



Analysis and Technical Update to the Colorado Water Plan

Technical Memorandum

Prepared for:

Colorado Water Conservation Board

Project Title:

**Colorado Environmental and Recreational Database
Documentation**

Date: July 18, 2019

Prepared by: David Knight, Allison Wagner and Paniz Miesen, CDM Smith

Reviewed by: Sue Morea and Becky Dunavant, CDM Smith

Table of Contents

Section 1 : Introduction.....	1
1.1 Background.....	1
1.2 Environmental and recreational database overview.....	2
1.2.1 Enhanced Technical Foundation.....	2
1.2.2 Engaging Meaningful User Experience.....	2
1.2.3 Integration into Colorado Water Planning Process.....	2
1.3 Report overview.....	3
Section 2 : Colorado Environmental and Recreational Database Updates.....	4
2.1 Spatial Unit.....	4
2.2 E&R Attributes.....	5
2.3 Project Information.....	5
2.4 Geodatabase.....	6
Section 3 : Intended Use and Future Enhancements.....	7

List of Figures

Figure 2-1: E&Rdb Relationships.....	
---	--

List of Appendices

Appendix A: Draft Colorado Environmental and Recreational Database User’s Guide
Appendix A1: E&Rdb Entity Relationship Map
Appendix A2: E&Rdb Data Dictionary
Appendix A3: E&Rdb Project Template
Appendix B: Attribute Data

List of Acronyms

BRTs	basin roundtables
CDOW	Colorado Department of Wildlife
CDNR	Colorado Department of Natural Resources
COMID	common ID
CPW	Colorado Parks and Wildlife
CWCB	Colorado Water Conservation Board
Db	database
E&R	Environmental Recreational
E&Rdb	Environmental and Recreational Database
EnRec	Environment and Recreation
GIS	geographic information system
GNIS	Geographic Names Information System
HUC	Hydrological Unit Code
IPP	Identified Projects and Processes
NCNA	Nonconsumptive Needs Assessment
NCNAdb	Nonconsumptive Needs Assessment Database
NHD	National Hydrography Dataset
SRGAP	Southwest Regional Gap Analysis Project
SWRF	Source Water Route Framework
SWSI	Statewide Water Supply Initiative
USGS	United States Geological Survey
WSRA	Water Supply Reserve Account

Section 1: Introduction

A database was developed in 2010, known as the “Nonconsumptive Needs Assessment (NCNA) Database (db)” to help manage the nonconsumptive data received by basin roundtables (BRTs) and other stakeholders. The database included information related to nonconsumptive attributes, projects, and protections. A component of reviewing Environmental and Recreational (E&R) data for the Technical Update has been enhancing the NCNAdb. The enhanced NCNAdb is now referred to as the E&Rdb. The E&Rdb includes an enhanced technical foundation, a more engaging and meaningful user interface, and has been updated for better integration into the Colorado Water Planning process.

1.1 BACKGROUND

During the Statewide Water Supply Initiative (SWSI) 2010 process, the BRTs utilized mapping tools as a common technical platform to identify nonconsumptive needs focus areas within their basins. The BRTs initially reviewed a set of geographic information system (GIS) data layers developed by the NCNA Technical Roundtable. The term “data layer” refers to geographic data that represents a specific type of feature or attribute (e.g., wetlands or species habitat) and can also be referred to as a shapefile. After reviewing the data layers, the BRTs then suggested and contributed additional data layers as deemed appropriate for each basin.

Each basin used one of three methods to develop a summary map that highlighted NCNA focus areas:

- Method 1: NCNA focus areas in each basin were aggregated to the watershed level (US Geological Survey (USGS) 12-digit Hydrological Unit Code [HUC]).
- Method 2: NCNA focus areas in each basin were aggregated to the stream level using USGS information for stream segments provided by the National Hydrography Dataset (NHD).
- Method 3: Stream reaches were selected that represented most of the E&R activity within the basin. These stream reaches were selected based on a review of all available data layers and feedback from stakeholders and public outreach efforts.

During the SWSI 2010 process, the BRTs also identified projects and methods required to meet nonconsumptive needs. In 2010, the Colorado Water Conservation Board (CWCB) developed a survey to collect information on existing or planned nonconsumptive projects, methods and studies. CWCB ultimately facilitated 58 meetings to gather additional data from stakeholders. CWCB also collected data from agencies and projects such as Colorado Department of Natural Resources (DNR), Colorado Division of Wildlife (CDOW) and the Southwest Regional Gap Analysis Project (SRGAP).

The collected information was spatially digitized using the USGS NHD 12-digit stream segment dataset. A unique project ID and segment ID were given to all projects identified in surveys and interviews within the NCNAdb. Water Supply Reserve Account (WSRA) grant projects were also digitized in a similar fashion. A more detailed discussion on the NCNAdb is provided below.

The output of the Nonconsumptive Projects and Methods process included four maps that provided information on the location of projects and methods, the status of these projects and methods, and NCNA focus areas that had identified projects and methods completed or in progress.

The NCNAdb was developed beginning in 2010 to assist in the internal management of nonconsumptive data received from the BRTs. The NCNAdb contained key information related to nonconsumptive attributes, projects, and associated protections (direct or indirect). The content of the database was

developed by a stakeholder-driven process that included members of the nine BRTs and statewide technical committees.

1.2 ENVIRONMENTAL AND RECREATIONAL DATABASE OVERVIEW

The E&Rdb is a Microsoft Access database formatted in Microsoft Access 2010 file format. Enhancements made to the NCNadb to create the E&Rdb focused on three success factors: enhanced technical foundation, creating a meaningful user experience, and integration in the Colorado Water Planning process. A summary of each enhancement is provided below while additional detail can be found throughout the remainder of this technical memorandum.

1.2.1 ENHANCED TECHNICAL FOUNDATION

The previous NCNadb utilized a spatial unit of analysis based on the USGS's NHD, specifically the common ID (COMID). This stream segment-based spatial unit was retired by USGS which required an update to the spatial unit of analysis within the enhanced database. The database now uses both the Source Water Route Framework (SWRF) and NHD (Geographic Names Information System (GNIS)) for spatial reference. The SWRF is a spatial data set developed only for the state of Colorado. Data in the database can be queried by HUC and/or stream segment.

Data processing procedures are critical to ensure accuracy, promote data quality, and create a process that can be adopted through training. A data loading procedure was developed to provide instructions and guidance for loading data into the database, be it new data or updates to existing data. The procedure streamlines the data loading process, facilitates transparency with the process, and improves the quality of data. Data loading templates have been developed in coordination with ongoing Identified Projects and Processes (IPP) database development so that E&R data are consistent and comparable for any future coordinated efforts.

1.2.2 ENGAGING MEANINGFUL USER EXPERIENCE

Enhancing the user experience included the development of user-friendly Excel-based templates for data loading. The templates have been created to streamline the data loading process and to increase data integrity through validations functions.

Spatial data from the database will be viewable through the existing CWCB Data Viewer. Data viewing through the CWCB Data Viewer benefits the BRTs and BIP process by providing an interactive visualization tool for retrieving data.

Standard Excel-based reports can now be used to retrieve data for additional analysis by database users. The focus of the standard reports is to provide the data for analysis in the next round of BIPs, not the analysis itself. The standard reports will ensure users are receiving a consistent dataset across the board as part of the BIP process and will be able to report back additional project, protection, and attribute information.

