  Data resolution is 1:100,000
  Standard_Order_Process
    Digital_Form
      Digital_Transfer_Information
        Format_Name:shape
      Digital_Transfer_Option
        Offline_Option
```

```
          Offline_Media: CDROM
          Recording_Format: ISO 9660
            Compatibility_Information: ISO 9660 format allows the CDROM
            to be read by most computer operating systems.
    Fees:

METADATA_REFERENCE_INFORMATION

  Metadata_Date: 19980630
  Metadata_Review_Date: 19980630
  Metadata_Contact
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd SE #101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 x230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Metadata_Standard_Name: FGDC CSDGM
  Metadata_Standard_Version: 19940608
```

WSMR Boundary

```
Citation
  Citation_Information
    Originator: New Mexico Natural Heritage Program
    Publication_Date:  19980630
    Title: WSMR Boundary
    Geospatial_Data_Presentation_Form: Map
    Publication_Information
      Publication_Place:  Albuquerque, NM
      Publisher:  New Mexico Natural Heritage Program (NMNHP)
    Larger_Work_Citation
      Citation_Information
        Originator: White Sands Missile Range
        Publication_Date: unknown
        Title: WSMR Boundary
        Publication_Information
          Publication_Place: unknown
          Publisher:  White Sands Missile Range
        Other_Citation_Details:

Description
  Abstract:
    White Sands Missile Range boundary file.
    Boundary was retrieved from WSMR GIS as a shapefile.
  Purpose:
    WSMR boundary used to determine a portion of
    the study area extent.
Time_Period_of_Content
  Time_Period_Information
    Range_of_Dates/Times
      Beginning_Date: 19980630
      Ending_Date: 19980630
  Currentness_Reference: unknown
Status
  Progress: Complete
  Maintenance_and_Update_Frequency: unknown
Spatial_Domain
  Bounding_Coordinates
    West_Bounding_Coordinate: 336157.0625
    East_Bounding_Coordinate: 397822.6875
    North_Bounding_Coordinate: 3743747.7500
    South_Bounding_Coordinate: 3577190.0000
Keywords
  Theme
    Theme_Keyword_Thesaurus: None
    Theme_Keyword: WSMR
    Theme_Keyword: White Sands Missile Range
    Theme_Keyword: Military Base
    Theme_Keyword: Political boundary
  Place
    Place_Keyword_Thesaurus: None
    Place_Keyword: Tularosa Basin
    Place_Keyword: Chihuahuan Desert
```

```
  Access_Constraints: none
  Use_Constraints: none
  Point_of_Contact
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization:   New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd SE Suite 101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 ext. 230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Native_Data_Set_Environment
    ArcView version 3.0a
    c:\wsmrbasin\shapefiles\utm\wsmr_bnd.shp

DATA_QUALITY_INFORMATION

  Attribute_Accuracy
    Attribute_Accuracy_Report:
      Unknown, attributes created
      by WSMR GIS.
  Logical_Consistency_Report:
      Unknown
  Completeness_Report:
      Unknown
  Positional_Accuracy
    Horizontal_Positional_Accuracy
      Horizontal_Positional_Accuracy_Report:
        Unknown
    Vertical_Positional_Accuracy
      Vertical_Positional_Accuracy_Report:
        N/A
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Range_of_Dates/Times:
            Beginning_Date: 19980630
            Ending_Date: 19980630
        Source_Currentness_Reference: unknown
      Source_Citation_Abbreviation: WSMR
      Source_Contribution:
    Process_Step

SPATIAL_DATA_ORGANIZATION_INFORMATION

  Direct_Spatial_Reference_Method: Vector
  Point_and_Vector_Object_Information
    SDTS_Terms_Description
      SDTS_Point_and_Vector_Object_Type: GT-polygon composed of chains
      Point_and_Vector_Object_Count: 1
```

