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## **Appendix A**

### **Metadata Database**

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**APPENDIX A**  
**Metadata Database**

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## **A.1 INTRODUCTION**

The purpose of the Middle Rio Grande Water Supply Study is to prepare a quantitative description of the conjunctive-use groundwater and surface-water supply available to the Middle Rio Grande from Cochiti Reservoir to Elephant Butte Reservoir, under the constraints of the Rio Grande Compact and the upstream Rio Grande basin water use within New Mexico. This study is based on analysis of surface-water and groundwater data.

As part of this work, available water resource data sets with potential relevance to the study have been catalogued. These water resource data sets have been developed over a period of many years by federal, state, regional and municipal governmental entities, and others. A metadata database has been constructed to document background information about the water resource data sets. This information, or, “data about data”, includes descriptions of the content, quality, condition and other appropriate characteristics of the data. The metadata database serves as a reference for this study and subsequent studies. This compilation will provide information to investigators evaluating the suitability of diverse water resource data sets to their particular needs.

## **A.2 METADATA**

Metadata are data about data. They provide the description of a particular data set that identifies its contents and usefulness: metadata answer the questions of who, what, when, where, why, and how about every component of the data set being documented. Additionally, metadata maintains the integrity of the data set as it is utilized and provides a reference as to the quality and suitability of the data set.

### **A.2.1 Water Resource Data Types**

Water resource data sets can be categorized into several major groups. These include groundwater data, surface water conveyance data (rivers, canals, drains), water use data (surface and groundwater; agricultural, riparian, municipal, industrial), and reservoir data (storage, evaporation). Within each of these groups, two types of datasets will be encountered: spatial data and time series data. Spatial data consists of geographic

data that is generally utilized by a Geographical Information System (GIS) such as ArcInfo or ArcView but can also exist as basic maps in a variety of formats. Time series data is any data that measures a specific value over time. Each data set includes several intrinsic attributes, in addition to data characteristics related to quality, condition and source.

### **A.2.2 Data and Metadata Attributes**

Data attributes typical of time series water resource data include the station location, measured value, date of measurement, unit of measurement, measurement device and comments which may have been made at the time of measurement describing conditions encountered. Typical data attributes of spatial data include boundaries, waterways, vegetation, roads, geology and points of interest.

The information conveyed in each type of dataset is different and, therefore, the associated metadata is different. Spatial metadata consists of information that is relevant to executing and understanding the specific program file or coverage. For example, information on vectors, latitude and longitude resolution, and ellipsoids would be included. Time series metadata includes information such as the entity being measured and time period and frequency of content, unit of measurement, measurement device and accuracy.

Despite the differences in information, the two types of datasets share many of the same metadata attributes. Metadata attributes relevant to both spatial and time series water resource data sets for the purpose of this and subsequent water supply studies include identification information (title, area covered, keywords, purpose, access), data quality information, spatial reference information, entity and attribute information, distribution information and reference information.

### **A.2.3 Water Resources Data and Metadata Sources**

Data sources for water resource datasets are diverse. For the Middle Rio Grande region, key sources of original data are the U.S. Geological Survey, the U.S. Bureau of Reclamation, the U.S. Army Corps of Engineers, the Environmental Protection Agency,

the Middle Rio Grande Conservancy District, and the City of Albuquerque. In addition to these entities, data have been developed by numerous private parties, local governing bodies and universities. Data have been developed by Indian pueblos; however, unless published, these data are considered confidential by the pueblos and are not available to this study.

The formalization of metadata into a standardized reporting format is a relatively new concept. Many data sources do not maintain formal metadata, and metadata can only be partially reconstructed from available information. For recent data sets, metadata is more widely available. Metadata is noticeably lacking for historical data, especially for time series data. Data sets spanning long periods of record have been collected under differing conditions, with different levels of accuracy and precision making the quality of the data difficult to determine. In some instances, generalized metadata are applied to multiple and diverse data sets with the result of metadata limited in practical value.

### **A.3 METADATA DATABASE**

The metadata database for this study was compiled by the SSPA study team based on formalized metadata when available and, more frequently, through personal communication with the distributing agency. An initial survey was distributed to the agencies and groups associated and familiar with the Middle Rio Grande requesting the identification of data sets collected and maintained by the respondent. Following review of survey responses and review of other published and other unpublished information, data and metadata requests were submitted to the source agencies. In many cases, after receiving data sets, more than one follow-up interview was conducted to obtain metadata known to agency employees. This metadata database is based solely on the information provided by the source agencies and is not intended to provide a complete metadata reference for all data sets utilized in the Middle Rio Grande Water Supply Study. Further investigation into metadata attributes of various data sets is warranted.