1.2.3 INTEGRATION INTO COLORADO WATER PLANNING PROCESS

Data have been updated within the E&Rdb to help inform the water planning process. The existing attributes list was consolidated to a manageable and consistent format across all basins to promote a unified language for attribute identification. The NCNadb contained over 100 E&R attributes. The original attributes were reviewed and quality checked to identify repetitive or unreliable data sources and datasets. Closely related attributes that provided repetitive or overlapping data were consolidated into a

single attribute. Additionally, previous attributes that did not have public data sources or datasets available to confirm spatial data were archived and not included in the updated attribute list. Several attributes were also renamed to better reflect the dataset and simplify database development. The final 58 attributes were grouped into “macro” categories that help increase organization of attributes and provide a foundation for the Colorado Environmental Flow Tool that was developed separately for the Technical Update.

Existing BIPs were reviewed for project information to be added to the E&Rdb. Due to inconsistent information, naming conventions, and lack of spatial reference, project data were not updated in this version of the db. Excel-based loading templates were developed in conjunction with the IPP database efforts so that future iterations of the E&Rdb can be expanded to include consistent project information to support planning for both consumptive and nonconsumptive needs.

1.3 REPORT OVERVIEW

The remainder of this technical memorandum contains the following sections:

- Section 2: Colorado Environmental and Recreational Database Updates – provides further details on the enhancements made to the NCNadb including updates to the spatial unit, E&R attributes, and project information.
- Section 3: Intended Uses and Future Enhancements – discusses the capabilities and limitations of the E&Rdb as well as additional enhancements that could be implemented in future iterations of the E&Rdb to further integrate into the Colorado Water Planning process.

Section 2: Colorado Environmental and Recreational Database Updates

A variety of updates were completed within the database in order to enhance the technical foundation, create an engaging and meaningful user experience, and provide for integration into the Colorado Water Planning process. Updates and data sources are discussed below.

Figure 2-1 show the key entities, or groups of data, and their relationships with each other within the E&Rdb. The E&Rdb contains seven core entities which include: Projects, Protections, Contacts, Segments, Segment Attribute Classes, Basins, and Attribute Classifications.

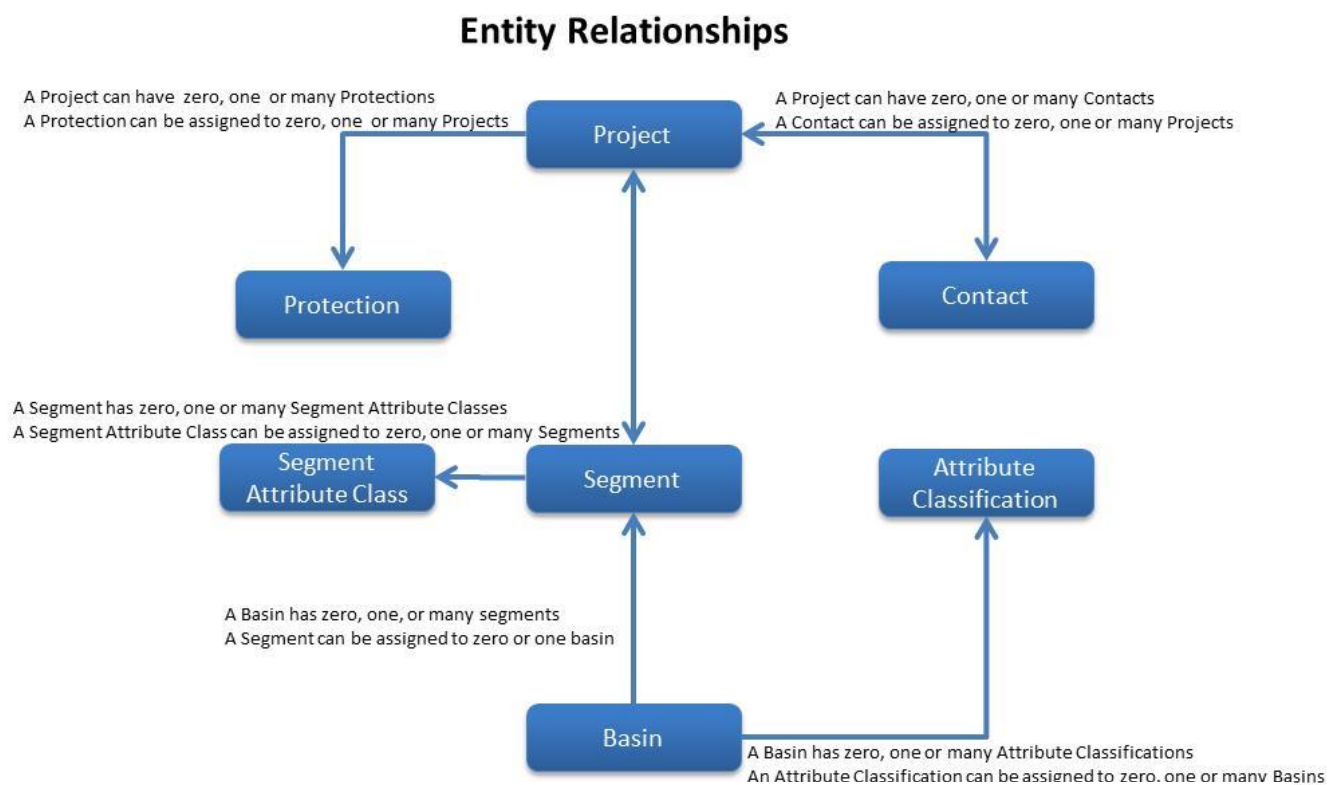


Figure 2-1: E&Rdb Relationships

2.1 SPATIAL UNIT

The previous NCNAdb utilized a spatial unit of analysis based on the USGS’s NHD, specifically the COMID. This stream segment-based spatial unit was retired by USGS which required an update to the spatial unit of analysis within the enhanced database. The database now uses both the SWRF and NHD (GNIS) for spatial reference.

The SWRF is a spatial data set developed only for the state of Colorado. The SWRF extracts spatial data from the NHD if it a) has a GNIS record or b) is identified as source waters for decreed water rights in Colorado. It should be noted that while the SWRF reports all identification numbers in the GNIS ID field, not all identification numbers are official GNIS IDs. The dataset uses the USGS GNIS ID number as the

unique identifier for a water feature, except those features that are decreed water rights but not GNIS recognized. These features are assigned a 5-digit identification number based on the district the feature is located (ex: the first identified stream in District 1 will have an assigned ID number 10001, the second identified stream will have the ID number 10002). The user should be aware that the SWRF water rights features may be assigned an identification number that is already in use by an official GNIS record located outside of Colorado. This dataset was utilized during the development of the South Platte BIP. Note that the SWRF does not include all tributaries covered by NHD. Because of this, the two coverages were married to create the spatial reference in the current version of the E&Rdb. With this spatial reference, the user is able to query data by stream segment and/or HUC.

2.2 E&R ATTRIBUTES

A total of 108 E&R attributes existed through the NCNA Focus Area Mapping efforts described in Section 1 (**Table B-1** of **Appendix B**). The original 108 attributes were reviewed and quality checked to identify repetitive or unreliable data sources and datasets. Closely related attributes that provided repetitive or overlapping data were consolidated into a single attribute. Additionally, previous attributes that did not have public data sources or datasets available to confirm spatial data were not included in the updated attribute list. A number of attributes were also renamed to better reflect the dataset and simplify database development. Note that original NCNA attributes are available for review in the archived NCNAdb. Refer to **Tables B-2** and **B-3** in **Appendix B** for a summary of E&R attributes that were consolidated or were not included in this update, respectively.

Once the previous attributes were consolidated and unreliable datasets were identified, the remaining E&R attributes were updated with the most recent public data sources and datasets. The final updated E&R attribute list is comprised of a total of 58 attributes as listed in **Table B-4**.

The updated E&R attributes were categorized into macro-attribute classes to facilitate map development. The E&Rdb will allow users to customize visible attribute layers by general macro-attribute class or by individual attribute. **Table B-5** identifies the individual attributes that make up each macro-attribute class.