```
SPATIAL_REFERENCE_INFORMATION

  Horizontal_Coordinate_System_Definition
    Planar
      Grid_Coordinate_System
        Grid_Coordinate_System_Name: Universal Transverse Mercator
        Universal_Transverse_Mercator:
          UTM_Zone_Number: 13
          Transverse_Mercator
            Scale_Factor_at_Central_Meridian:
            Longitude_of_Central_Meridian:
            Latitude_of_Projection_Origin:
            False_Easting:
            False_Northing:
      Planar_Coordinate_Information
        Planar_Coordinate_Encoding_Method: Coordinate pair
        Coordinate_Representation:
          Abscissa_Resolution:
          Ordinate_Resolution:
        Planar_Distance_Units: Meters
    Geodetic_Model
      Horizontal_Datum_Name: North American Datum 1927
      Ellipsoid_Name: Clarke 1866
      Semi-major_Axis: 6378206.4
      Denominator_of_Flattening_Ratio: 294.98

ENTITY_AND_ATTRIBUTE_INFORMATION

  Detailed_Description
    Entity_Type
      Entity_Type_Label: wsmr_bnd.dbf
      Entity_Type_Definition: Shapefile Attribute Table
      Entity_Type_Definition_Source: None
    Attribute
      Attribute_Label: Area
      Attribute_Definition: Area of polygon
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 8858906000.000000
          Range_Domain_Maximum: 8858906000.000000
    Attribute
      Attribute_Label: Perimeter
      Attribute_Definition: Perimeter of polygon
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 501358.800000
          Range_Domain_Maximum: 501358.800000
    Attribute
      Attribute_Label: Attribute
      Attribute_Definition: Ownership
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Unrepresentable_Domain: Character field
    Attribute
```

```
      Attribute_Label: Ha
      Attribute_Definition: Hectares
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 885890.60
          Range_Domain_Maximum: 885890.60
    Attribute
      Attribute_Label: Ac
      Attribute_Definition: Acres
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 2189035.67
          Range_Domain_Maximum: 2189035.67

DISTRIBUTION_INFORMATION

  Distributor
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd. SE #101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 x230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Resource_Description:
       unknown
  Distribution_Liability: NMNHP assumes no responsibility for the
misuse of the data.
       Standard_Order_Process
    Digital_Form
      Digital_Transfer_Information
        Format_Name: shape
      Digital_Transfer_Option
        Offline_Option
          Offline_Media: CDROM
          Recording_Format: ISO 9660
            Compatibility_Information: ISO 9660 format allows the CDROM
            to be read by most computer operating systems.
    Fees:

METADATA_REFERENCE_INFORMATION

  Metadata_Date: 19980630
  Metadata_Review_Date: 19980630
  Metadata_Contact
    Contact_Information
```

```
    Contact_Organization_Primary
      Contact_Organization: New Mexico Natural Heritage Program
      Contact_Person: Teri Bennett
    Contact_Position: GIS Analyst
    Contact_Address
      Address_Type: mailing and physical address
      Address: 851 University Blvd SE #101
      City: Albuquerque
      State_or_Province: New Mexico
      Postal_Code: 87131
      Country: USA
    Contact_Voice_Telephone: 505-272-3545 ext. 230
    Contact_Facsimile_Telephone: 505-272-3544
    Contact_Electronic_Mail_Address: tbennett@unm.edu
    Hours_of_Service: 8:00am - 5:00pm
Metadata_Standard_Name: FGDC CSDGM
Metadata_Standard_Version: 19940608
```

New Mexico Boundary

```
Citation
  Citation_Information
    Originator:
    Publication_Date: 19980630
    Title: New Mexico Boundary
    Geospatial_Data_Presentation_Form: Map
    Publication_Information
      Publication_Place:  Albuquerque, NM
      Publisher:  New Mexico Natural Heritage Program (NMNHP)
    Larger_Work_Citation
      Citation_Information
        Originator: Resource Geographic Information System (RGIS)
        Publication_Date: 1996
        Title: New Mexico Boundary
        Publication_Information
          Publication_Place: Albuquerque
          Publisher: Resource Geographic Information System (RGIS)
        Other_Citation_Details:
        RGIS Clearinghouse
Description
  Abstract:
    State of New Mexico
  Purpose:
    State of New Mexico boundary for geographic
    reference.
Time_Period_of_Content
  Time_Period_Information
    Range_of_Dates/Times
      Beginning_Date: 19980630
      Ending_Date: 19980630
  Currentness_Reference: unknown
Status
  Progress: Complete
  Maintenance_and_Update_Frequency: unknown
Spatial_Domain
  Bounding_Coordinates
    West_Bounding_Coordinate: 114432.6641
    East_Bounding_Coordinate: 683105.3750
    North_Bounding_Coordinate: 4102352.0000
    South_Bounding_Coordinate: 3470532.2500
Keywords
  Theme
    Theme_Keyword_Thesaurus: None
    Theme_Keyword: political boundary
  Place
    Place_Keyword_Thesaurus: None
    Place_Keyword: New Mexico
Access_Constraints: none
Use_Constraints: none
Point_of_Contact
  Contact_Information
    Contact_Organization_Primary
```