### **A.3.1 Metadata Standards**

The most recognized and current publication of geo-spatial metadata is the Federal Geographic Data Committee (FGDC) "Content Standards for Spatial Metadata" (FGDC-STD-001-1998). This standard was selected as being the most desirable standard for both the management and generation of geo-spatial and time series metadata for the Middle Rio Grande Water Supply Study data sets. The FGDC Content Standard helps data users determine what data are available, whether those data meet their specific needs, how to acquire it, and how to transfer it between computer systems. It also provides a mechanism for data generators to share their products with others. Efficient data sharing speeds completion of projects, improves the quality of research and decision-making, and reduces costs by minimizing the duplication of effort. While this standard may appear complex and cumbersome to many, and the application to time series data unjustified, this level of standardization will facilitate future appropriate use of data sets incorporated into or generated by this study. This metadata standard, however, will include many fields for which metadata is unavailable, for a number of data sets relevant to this study. In these cases, the metadata are simply specified as unknown, unavailable or not determined.

### **A.3.2 Structure**

The FGDC Metadata Standard is composed of sections, compound elements, and data elements. Sections are the main divisions of the Standard. The Sections contain the data elements and compound elements and are like the "chapters" of the Standard. The Metadata Standard contains seven main sections and three supporting sections. The main sections of the standard are summarized as follows:

1. **Identification** - General information about the data set.
2. **Data Quality** - Information about the quality of horizontal and vertical positions, and the attributes assigned to geographic features.
3. **Spatial Data** - Organization information about the data types contained in the data set.
4. **Spatial Reference** - Information about the coordinates used to describe locations in the data set.
5. **Entity and Attribute** - Names, definitions, and other information about the features and their attributes found in the data set.
6. **Distribution** - Information about how the data set is distributed.

7. **Metadata Reference** - Metadata about the metadata file. This section contains information about the metadata file itself.

Additionally, the content standards define three 'floating' minor sections.

1. **Citation** - This section contains a structure to create a bibliographic reference to a data set.
2. **Time Period** - This section contains three structures for expressing dates and times.
3. **Contact** - This section contains information used to contact someone to ask questions about the metadata file or the data set.

#### **A.3.2.1 Tools**

Numerous public domain and commercially available database tools currently exist for the generation and management of geo-spatial metadata. These tools preclude the necessity for creating or customizing a database application specifically for this purpose. Spatial Metadata Management System from RTS Enabling Technology was selected based on the following considerations in the evaluation and selection of database tools for the generation and management of metadata for the water supply study:

- Compliance with the FGDC Content Standards for Digital Geo-spatial Metadata;
- Compatible for use on Windows 95/98/NT platform computers;
- Ease of use for generators not familiar with the content standards;
- Ability for multiple organizations to access the metadata base over a wide area network;
- Costs associated with the acquisition, implementation and maintenance of the database;
- Data import and export capabilities; and,
- Database Security.

#### **A.3.3 FGDC Metadata Elements**

The FGDC content standard consists of a hierarchy of metadata elements, or fields, available for specifying information about the data. The following element list provides a summary of the kind of metadata that populates the database, for the datasets with fairly complete existing metadata, for example, recently produced GIS coverages. Datasets lacking in formal metadata were described according to information obtained from the source. Although many fields remain unpopulated, the standardization of

available information should still prove useful. The metadata elements are described below, according to the seven primary sections of the standard.

### **Section 1 - Identification Information**

- Citation Information
  - Originator
  - Publication Date
  - Publisher
  - Title
  - Edition
  - Online Linkage
- Description
  - Abstract
  - Purpose
  - Supplemental Information
- Time Period of Content
  - Beginning Date
  - Ending Date
- Progress
- Maintenance and Update Frequency
- Spatial Domain
  - West Bounding Coordinate
  - East Bounding Coordinate
  - North Bounding Coordinate
  - South Bounding Coordinate
- Theme Keyword(s)
- Place Keyword
- Access Constraints
- Use Constraints
- Contact Information
  - Contact Person
  - Contact Organization
  - Address Type: mailing and physical address
    - Address
    - City
    - State or Province
    - Postal Code
    - Country
    - Contact Voice Telephone
    - Contact Facsimile Telephone
    - Contact Electronic Mail Address
- Browse Graphic

- Browse Graphic File Name
- Browse Graphic File Description
- Browse Graphic File Type
- Native Data Set Environment