2.3 PROJECT INFORMATION

In 2010, CWCB developed a survey to collect information on where there were existing or planned nonconsumptive projects, methods, and studies. Studies were included as they may recommend or inform the implementation of projects or methods that would provide protection or enhancement of E&R attributes. A GIS database of this information was created by digitizing the information.

In addition to identifying the spatial extent and status of the identified projects and methods, CWCB also examined what type of protection the project or method may provide to a given E&R attribute. Projects were classified as having direct or indirect protections based on a given E&R attribute. The definitions used for direct and indirect protections were as follows:

- Direct Protection – Projects and methods with components designed intentionally to protect a specific attribute. For example, ISFs provide direct protection of fish attributes. Additionally, restoration of a stream channel would provide direct protection of aquatic species.
- Indirect Protection – Projects and methods with components that were not designed to directly protect the specific attribute but may still provide protection. For example, flow protection for a fish species may also indirectly protect riparian vegetation that is located in the protected stream reach. Other examples include protective land stewardship or a wetland or bank stabilization effort that could indirectly protect aquatic species.

Project data from these efforts in 2010 has been maintained in the E&Rdb for reference.

During the last round of BIP development, BRTs were tasked with updating their completed, ongoing, and proposed projects and methods for addressing water supply needs. The intent was to include this updated information in the E&Rdb. However, upon detailed review of the BIPs, it was evident that the data needed to include updated project information lacked necessary information and were often inconsistent. Recommendations for future updates to project data within the E&Rdb are included in **Section 3**.

2.4 GEODATABASE

The E&Rdb deliverable includes supplemental geodatabases that contain the spatial data used for GIS. The spatial data were transmitted to CWCB for use in the CWCB online Data Viewer (<https://gis.colorado.gov/dnrviewer/Index.html?viewer=cwcbviewer>). The following 4 feature classes are available to view through the CWCB Data Viewer:

- **“Macroattributes by Segment”** (*SWRF_with_macroattributes*) and **“Macroattributes by HUC”** (*WBDHU10_with_macroattributes*) feature classes are stream lines and watershed boundaries respectively. Each feature has E&R attributes along with the macro-attribute categories: Fish, Wildlife, Recreation & Economy, Water Rights, and Physical Environment. These text fields are populated with a list of the macro-attributes existing within one mile of the stream segment or within the watershed boundary.
- **“Flow Tool Nodes”** (*Flow_Tool_Nodes_with_attributes*) is a point feature class containing nodes along stream segments that were selected for the Flow Tool. The basic attributes are USGS station number, name, and location data. Also included are the flow tool categories: Cold Water Fish, Warm Water Fish, Plains Fish, Boating, Wetlands/Riparian, and ISF. These fields are populated with a count of the relevant attributes that exist near that node.
- **“Legacy Project Data”** (*Project_attributes_by_reach*) is a line feature class which is a combination of the SWRF and the NHD from 2006 (as described in **Section 2.1**; see **Table 2.1** below). Feature duplicates exist where there is more than one project on a river segment to allow for each project to be recorded. For example, the South Platte River (GNIS_ID = 00201759) has 125 projects joined to it. Therefore, this feature exists a total of 125 times with different project attributes.

Table 2.1

Data Source	Number of Projects	Number of Unique River Segments	Records in Feature Class
SWRF	4,945	1,889	6,530
NHD 2006	3,614	7,171	13,491

Users can examine the attributes for a given project by querying the field [ProjectID] or [ProjectName]. See the sample query results for project 192 below (**Table 2.2**).

Table 2.2

GNIS_ID	GNIS_Name	ProjectID	ProjectName	ProjectStatus
00201748	Gunnison River	192	Recommended Minimum flows along the Gunnison and Colorado Rivers	Completed
00045730	Colorado River	192	Recommended Minimum flows along the Gunnison and Colorado Rivers	Completed

Section 3: Intended Use and Future Enhancements

The E&Rdb can be used by many stakeholders to add, view, or extract content related to non-consumptive needs. This includes projects and attributes. Attributes can be related to a project and/or a specific stream segment. The database can be utilized with the accompanying geodatabase for spatial analysis and viewing.

The current database is in a Microsoft Access format, and is designed to be used as a single user tool. Adding or modifying data should be done using the templates and providing templates to the database manager to upload.

The long-term objectives for the E&Rdb include:

1. Providing the database in an online solution. The solution would include a mapping component as well as a query tool for extracting data.
2. Expand the database content with projects and attributes provided by stakeholders.

In future iterations of the E&Rdb, the project data can be expanded to include additional information such as project dates and descriptions. It is recommended that this information be collected during the next round of BIPs. In addition, a meaningful project identifier (Project ID) should be utilized globally. The original project IDs from the data providers can be maintained while global project IDs will ensure the project IDs are uniquely identified with a meaningful ID nomenclature.

As data are collected, additional fields can be added to the tblProject that answer the following questions related to flow to help guide stakeholders in their project development and planning.

- Is the project flow-based? (Y/N)
 - Does the project have a flow component? (Y/N)
 - Have flow needs been identified and/or quantified? (Y/N)
 - Does project success require securing flows? (Y/N)
3. Utilize the database for long-term water planning activities.

The ultimate goal for the future of the E&Rdb is to develop a comprehensive tool with the best available information on E&R projects and attributes that can be used by BRTs to inform planning and implementation of solutions to protect and enhance the E&R uses of the state's waters. The current updates and enhancements to the E&Rdb have set up a framework for reaching this goal in future iterations. Updating E&R attribute data at regular intervals, continued expansion of quality project information in the E&Rdb, and continued coordination with CWCB to work towards an online platform will ensure that the E&Rdb aligns with Colorado's water planning future.



Appendix A: Colorado Environmental and Recreational Database User's Guide



Analysis and Technical Update to the Colorado Water Plan

Technical Memorandum

Prepared for:

Colorado Water Conservation Board

Project Title:

Appendix A: Colorado Environmental and Recreational Database User's Guide

Date: July 18, 2019

Prepared by: Dave Knight and Allison Wagner (CDM Smith)

Reviewed by: Becky Dunavant and Rob Parsons (CDM Smith)

Table of Contents

Section A1: Introduction	1
A1.1 Technical Specifications.....	2
A1.2 Tables	2
Section A2: Understanding the Database Design.....	4
Section A3: Viewing, Editing and Reporting Tools.....	6
A3.1 View and Edit Projects.....	6
A3.2 Reports.....	6
A3.3 How to Query the Database – Advanced Users	6
A3.4 Steps for Querying Database	7
Section 4: Performing Updates to Database	9
A4.1 Database Template for Adding or Updating Projects or Attributes	9
A4.2 Database Log.....	9
A4.3 How to Re-version Database	10

List of Figures

Figure A2-1. E&Rdb Entity Relationships	4
Figure A2-2. E&Rdb relationships	4
Figure A2-3. M:M Relationship Intermediate Table	5
Figure A2-4. The Physical Entity Relationship Diagram	5
Figure A3-1. Intersecting Join Properties	7
Figure A3-2. Inclusive Join Properties.....	7
Figure A3-3 Types of Join Properties.	7

List of Attachments

Attachment A-1: Entity Relationship Diagram

Attachment A-2: Data Dictionary

Attachment A-3: Database Template for Adding or Updating

Section A1: Introduction

The Colorado Environmental and Recreational database (E&Rdb), originally named the Nonconsumptive Needs Assessment database (NCNadb), was developed originally in 2010 by CDM Smith staff to assist in the internal management of nonconsumptive data received from Basin Roundtables (BRTs). The E&Rdb was initially used to support projects such as the Nonconsumptive Needs Assessment Focus Mapping and Nonconsumptive Projects and Methods. In 2017, methodology enhancements were identified through a collaborative effort with the Colorado Water Conservation Board (CWCB). The enhancements focused on three success factors with respective methodologies that have been implemented:

Enhanced Technical Foundation

- a. *Update Spatial Unit of Analysis.* The previous NCNadb utilized a spatial unit of analysis based on the US Geological Survey (USGS) National Hydrography Dataset (NHD), specifically the common ID (COMID). This stream segment-based spatial unit was retired by USGS which required an update to the spatial unit of analysis within the enhanced database. The database now uses both the Colorado Source Water Route Framework (SWRF) and NHD (Geographic Names Information System (GNIS)) for spatial reference. The SWRF is a spatial data set developed only for the state of Colorado. Data in the database can be queried by HUC and/or stream segment.