```
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd SE Suite 101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 ext 230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Native_Data_Set_Environment
    ArcView version 3.0a
    c:\wsmrbasin\shapefiles\utm\nmstate.shp

DATA_QUALITY_INFORMATION

  Attribute_Accuracy
    Attribute_Accuracy_Report:
      Unknown
  Logical_Consistency_Report:
      Unknown
  Completeness_Report:
      unknown
  Positional_Accuracy
    Horizontal_Positional_Accuracy
      Horizontal_Positional_Accuracy_Report:
        unknown
    Vertical_Positional_Accuracy
      Vertical_Positional_Accuracy_Report:
        N/A
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Range_of_Dates/Times:
            Beginning_Date: 19980630
            Ending_Date: 19980630
        Source_Currentness_Reference: unknown
      Source_Citation_Abbreviation: RGIS
      Source_Contribution:
         unknown
         unknown
    Process_Step

SPATIAL_DATA_ORGANIZATION_INFORMATION

  Direct_Spatial_Reference_Method: Vector
  Point_and_Vector_Object_Information
    SDTS_Terms_Description
      SDTS_Point_and_Vector_Object_Type: GT-polygon composed of chains
      Point_and_Vector_Object_Count: 1

SPATIAL_REFERENCE_INFORMATION

  Horizontal_Coordinate_System_Definition
```

```
    Planar
      Grid_Coordinate_System
        Grid_Coordinate_System_Name: Universal Transverse Mercator
        Universal_Transverse_Mercator:
          UTM_Zone_Number: 13
          Transverse_Mercator
            Scale_Factor_at_Central_Meridian:
            Longitude_of_Central_Meridian:
            Latitude_of_Projection_Origin:
            False_Easting:
            False_Northing:
      Planar_Coordinate_Information
        Planar_Coordinate_Encoding_Method: Coordinate pair
        Coordinate_Representation:
          Abscissa_Resolution:
          Ordinate_Resolution:
        Planar_Distance_Units: Meters
    Geodetic_Model
      Horizontal_Datum_Name: North American Datum 1927
      Ellipsoid_Name: Clarke 1866
      Semi-major_Axis: 6378206.4
      Denominator_of_Flattening_Ratio: 294.98

ENTITY_AND_ATTRIBUTE_INFORMATION

  Detailed_Description
    Entity_Type
      Entity_Type_Label: nmstate.dbf
      Entity_Type_Definition: Shapefile Attribute Table
      Entity_Type_Definition_Source: None
    Attribute
      Attribute_Label: Area
      Attribute_Definition: Area of polygon
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 315285667840.000
          Range_Domain_Maximum: 315285667840.000
    Attribute
      Attribute_Label: Perimeter
      Attribute_Definition: Perimeter of polygon
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 2390427.250
          Range_Domain_Maximum: 2390427.250
    Attribute
      Attribute_Label: Nmstate_
      Attribute_Definition: Artifact from ArcInfo coverage
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 2
          Range_Domain_Maximum: 2
    Attribute
      Attribute_Label: Nmstate_id
      Attribute_Definition: Artifact from ArcInfo coverage
```

```
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 1
          Range_Domain_Maximum: 1
    Attribute
      Attribute_Label: Name
      Attribute_Definition: Name of state
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Unrepresentable_Domain: Character field