## **Section 2 - Data Quality Information**

- Attribute Accuracy Report
- Logical Consistency Report
- Completeness Report
- Positional Accuracy Report
- Horizontal
- Vertical
- Lineage
- Source Information
  - Publication Date
  - Title
  - Edition
  - Publication Place
  - Publisher
  - Online Linkage
  - Type of Source Media
  - Source Citation Abbreviation
- Process
  - Process step
  - Process date
  - Process contact

## **Section 3 - Spatial Data Organization Information**

- Direct Spatial Reference Method
- Point and Vector Object Information
- SDTS Point and Vector Object Type
- Point and Vector Object Count

## **Section 4 - Spatial Reference Information**

- Horizontal Coordinate System Definition
  - Latitude Resolution
  - Longitude Resolution
  - Geographic Coordinate Units
  - Horizontal Datum Name
  - Ellipsoid Name
  - Semi-Major Axis
  - Denominator of Flattening Ratio
- Vertical Coordinate Definition

## **Section 5 - Entity and Attribute**

- Entity and Attribute (For Each Entity)
  - Entity and Attribute Overview
  - Entity Type Label
  - Entity Type Definition
  - Attribute Label
  - Attribute Definition

## **Section 6 - Distribution**

- Contact Person
- Contact Organization
- Address Type
- Address
- Country
- Contact Voice Telephone
- Contact Facsimile Telephone
- Contact Electronic Mail Address
- Distribution Liability

## **Section 7 - Metadata Reference Information**

- Metadata Date
- Contact Person
- Contact Position
- Contact Organization
- Address Type: physical address
  - Address
  - City
  - State or Province
  - Postal Code
  - Country USA
  - Contact Voice Telephone
  - Contact Facsimile Telephone
  - Contact Electronic Mail Address
- Metadata Standard Name
- Metadata Standard Version

### **A.3.4 Summary of Included Data Sets**

This summary represents the data collected and used in the Middle Rio Grande Water Supply study. The metadata database consists of both spatial and time series data sets.

## **Time Series Data**

USGS Gaging Stations, Flow:	9 stations, daily discharge
Reservoir Storage:	Elephant Butte Reservoir
EPA records, wastewater:	6 primary cities: Rio Rancho, Bernallilo, Albuquerque, Los Lunas, Belen, Socorro; monthly total discharge
Rio Grande Compact Data, taken from Compact annual reports:	
	Otowi index flow
	Obligation at Elephant Butte (Elephant Butte Effective Index Supply)
	Delivery at Elephant Butte (Actual Elephant Butte Effective Supply)
	San Juan Chama Transmountain Diversions at Otowi Bridge
	Credit/Debit Balance
Crop Consumptive Use:	CU and acreage, by reach, for all crops, from ET Toolbox, January 2003
Riparian Consumptive Use:	CU and acreage, by reach, for all riparian types, from ET Toolbox, January 2003
Open Water Consumptive Use:	CU and acreage, by reach, for all canals, rivers, drains and ponds, from ET Toolbox, January 2003
Cochiti Lake Evaporation:	Army Corps of Engineers
Elephant Butte Evaporation:	U. S. Bureau of Reclamation
Groundwater Extraction:	USGS, model files (as replicated in OSE model, well package, final time step, historical run)
Precipitation	Albuquerque WSFO Airport, Bosque del Apache and Socorro monthly precipitation totals

## **Spatial Data**

USGS Gaging Station Locations for the 9 stations used in the Phase 3 modeling

Land Use /Land Classification (from LUTA, USBR MRG Assessment)(polygon)

Vegetation classification for MRGCD Divisions as follows:

- Cochiti Division
- Albuquerque Division
- Belen Division
- Socorro Divison
- San Marcial sub-area

Hydrography coverages, including MRGCD drains, canals, river and portions of tributary inflow channels for MRGCD Divisions (as listed above) and counties (as listed above)

Transportation coverages for the MRGCD divisions (as listed above)

County boundaries for the State of New Mexico, line coverages

Boundary of USGS Middle Rio Grande study area

Transportation line coverage for the State of New Mexico

CDP polygon coverage for the State of New Mexico (cities)

Federal land ownership for lands in the Middle Rio Grande region, polygon coverage

Natural hydrography for the State of New Mexico

Digital geologic map of State of New Mexico – river alluvium

Shaded relief map of the State of New Mexico

1:1,000,000 BLM PLSS map of New Mexico

Hydrologic Unit Codes (HUC) for the State of New Mexico

MRGCD Property Boundary Coverage