- b. *Update Data Processing Procedures.* Data processing procedures are critical to ensure accuracy, promote data quality, and create a process that can be adopted through training. A data loading procedure was developed to provide instructions and guidance for loading data into the database, be it new data or updates to existing data. The procedure streamlines the data loading process, facilitates transparency with the process, and improves the quality of data. Data loading templates have been developed in coordination with ongoing Identified Projects and Processes (IPP) database development so that E&R data are consistent and comparable for any future coordinated efforts.

Engaging Meaningful User Experience

- a. *Excel Based Templates to Streamline Data Loading.* Excel-based templates for data loading were created to streamline the data loading process and to increase data integrity through validation functions.
- b. *Online Mapping Tool.* Spatial data from the database will be viewable through the existing CWCB Data Viewer. Data viewing through the CWCB Data Viewer benefits the BRTs and Basin Implementation Plan (BIP) process by providing an interactive visualization tool for retrieving data.

- c. *Feedback from Users.* Feedback from the BRT members and other E&Rdb users can help gauge the usefulness of the database and identify additional future needs. Feedback may be solicited in several ways, including: simple survey, continued outreach to users, and providing contact information at user end points such as the online mapping tool.
- d. *Ease of Loading or Retrieving Information.* Standard Excel-based reports can be used to retrieve data to be used for analysis. The focus of the standard reports is to provide the data for analysis in the next round of BIPs, not the analysis itself. The standard reports will ensure E&Rdb users are receiving a consistent dataset across the board as part of the BIP process and will be able to report back additional project and attribute information.

Integration into Colorado Water Planning Process

- a. *Improve Database Content.* The existing attributes list was consolidated to a manageable and consistent format across all basins to promote a unified language for attribute identification. The previous NCNadb had over 100 E&R attributes. The original attributes were reviewed, and quality checked to identify repetitive or unreliable data sources and datasets. Closely related attributes that provided repetitive or overlapping data were consolidated into a single attribute. Additionally, previous attributes that did not have public data sources or datasets available to confirm spatial data were archived and not included in the updated attribute list. Several attributes were also renamed to better reflect the dataset and simplify database development. The final 58 attributes were grouped into “macro” categories that help increase organization of E&Rdb and provide a foundation for the Colorado Environmental Flow Tool.
- b. *Expand Available Project Information.* Existing BIPs were reviewed for project information to be added to E&Rdb. Due to inconsistent information, naming conventions, and lack of spatial reference, project data were not updated in this version of the db. Excel-based loading templates were developed in conjunction with IPP database efforts so that future iterations of the E&Rdb can be expanded to include consistent project information to support planning for both consumptive and nonconsumptive needs.

This document details the technical specifications of the database and instructions for utilizing database features. In addition, information related to database structure and how to use the database is included.

A1.1 TECHNICAL SPECIFICATIONS

The E&Rdb is a Microsoft Access database formatted in Microsoft Access 2010 file format. The database contains several tables, queries, and modules. The database uses industry standards such as indexes, keys, referential integrity, normalization, and naming standards for tables and fields. In addition, the database contains a version table (tblApplicationVersion) which is used to identify the version of database, date of the version, and release notes related to the version.

A1.2 TABLES

There are two types of tables: reference tables and data tables. Reference tables are denoted with a ‘ref’ prefix and contain lookup values used within the data tables. Data tables contain the data records and their attributes. Data tables are denoted with a ‘tbl’ prefix.

The core data tables in the E&Rdb are described below in **Table A1-1**. A more in-depth data dictionary is provided as **Attachment A-2** and is available within the database (tblDataDictionary).

Table A1-1. Core Data Tables

Table	Description
tblBasin	Contains Basin information
tblContact	Contact information such as name, address, phone
tblContactProject	Intermediate table relates Contacts to Projects
tblDatabaseLog	Used to document modifications to database
tblDataDictionary	Contains all tables/fields and respective attributes within the database
tblProject	Projects
tblProjectProtection	Protections assigned to projects and their attributes
tblSegment	Stream segments
tblSegmentAttributeClass	Attribute classifications for attributes along a given stream segment
tblSegmentProject	List of projects that are related stream segments, and the length of the segment
tblSegmentIDXRef	Contains cross-reference identification between COM ID and GNIS ID
tblSegmentReach	List of Reaches by COMID

Section A2: Understanding the Database Design

The first step in designing the database was to develop an understanding of the entities, or groups of data, and their relationships with each other. For the E&Rdb, there are seven core entities which include: Projects, Protections, Contacts, Segments, Segment Attribute Classes, Basins, and Attribute Classifications. The relationships between the core entities are noted in **Figure A2-1** and a detailed relationship diagram is available in **Attachment A-1**.

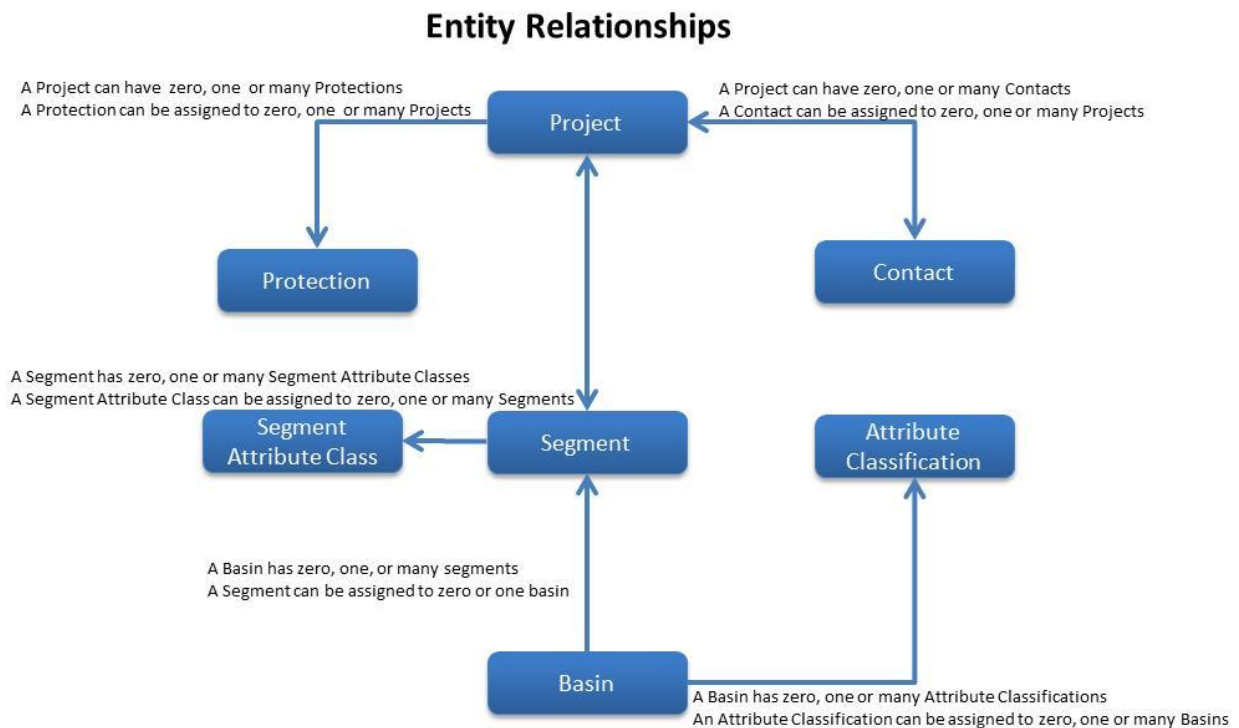


Figure A2-1. E&Rdb Entity Relationships

Once the entities and relationships were defined the database tables and relationships were designed. The database contains relational tables which are defined as two tables that share a relationship between each other. There are three types of relationships: A one-to-one (1:1), one-to-many (1:M), and a many-to-many (M:M).