DISTRIBUTION_INFORMATION

  Distributor
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd. SE #101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 x230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Resource_Description:
       State of New Mexico, RGIS Clearinghouse
       data.
  Distribution_Liability:
       NMNHP is not responsible for the misuse
       of data.
  Standard_Order_Process
    Digital_Form
      Digital_Transfer_Information
        Format_Name:shape
      Digital_Transfer_Option
        Offline_Option
          Offline_Media: CDROM or diskette
          Recording_Format: ISO 9660
            Compatibility_Information: ISO 9660 format allows the CDROM
            to be read by most computer operating systems.
    Fees: Contact NMNH

METADATA_REFERENCE_INFORMATION

  Metadata_Date: 19980630
  Metadata_Review_Date: 19980630
  Metadata_Contact
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
```

```
      Contact_Person: Teri Bennett
    Contact_Position: GIS Analyst
    Contact_Address
      Address_Type: mailing and physical address
      Address: 851 University Blvd SE #101
      City: Albuquerque
      State_or_Province: New Mexico
      Postal_Code: 87131
      Country: USA
    Contact_Voice_Telephone: 505-272-3545 ext. 230
    Contact_Facsimile_Telephone: 505-272-3544
    Contact_Electronic_Mail_Address: tbennett@unm.edu
    Hours_of_Service: 8:00am - 5:00pm
Metadata_Standard_Name: FGDC CSDGM
Metadata_Standard_Version: 19940608
```

Reach File 3-Alpha Hydrology (1:100,000)

```
  Citation
    Citation_Information
      Originator: New Mexico Natural Heritage Program
      Publication_Date: 19980630
      Title: Reach File 3-Alpha Hydrology (1:100,000)
      Geospatial_Data_Presentation_Form: Map
      Publication_Information
        Publication_Place:  Albuquerque, NM
        Publisher:  New Mexico Natural Heritage Program (NMNHP)
      Larger_Work_Citation
        Citation_Information
          Originator: Environmental Protection Agency
          Publication_Date: unknown
          Title: Reach File 3-Alpha Hydrology (1;100,000)
          Publication_Information
            Publication_Place: unknown
            Publisher: Environmental Protection Agency
          Other_Citation_Details:
Description
    Abstract:
      Reach File 3-Alpha includes stream level information
      for all basins included in the study.  Attributes are a subset
      of the original EPA Reach File 3-Alpha.
    Purpose:
      Reach File 3-Alpha provided here as a subset of the
      original data can be linked to the full dataset (export file on
CDROM)
      The full dataset was not needed for these analyses.
  Time_Period_of_Content
    Time_Period_Information
      Range_of_Dates/Times
        Beginning_Date: 19980630
        Ending_Date: 19980630
    Currentness_Reference: 1998
  Status
    Progress: Planned
    Maintenance_and_Update_Frequency: contact EPA
  Spatial_Domain
    Bounding_Coordinates
      West_Bounding_Coordinate: 229118.3281
      East_Bounding_Coordinate: 442796.8750
      North_Bounding_Coordinate: 3920738.7500
      South_Bounding_Coordinate: 3517213.0000
  Keywords
    Theme
      Theme_Keyword_Thesaurus: None
      Theme_Keyword: Hydrology
      Theme_Keyword: South-central New Mexico Hydrology
      Theme_Keyword: Reach File 3-Alpha
    Place
      Place_Keyword_Thesaurus: None
      Place_Keyword: WSMR
```

```
      Place_Keyword: White Sands Missile Range
      Place_Keyword: New Mexico
      Place_Keyword: Tularosa Basin
      Place_Keyword: South-central New Mexico
  Access_Constraints: none
  Use_Constraints: none
  Point_of_Contact
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization:   New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd SE Suite 101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 ext 230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Native_Data_Set_Environment
    ArcView version 3.0a
    c:\wsmrbasin\shapefiles\utm\rf3_hydro.shp

DATA_QUALITY_INFORMATION

  Attribute_Accuracy
    Attribute_Accuracy_Report:
      Attributes are in the development stage.
      See: http://www.epa.gov/OWOW/NPS/rf/techref.html#RF3
      for complete technical references.
  Logical_Consistency_Report:
      Unknown
  Completeness_Report:
      unknown - in development
  Positional_Accuracy
    Horizontal_Positional_Accuracy
      Horizontal_Positional_Accuracy_Report:
        Accuracy is related to the original USGS DLGs.  One re-
projection
        was made from the original data.
    Vertical_Positional_Accuracy
      Vertical_Positional_Accuracy_Report:
        N/A
      Source_Time_Period_of_Content:
        Time_Period_Information:
          Range_of_Dates/Times:
            Beginning_Date: 19980630
            Ending_Date: 19980630
        Source_Currentness_Reference: unknown
      Source_Citation_Abbreviation:
    Process_Step
      Process_Description:
        Created a shapefile from the original ArcInfo coverage.
```

```
        Maintained a subset of attributes pertinent to
        the project.
      Process_Date: 1998

SPATIAL_DATA_ORGANIZATION_INFORMATION

  Direct_Spatial_Reference_Method: Vector
  Point_and_Vector_Object_Information
    SDTS_Terms_Description
      SDTS_Point_and_Vector_Object_Type: Complete Chain
      Point_and_Vector_Object_Count: 14134

SPATIAL_REFERENCE_INFORMATION

  Horizontal_Coordinate_System_Definition
    Planar
      Grid_Coordinate_System
        Grid_Coordinate_System_Name: Universal Transverse Mercator
        Universal_Transverse_Mercator:
          UTM_Zone_Number: 13
          Transverse_Mercator
            Scale_Factor_at_Central_Meridian:
            Longitude_of_Central_Meridian:
            Latitude_of_Projection_Origin:
            False_Easting:
            False_Northing:
      Planar_Coordinate_Information
        Planar_Coordinate_Encoding_Method: Coordinate pair
        Coordinate_Representation:
          Abscissa_Resolution:
          Ordinate_Resolution:
        Planar_Distance_Units: Meters
    Geodetic_Model
      Horizontal_Datum_Name: North American Datum 1927
      Ellipsoid_Name: Clarke 1866
      Semi-major_Axis: 6378206.4
      Denominator_of_Flattening_Ratio: 294.98

ENTITY_AND_ATTRIBUTE_INFORMATION

  Detailed_Description
    Entity_Type
      Entity_Type_Label: rf3_hydro.dbf
      Entity_Type_Definition: Shapefile Attribute Table
      Entity_Type_Definition_Source: None
    Attribute
      Attribute_Label: Fnode_
      Attribute_Definition: From-node identifier of linear feature
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 2
          Range_Domain_Maximum: 15270
    Attribute
      Attribute_Label: Tnode_
      Attribute_Definition: To-node identifier of linear feature
      Attribute_Definition_Source: Software computed
```

```
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 1
          Range_Domain_Maximum: 15270
    Attribute
      Attribute_Label: Length
      Attribute_Definition: Length of line
      Attribute_Definition_Source: Software computed
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 0.000
          Range_Domain_Maximum: 57741.789
    Attribute
      Attribute_Label: Rf3_100_
      Attribute_Definition: Linkage to the rf3_100.e00 export file with
the complete dataset.
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 1
          Range_Domain_Maximum: 14134
    Attribute
      Attribute_Label: Rf3_100_id
      Attribute_Definition: Linkage to the rf3_100.e00 export file for
the complete dataset.
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 1
          Range_Domain_Maximum: 14140
    Attribute
      Attribute_Label: Cu
      Attribute_Definition: Cataloging Unit - 8 digit
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 13020203
          Range_Domain_Maximum: 13050003
    Attribute
      Attribute_Label: Reachtype
      Attribute_Definition: EPA - see
http://www.epa.gov/OWOW/NPS/rf/techref.html#RF3
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Unrepresentable_Domain: Character field
    Attribute
      Attribute_Label: Level
      Attribute_Definition: Stream ordering (Rio Grande is a level 1
order stream)
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Range_Domain
          Range_Domain_Minimum: 0
          Range_Domain_Maximum: 16
    Attribute
      Attribute_Label: Pname
      Attribute_Definition: Name of stream (where given)
```