Figure A1-2. E&Rdb relationships

- **1:1 Relationship:** A one-to-one relationship is a relationship in which a record can have zero or one, and only one, related record from the other table. For example, a Project can belong in only one Basin. Note: the E&Rdb does not contain any 1:1 relationships. Rather, the core entity tables contain the related item as an attribute. So, the Project table contains a field, ProjectBasin.
- **1:M Relationship:** The 1:M relationship is the most common relationship. The relationship between the two tables has two parts. First, the parent table has a relationship to the child table (referred to as “has a”). The child table has a relationship to the parent tables (referred to as “belongs to”). Parents can have zero, one, or many children records. Conversely, children can only belong to one parent record. For example, a Basin can have one or many stream segments. And, a stream segment can only belong to one basin.
- **M:M Relationship:** Lastly, the M:M relationship is simply two 1:M relationships bound together. The two tables share the same relationship; in that, each table can have zero, one, or many records from the other table. M:M relationships are created using an intermediate table between the two tables. The intermediate table



Figure A2-2. M:M Relationship Intermediate Table

contains a unique compound key of the primary keys from each table. For example, a Project can have many contacts, and a contact can belong to many projects.

The Physical Entity Relationship Diagram (ERD) below describes all the E&Rdb tables and relationships. The ERD is an effective mapping tool to help users understand how data tables are related.

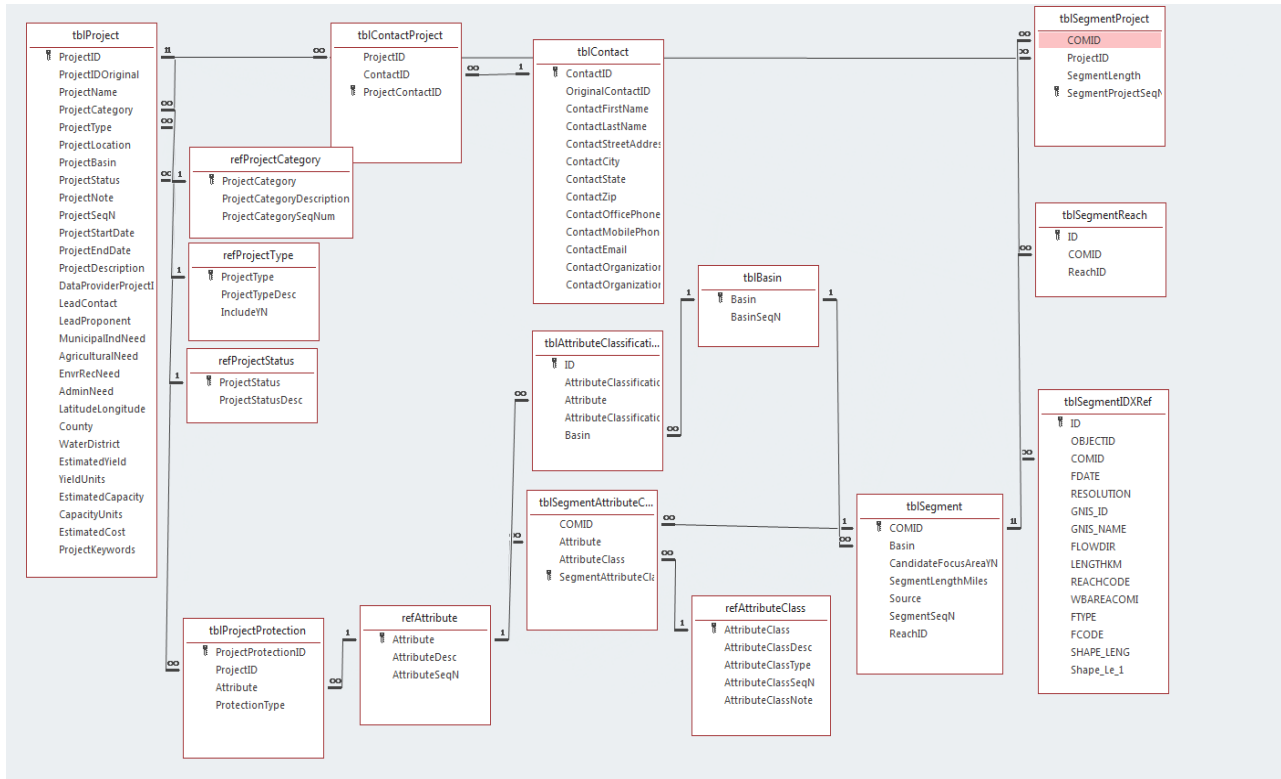


Figure A2-4. The Physical Entity Relationship Diagram

Section A3: Viewing, Editing and Reporting Tools

The database contains several tools to help browse, search and extract data. The following sections describe the process for utilizing the available tools.

A3.1 VIEW AND EDIT PROJECTS

There is a project data entry form that contains the projects and the related information.

1. From the Switchboard click Projects.
2. Select a project in the drop down.
3. There are several tabs containing groups of information about the selected project.
 - a. General Info – more basic information about the project.
 - b. Project Attributes – Attributes related to the selected project.
 - c. Project Segments – Stream segments, by COMID, related to the selected project.
 - d. Project Contacts – contacts related to the selected project.

A3.2 REPORTS

There are predefined reports that can be used to view and export data. To utilize the reports:

1. From the Switchboard click Reports.
2. Select a report from the drop down.
3. The report will be displayed in a new tab. The report utilizes a similar functionality to MS Excel with filtering, sorting and copy/paste.

A3.3 HOW TO QUERY THE DATABASE – ADVANCED USERS

Querying the database requires experience using Microsoft Access, a solid understanding of the question that is translated to a query, and familiarity with the database design to retrieve the information appropriately.

Microsoft Access provides a graphical interface for querying where users can add tables, drag fields, filter, and perform simple calculations. There are many resources available to help users become familiar with the query interface. For example, Microsoft provides a simple course (<https://support.office.com/en-nz/article/Create-queries-for-a-new-database-babf5d53-66e7-405f-a6ad-c29c276ee6b0>) which provides some hands-on experience.

Understanding the question that is translated to a query and familiarity with the database design are critical skills to ensure the correct data are retrieved. The example below describes two questions that seem very similar; however, they produce very different results.

- Example 1: “I’d like to see projects with their protections.”
- Example 2: “I’d like to see all the projects and any protections that might be associated with the project.”

In example 1, it could be implied that the user only wants projects that have related protections. The database design allows a project to have zero, one, or many protections. So, the resulting dataset will only contain projects with protections. Figure 3-1 illustrates how the join properties between the two tables that are intersecting (Inner Join).