```
      Attribute_Definition_Source: User Defined
      Attribute_Domain_Values
        Unrepresentable_Domain: Character field

DISTRIBUTION_INFORMATION

  Distributor
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd. SE #101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
        Country: USA
      Contact_Voice_Telephone: 505-272-3545 x230
      Contact_Facsimile_Telephone: 505-272-3544
      Contact_Electronic_Mail_Address: tbennett@unm.edu
      Hours_of_Service: 8:00am - 5:00pm
  Resource_Description:
       Reach File 3-Alpha

  Distribution_Liability:
       NMNHP accepts no responsibility for the
       misuse of the data.
  Standard_Order_Process
    Digital_Form
      Digital_Transfer_Information
        Format_Name: shape
      Digital_Transfer_Option
        Offline_Option
          Offline_Media: CDROM
          Recording_Format: ISO 9660
            Compatibility_Information: ISO 9660 format allows the CDROM
            to be read by most computer operating systems.
    Fees: Contact NMNH

METADATA_REFERENCE_INFORMATION

  Metadata_Date: 19980630
  Metadata_Review_Date: 19980630
  Metadata_Contact
    Contact_Information
      Contact_Organization_Primary
        Contact_Organization: New Mexico Natural Heritage Program
        Contact_Person: Teri Bennett
      Contact_Position: GIS Analyst
      Contact_Address
        Address_Type: mailing and physical address
        Address: 851 University Blvd SE #101
        City: Albuquerque
        State_or_Province: New Mexico
        Postal_Code: 87131
```

```
      Country: USA
    Contact_Voice_Telephone: 505-272-3545 ext. 230
    Contact_Facsimile_Telephone: 505-272-3544
    Contact_Electronic_Mail_Address: tbennett@unm.edu
    Hours_of_Service: 8:00am - 5:00pm
Metadata_Standard_Name: FGDC CSDGM
Metadata_Standard_Version: 19940608
```

Appendix C. EPA RF 3-Alpha Attributes

RF3-Alpha
Structure Record Layer

Var Name	Data Type	Length	Positions	Description
CU	numeric	8	1 - 8	Cataloging Unit
SEG	numeric	4	9 - 12	Segment Number
MI	numeric	5.2	13 - 17	Marker Index
UPMI	numeric	5.2	18 - 22	Upstream Marker Index
SEQNO	numeric	11.6	23 - 33	Hydro Sequence No.[future use]
RFLAG	character	1	34 - 34	Reach Flag (0,1)
OWFLAG	character	1	35 - 35	Open Water Flag(0,1)
TFLAG	character	1	36 - 36	Terminal Flag (0,1)
SFLAG	character	1	37 - 37	Start Flag (0,1)
REACHTYPE	character	1	38 - 38	Reach Type Code
LEV	numeric	2	39 - 40	Stream Level
JUNC	numeric	2	41 - 42	Level of Downstream Reach
DIVERGENCE	numeric	1	43 - 43	Divergence Code
STARTCU	numeric	8	44 - 51	Start CU [future use]
STRTSG	numeric	4	52 - 55	Start SEG [future use]
STOPCU	numeric	8	56 - 63	Stop CU [future use]
STOPSG	numeric	4	64 - 67	Stop SEG [future use]
USDIR	character	1	68 - 68	Upstream Direction of main path
TERMID	numeric	5	69 - 73	Terminal Stream ID [future use]
TRMBLV	numeric	1	74 - 74	Terminal Base Level [future use]
PNAME	character	30	75 - 104	Primary Name
PNMCD	numeric	11	105 - 115	Primary Name Code
CNAME	character	30	116 - 145	Common Name
CNMCD	numeric	11	146 - 156	Common Name Code
OWNAME	character	30	157 - 186	Open Water Name
OWNMCD	numeric	11	187 - 197	Open Water Name Code
DSCU	numeric	8	198 - 205	Downstream CU
DSSEG	numeric	4	206 - 209	Downstream SEG
DSMI	numeric	5.2	210 - 214	Downstream MI
CCU	numeric	8	215 - 222	Complement CU
CSEG	numeric	4	223 - 226	Complement SEG
CMILE	numeric	5.2	227 - 231	Complement MI
CDIR	character	1	232 - 232	Complement Direction
ULCU	numeric	8	233 - 240	Upstream Left CU
ULSEG	numeric	4	241 - 244	Upstream Left SEG
ULMI	numeric	5.2	245 - 249	Upstream Left MI
URCU	numeric	8	250 - 257	Upstream Right CU
URSEG	numeric	4	258 - 261	Upstream Right SEG

URMI	numeric	5.2	262 - 266	Upstream Right MI
SEGL	numeric	6.2	267 - 272	Reach Length (Miles)
RFORGFLAG	character	1	273 - 273	RF Origin flag(1,2,3)
ALTPNMCD	numeric	8	274 - 281	Alt. Primary Name Code [future use]
ALTOWNMC	numeric	8	282 - 289	alt. OW Name Code [future use]
DLAT	numeric	8.4	290 - 297	Downstream Latitude
DLONG	numeric	8.4	298 - 305	Downstream Longitude
ULAT	numeric	8.4	306 - 313	Upstream Latitude
ULONG	numeric	8.4	314 - 321	Upstream Longitude
MINLAT	numeric	8.4	322 - 329	Minimum Latitude
MINLONG	numeric	8.4	330 - 337	Minimum Longitude
MAXLAT	numeric	8.4	338 - 345	Maximum Latitude
MAXLONG	numeric	8.4	346 - 353	Maximum Longitude
NDLGREC	numeric	4	354 - 357	No. of DLG Records
LL1KEY1	numeric	10	358 - 367	Starting DLG LL Key 1
LL2KEY1	numeric	10	368 - 377	Ending DLG LL Key 1
LL1KEY2	numeric	10	378 - 387	Starting DLG LL Key 2
LL2KEY2	numeric	10	388 - 497	Ending DLG LL Key 2
LL1KEY3	numeric	10	398 - 407	Starting DLG LL Key 3
LL2KEY3	numeric	10	408 - 417	Ending DLG LL Key 3
LL1KEY4	numeric	10	418 - 427	Starting DLG LL Key 4
LL2KEY4	numeric	10	428 - 437	Ending DLG LL Key 4
LL1KEY5	numeric	10	438 - 447	Starting DLG LL Key 5
LL2KEY5	numeric	10	448 - 457	Ending DLG LL Key 5
LL1KEY6	numeric	10	458 - 467	Starting DLG LL Key 6
LL2KEY6	numeric	10	468 - 477	Ending DLG LL Key 6
LL1KEY7	numeric	10	478 - 487	Starting DLG LL Key 7
LL2KEY7	numeric	10	488 - 597	Ending DLG LL Key 7
LL1KEY8	numeric	10	498 - 507	Starting DLG LL Key 8
LL2KEY8	numeric	10	508 - 517	Ending DLG LL Key 8
LL1KEY9	numeric	10	518 - 527	Starting DLG LL Key 9
LL2KEY9	numeric	10	528 - 537	Ending DLG LL Key 9
LL1KEY10	numeric	10	538 - 547	Start DLG LL Key 10
LL2KEY10	numeric	10	548 - 557	Ending DLG LL Key 10
LN1AT2	numeric	4	558 - 561	DLG Line Attribute 1
LN2AT2	numeric	4	562 - 565	DLG Line Attribute 2
AREA1	numeric	4	566 - 569	DLG Area ID 1
AREA2	numeric	4	570 - 573	DLG Area ID 2
AR1AT2	numeric	4	574 - 577	DLG Area attribute
AR1AT4	numeric	4	578 - 581	DLG Area attribute
AR2AT2	numeric	4	582 - 585	DLG Area attribute
AR2AT4	numeric	4	586 - 589	DLG Area attribute
UPDATE1	character	6	590 - 595	Update Date #1(mmddyy)
UPDTCD1	character	8	596 - 603	Update type Code #1
UPDTSRC1	character	8	604 - 611	Update Source #1

UPDATE2	character	6	612 - 617	Update Date #2(mmddyy) [future use]
UPDTCD2	character	8	618 - 625	Update Type Code #2 [future use]
UPDTSRC2	character	8	626 - 633	Update Source #2 [future use]