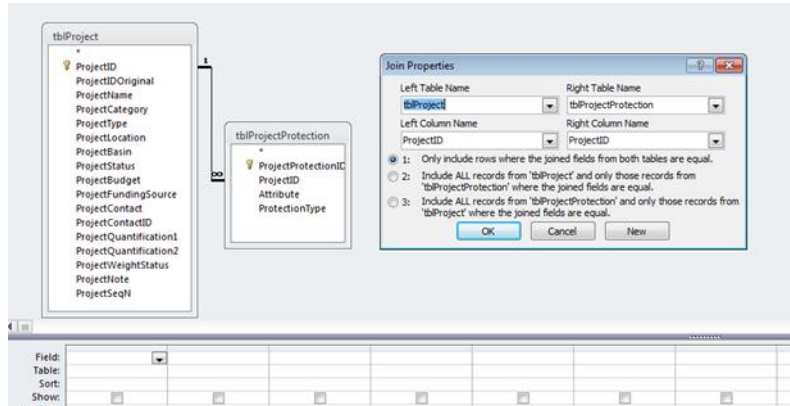


Figure A3-1. Intersecting Join Properties

Conversely, example 2 explicitly indicates the user wants all projects whether there are protections or not. The resulting dataset would include all projects and any related protections. In fact, example 2 produces over 4,400 additional projects that do not have protections. Figure 3-2 illustrates how the join properties between the two tables are inclusive (Outer Join).

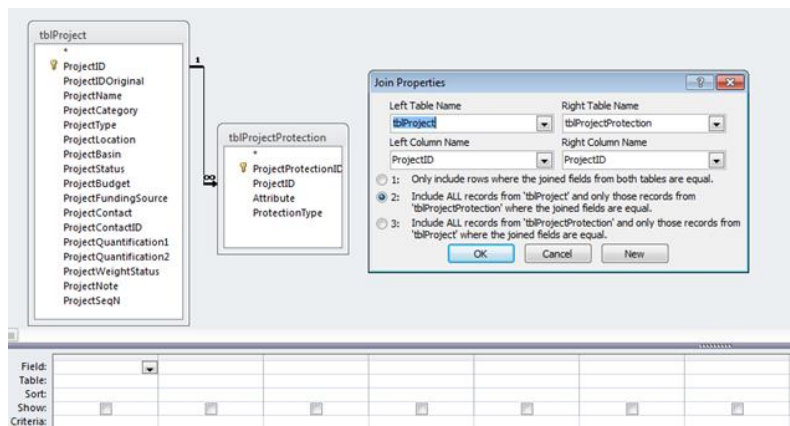


Figure A3-2. Inclusive Join Properties

A3.4 STEPS FOR QUERYING DATABASE

1. Identify question(s). This may seem simple at first glance. However, simple questions can have complex limitations, boundaries, and meaning. Understanding the data model and content can help surface these additional details.
2. Determine join properties. There are essentially three join types: inner, left outer, and right outer. The inner join is the point at which two tables intersect. The left outer join includes all the records from the left table AND records that match from the right table. The right outer join includes all records from the right table AND records that match from the left table. Figure 3-3 illustrates the different join types.

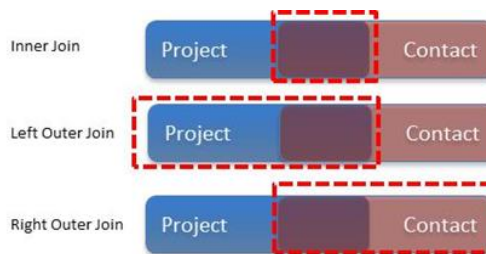


Figure A3-3. Types of Join Properties

3. Apply appropriate criteria filters (see Tips).
4. Comparison Operators. $</>$ and $<=>$ are often overlooked when translating question to query. Ensure the proper comparison is applied.

5. Logical Operators. The OR operator returns data that match any of the criteria. For example: "a" OR "b" will return data that contain either "a" or "b". The AND operator returns data where all criteria are met. For example: like "*a*" AND "*b*" will return data that contain an 'a' and a 'b'.
 - a. Null values are not returned when using the NOT operator. For example, NOT Like "*a*" will not return NULL values. The criteria must explicitly filter for NULL: Not Like "*a*" OR IS NULL.
 - b. Additional information on filtering can be found in Microsoft reference material (<https://support.office.com/>)
6. Perform quality checks. Quality checks include: performing record counts, evaluating opposing criteria (e.g., instead of LIKE "*a*", perform NOT LIKE "*a*" OR IS NULL), checking random 10% of records returned, or having a peer review the query. In addition, calculated fields and conditional statements should be reviewed thoroughly for accuracy.
7. Document and save results. The final query should be saved and the results exported for use. The filename of the export should match the query name in the database. Add a date stamp to the file name that serves as the date of query and version YYYYMMDDXXX .

Section 4: Performing Updates to Database

There are two types of updates to the database that can occur. Updates to the database structure (Data Model) include modifications to tables and fields, new tables and fields, and changes to relationships, indexes, or keys. Updates to data content (Data Definition) include adding records, removing records, or updating existing records. Best practices should be followed to ensure database changes are documented, tested, and distributed appropriately. An example database task documentation log has been provided in **Attachment A-3**. The document describes the tasks and their objectives, process for completing the tasks, and the quality control measures performed for each task.

A4.1 DATABASE TEMPLATE FOR ADDING OR UPDATING PROJECTS OR ATTRIBUTES

The database includes a Microsoft Excel Template that can be used to add or update projects and attributes associated with projects. It is important to follow the template instructions provided in the MS Excel Template.

Recommended Approach for database updates:

For database updates or additions, it is recommended that an advanced user provide the template to be filled out by the user. The template would be prepopulated with the existing projects and/or project attributes. This would allow users to locate the project to update and make modifications in the file.

The template contains instructions on how to fill it out. Once the template is filled out with the new projects:

1. From the Switchboard, select Import Data. This opens the Import form.
2. Select the type of import (Project or Attribute).
3. Select Add or Update from the drop down.
4. Locate the file by clicking the ... button.
5. Click Import.
6. If records are being added:
 - a. A message box will appear "You are about to run an append query...". Click Yes.
 - b. Another message box will appear "You are about to append x row(s)". Click Yes.
7. If records are being updated:
 - a. A message box will appear "You are about to run an update query...". Click Yes.
 - b. Another message box will appear "You are about to update x row(s)". Click Yes.
8. In the event there are errors, another dialog box will appear with details. It is recommended to consult the database administrator for support.

A4.2 DATABASE LOG

The database includes a log table, tblDatabaseLog which can be used to document data model updates to the database. To use the database log table:

1. From the Switchboard, select Database Log.
2. Add new record.

- a. Insert a brief note in the LogNote field.
- b. The LogDOE will automatically populate with the date/time.
- c. Provide the author's name in LogAuthor.

The unique LogID can then be referenced in other documentation such as tblApplicationVersion.

A4.3 HOW TO RE-VERSION DATABASE

A new feature within the database includes a simple versioning table, tblApplicationVersion. The purpose of the table is to provide a unique identifier for the database based on the state of its structure and content. Reports and queries that are produced from the database should reference the version number.