UPDATE3	character	6	634 - 639	Update Date #3(mmddyy) [future use]
UPDTCD3	character	8	640 - 647	Update Type Code #3 [future use]
UPDTSRC3	character	8	648 - 655	Update Source #3 [future use]
DIVCU	numeric	8	656 - 663	Divergent CU
DIVSEG	numeric	4	664 - 667	Divergent SEG
DIVMILE	numeric	5.2	668 - 672	Divergent MI
DLGID	numeric	6	673 - 678	DLG number (special use)
filler	character	7	678 - 685	Filler [future use]

Appendix D. EPA Reach Type

The term "reach type" refers to a one-character code which has been assigned to each reach. These type codes were generated, in part, from the DLG3 area and line attribute codes. Where DLG attribute codes appeared to be incorrectly assigned, temporary code changes were used to allow correct reach typing and to permit networking to be completed. For example, some lake shorelines had the DLG3 attribute code indicating that they were single line streams and, during compilation, the code would be temporarily changed to correctly indicate a lake shoreline. The original codes are stored in the DLG-3 code attributes (Extracted from Environmental Protection Agency technical data). The reach type codes are as follows:

A	Artificial Lake (RF1/RF2) Reach
C	Continental Coastline Reach Refers to a reach which represents a coastline on the Atlantic, Pacific or Gulf coasts.
F	Falls Reach A reach which is either a waterfall, drop spillway, or a reach of rapids.
G	Great Lakes Shoreline Reach Refers to a reach which represents a coastline in the Great Lakes.
H	Headwater Lake Reach A headwater reach, identified as a lake, which has no reaches above it in the reach file. This type of reach has either one or two reaches connected to its downstream end.
I	Island Shoreline Reach Identifies a reach whose DLG3 attributes identified it as an island shoreline.
J	Braided Stream Envelope Stream reaches which are around the perimeter of an unnetworked braided stream system.
L	Lake Shoreline Reach A reach which follows the shoreline of a lake other than the Great Lakes.
N	Isolated Stream Reach A stream reach not having navigation links in to other reaches.
O	Apparent Limit Reach

A non-transport reach, usually designated by the DLG attributes as a marsh or wetlands.

P — Indefinite or Intermittent Shoreline Reach
A non-transport reach, usually designated by the DLG attributes as a shoreline without definite boundaries.

Q — Questionable Shoreline Reach
A reach which could be either an island or another closed area.

R — Regular Reach
A reach which has upstream and downstream reaches connected to it and which is not classified as another type of reach.

S — Start Reach
A headwater reach which has no reaches above it in the reach file. This type of reach has either one or two reaches connected to its downstream end.

T — Terminal Reach
A reach downstream of which there is no other reach (for example, a reach which terminates into an ocean, a land-locked lake, or the ground). This type of reach has either one or two reaches connected to its upstream end.

U — Unknown Reach
Reach cannot be classified.

V — Open Water Terminal Reach
A reach which is both a terminal reach and an artificial open water reach.

W — Wide-River Shoreline Reach
A reach which identifies either the Right or Left bank of a wide river.

X — Terminal Start Reach
A reach which is both a terminal reach and a start reach.

Z — Terminal Entry Reach
A reach which is both a terminal reach and an entry reach.

Appendix E. ArcView Watershed Tutorial

This project (watershed.apr) is equipped with hot links for the display of Hydrologic Unit information. The following is a description of how to use these hot links:

1) From the project window, open the view called 'WSMR Hydrology'.

2) Select (make active) either the 'WSMR HU 1:100,000' theme or the 'WSMR HU 1:500,000' theme.

3) The hot link tool on the tool bar is now enabled. Click on this button (it looks like a lightning bolt).

4) Click the pointer in a HU. You will see a popup window that asks you to select the type of output that you would like the information to be presented in. The options are Display, Print, or Layout. The Display option will show the results within the current viewer. The Print option will send the results to your local printer. The Layout option will open a new layout within the viewer with the results as a view. The layout can be manipulated so that maps and other information can be added to create a map sheet. Select an output.

5) Information about the HU is the output.