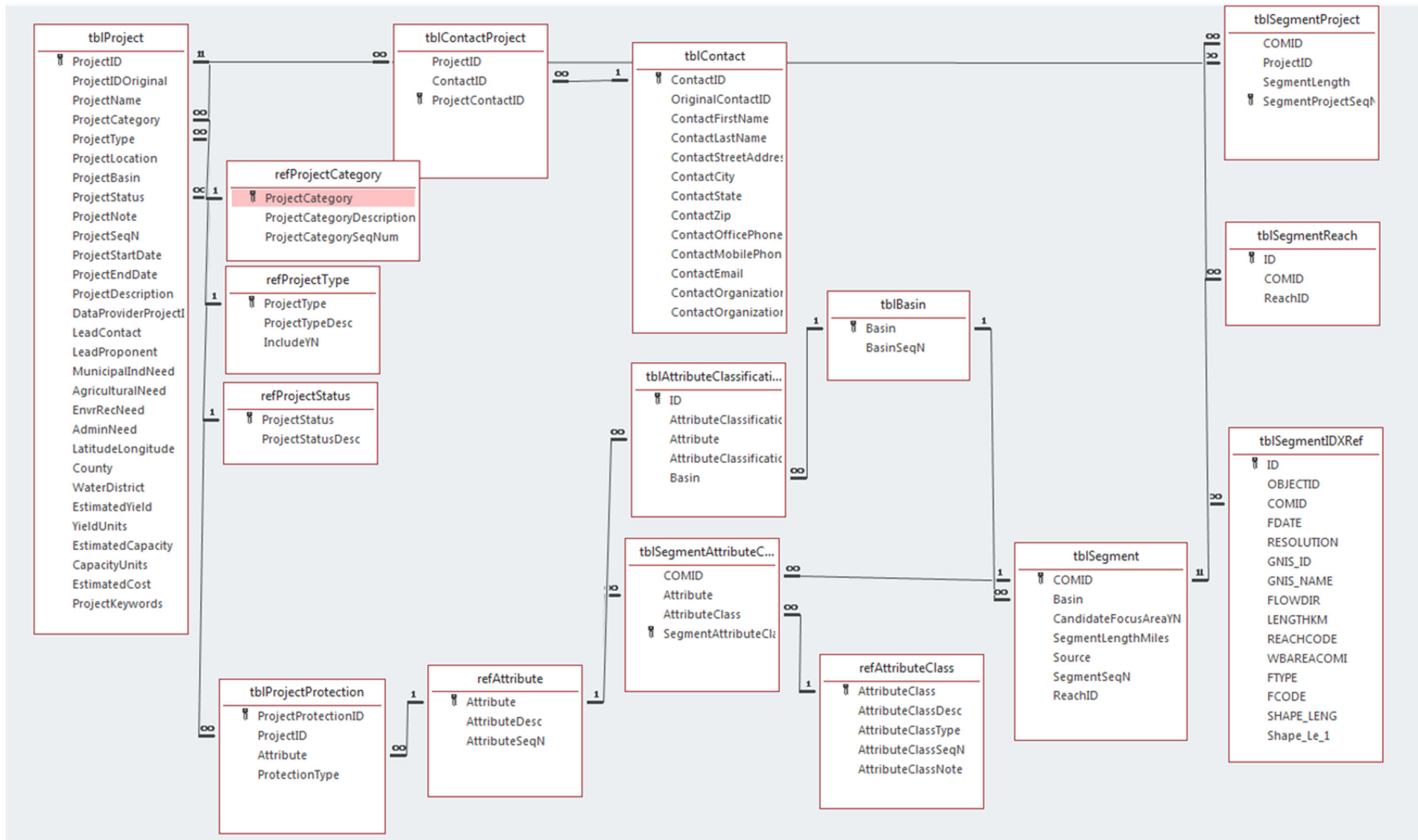
1. Open database.
2. Open the table, tblApplicationVersion.
3. Uncheck the ActiveYN box for the current version.
4. Add new record.
 - a. The version number should be in the format of: YYYYMMDDXXX where, YYYY = 4 digit year; MM = 2 digit month; DD = 2 digit day; XXX = 3 digit incremental number starting with 001.
5. Example 1: New release on November 14, 2014 would be: 20141114001.
6. Example 2: A second release on November 14, 2014 would be: 20141114002.
 - b. The version notes should include a brief summary of what modifications were performed. A more detailed summary can be referenced for large modifications.
 - c. The version release date should be the date of the version.
 - d. ActiveYN should be checked. Note: Only 1 version should be checked as active.



Appendix A-1: Entry Relationship Diagram

Entry Relationship Diagram

EnRec ver 1.0.20190710001





Appendix A-2: Data Dictionary

ID	Table	Field	Description	DataType	Length	Nulls	Default	IndexList	Seed	Increment	Table_or_Field	Dictionary	RecordDateEn
35	refAttribute										Table	312	11-Jul-19
36	refAttribute	Attribute	Unique attribute name	dbText	60	0		PrimaryKey			Field	313	11-Jul-19
37	refAttribute	AttributeDesc	Brief description of attribute	dbText	255	1					Field	314	11-Jul-19
38	refAttribute	AttributeSeqN	Autonumber generated by database	dbLong	4	1			1	1	Field	315	11-Jul-19
39	refAttributeClass										Table	316	11-Jul-19
40	refAttributeClass	AttributeClass	Classification used to group attributes	dbText	100	0		PrimaryKey			Field	317	11-Jul-19
41	refAttributeClass	AttributeClassDesc	Description of classification	dbText	255	1					Field	318	11-Jul-19
42	refAttributeClass	AttributeClassType	Groups classifications - attributes can be grouped in more than one classification	dbText	50	1					Field	319	11-Jul-19
43	refAttributeClass	AttributeClassSeqN	Autonumber generated by database	dbLong	4	1			1	1	Field	320	11-Jul-19
44	refAttributeClass	AttributeClassNote	Notes related to the classification	dbText	255	1					Field	321	11-Jul-19
45	refProjectCategory										Table	322	11-Jul-19
46	refProjectCategory	ProjectCategory		dbText	50	0		PrimaryKey			Field	323	11-Jul-19
47	refProjectCategory	ProjectCategoryDescription		dbText	255	1					Field	324	11-Jul-19
48	refProjectCategory	ProjectCategorySeqNum		dbLong	4	1			1	1	Field	325	11-Jul-19
49	refProjectStatus										Table	326	11-Jul-19
50	refProjectStatus	ProjectStatus	Unique project lifecycle status name	dbText	50	0		PrimaryKey			Field	327	11-Jul-19
51	refProjectStatus	ProjectStatusDesc	Describes project lifecycle status (planned, ongoing, completed)	dbText	255	1					Field	328	11-Jul-19
52	refProjectType										Table	329	11-Jul-19
53	refProjectType	ProjectType	Unique project type name	dbText	50	0		PrimaryKey			Field	330	11-Jul-19
54	refProjectType	ProjectTypeDesc	Describes project type	dbText	255	1					Field	331	11-Jul-19
55	refProjectType	IncludeYN	Yes/no field used for filtering out certain project types for statistics	dbBoolean	1	1	0				Field	332	11-Jul-19
56	Switchboard Items										Table	333	11-Jul-19
57	Switchboard Items	SwitchboardID		dbLong	4	0		PrimaryKey			Field	334	11-Jul-19
58	Switchboard Items	ItemNumber		dbInteger	2	0	0	PrimaryKey			Field	335	11-Jul-19
59	Switchboard Items	ItemText		dbText	255	1					Field	336	11-Jul-19
60	Switchboard Items	Command		dbInteger	2	1					Field	337	11-Jul-19
61	Switchboard Items	Argument		dbText	255	1					Field	338	11-Jul-19
71	tblAttributeClassificationGroup										Table	348	11-Jul-19
72	tblAttributeClassificationGroup	ID	Autonumber generated by database	dbLong	4	1		ID1			Field	349	11-Jul-19
73	tblAttributeClassificationGroup	AttributeClassificationVolume	Arbitrary value to identify a statistical grouping or volume	dbText	100	1					Field	350	11-Jul-19
74	tblAttributeClassificationGroup	Attribute	Attribute	dbText	60	1		{87A6B23C-234C-4F64-8E33-B13F2C1EB7D9}			Field	351	11-Jul-19
75	tblAttributeClassificationGroup	AttributeClassificationGroup	Groups attributes for statistics	dbText	100	1					Field	352	11-Jul-19
76	tblAttributeClassificationGroup	Basin	Basin	dbText	50	1		{37895C01-5944-45CC-8121-C6241E035671}			Field	353	11-Jul-19
77	tblBasin										Table	354	11-Jul-19
78	tblBasin	Basin		dbText	50	0		PrimaryKey			Field	355	11-Jul-19
79	tblBasin	BasinSeqN		dbLong	4	1			1	1	Field	356	11-Jul-19
80	tblContact										Table	357	11-Jul-19
81	tblContact	ContactID	Autonumber generated by database	dbLong	4	1		PrimaryKey	1	1	Field	358	11-Jul-19
82	tblContact	OriginalContactID	Contact ID from original data source	dbText	50	1		ContactID			Field	359	11-Jul-19
83	tblContact	ContactFirstName	First name of contact	dbText	50	1					Field	360	11-Jul-19
84	tblContact	ContactLastName	Last name of contact	dbText	50	1					Field	361	11-Jul-19
85	tblContact	ContactStreetAddress	Street address/PO of contact	dbText	50	1					Field	362	11-Jul-19
86	tblContact	ContactCity	Contact city	dbText	50	1					Field	363	11-Jul-19
87	tblContact	ContactState	Contact state	dbText	50	1					Field	364	11-Jul-19
88	tblContact	ContactZip	Contact zip code	dbText	50	1					Field	365	11-Jul-19
89	tblContact	ContactOfficePhone	Contact office phone	dbText	50	1					Field	366	11-Jul-19
90	tblContact	ContactMobilePhone	Contact mobile phone	dbText	50	1					Field	367	11-Jul-19
91	tblContact	ContactEmail	Contact email	dbText	50	1					Field	368	11-Jul-19
92	tblContact	ContactOrganization	Primary contact associated with contact	dbText	50	1					Field	369	11-Jul-19
93	tblContact	ContactOrganizationWebsite	Organization website	dbText	100	1					Field	370	11-Jul-19
94	tblContactProject										Table	371	11-Jul-19
95	tblContactProject	ProjectID		dbText	255	1		{8421B0CF-9A4C-4D9A-A1D1-FF83AA85C7E}, ProjectID			Field	372	11-Jul-19
96	tblContactProject	ContactID		dbLong	4	1		{19C3291B-2EA4-49D0-8ADD-33BD4626B2CF}, ContactID			Field	373	11-Jul-19
97	tblContactProject	ProjectContactID		dbLong	4	1		PrimaryKey	1	1	Field	374	11-Jul-19
98	tblDatabaseLog										Table	375	11-Jul-19
99	tblDatabaseLog	LogNote		dbMemo	0	1					Field	376	11-Jul-19
100	tblDatabaseLog	LogDOE		dbDate	8	1	=Now()				Field	377	11-Jul-19
101	tblDatabaseLog	LogAuthor		dbText	255	1					Field	378	11-Jul-19
102	tblDatabaseLog	LogID		dbLong	4	1		LogID, PrimaryKey	1	1	Field	379	11-Jul-19
103	tblProject										Table	380	11-Jul-19
104	tblProject	ProjectID	A Unique Project ID was given to each project within this database.	dbText	50	0		PrimaryKey, ProjectID			Field	381	11-Jul-19
105	tblProject	ProjectIDOriginal	Project ID supplied in original data source	dbText	50	1					Field	382	11-Jul-19
106	tblProject	ProjectName	Name of project	dbText	200	1					Field	383	11-Jul-19

ID	Table	Field	Description	DataType	Length	Nulls	Default	IndexList	Seed	Increment	able_or_Fie	Dictionary	cordDateEn
107	tblProject	ProjectCategory	There were 5 major project categories developed by CDM/CWCB (Instream Flow, CWCB Restoration Projects, Interviewed/Surveyed Projects, Water Supply Reserve Account Projects, Stewardship Projects, and Colorado Division of Wildlife Projects).	dbText	100	1		refProjectCategorytblProject			Field	384	11-Jul-19
108	tblProject	ProjectType	The type of the project (i.e. instream flow, restoration, habitat improvement, etc.).	dbText	50	1		{ACF272A2-BD00-4B4F-A3EA-7642862C6A8A}			Field	385	11-Jul-19
109	tblProject	ProjectLocation	A description of the project location.	dbText	150	1					Field	386	11-Jul-19
110	tblProject	ProjectBasin	Basin assigned to the project. Note: This is not used to determine the actual basin which the project sits within spatially.	dbText	20	1					Field	387	11-Jul-19
111	tblProject	ProjectStatus	The current status of a project (planned/proposed, ongoing or completed).	dbText	50	1		{78453DD5-3018-4130-A2C4-045501774630}			Field	388	11-Jul-19
112	tblProject	ProjectNote	Comments associated to any project or other miscellaneous fields.	dbText	255	1					Field	389	11-Jul-19
113	tblProject	ProjectSeqN	Autonumber generated by database	dbLong	4	1			1	1	Field	390	11-Jul-19
114	tblProject	ProjectStartDate	Project start date	dbDate	8	1					Field	391	11-Jul-19
115	tblProject	ProjectEndDate	Project end date	dbDate	8	1					Field	392	11-Jul-19
116	tblProject	ProjectDescription	Brief description of project	dbMemo	0	1					Field	393	11-Jul-19
117	tblProject	DataProviderProjectID	Project or Row ID provided by data provider	dbText	255	1		DataProviderProjectID			Field	394	11-Jul-19
118	tblProject	LeadContact	Person that can be contacted regarding the project and their affiliation. Name/Organization	dbText	255	1					Field	395	11-Jul-19
119	tblProject	LeadProponent	Indicates main entity proposing/leading project. Name/Email/Phone	dbText	255	1					Field	396	11-Jul-19
120	tblProject	MunicipalIndNeed	% of project dedicated to need	dbDecimal	16	10					Field	397	11-Jul-19
121	tblProject	AgriculturalNeed	% of project dedicated to need	dbDecimal	16	10					Field	398	11-Jul-19
122	tblProject	EnvrRecNeed	% of project dedicated to need	dbDecimal	16	10					Field	399	11-Jul-19
123	tblProject	AdminNeed	% of project dedicated to need	dbDecimal	16	10					Field	400	11-Jul-19
124	tblProject	LatitudeLongitude	Latitude and Longitude of the project's general point location in decimal degrees.	dbText	100	1					Field	401	11-Jul-19
125	tblProject	County	County where project is located	dbText	100	1					Field	402	11-Jul-19
126	tblProject	WaterDistrict	Water District where project is located	dbText	100	1					Field	403	11-Jul-19
127	tblProject	EstimatedYield	Average yield of a project that may be estimated using BIP modeling. Or how much water will be kept in a stream (average flow rate). Additional guidance will need to be provided.	dbText	200	1					Field	404	11-Jul-19
128	tblProject	YieldUnits	Unit of measure for yield; either acre-feet per year (AFY) or cubic-feet-per-second (cfs).	dbText	200	1					Field	405	11-Jul-19
129	tblProject	EstimatedCapacity	Maximum amount of water the project store, divert, convey, etc. For E&R project, this could be linear miles of stream or area of watershed effected.	dbText	200	1					Field	406	11-Jul-19
130	tblProject	CapacityUnits	Unit of measure for capacity; either acre-feet (AF), acre-feet per year (AFY), million gallons (MG), million gallons per day (MGD), cubic-feet-per-second (cfs), stream miles, area (acres).	dbText	200	1					Field	407	11-Jul-19
131	tblProject	EstimatedCost	Total cost to implement the project including capital and operations and maintenance (O&M).	dbCurrency	8	10					Field	408	11-Jul-19
132	tblProject	ProjectKeywords		dbText	255	1					Field	409	11-Jul-19
133	tblProjectProtection										Table	410	11-Jul-19
134	tblProjectProtection	ProjectProtectionID	Autonumber generated by database	dbLong	4	1		PrimaryKey	1	1	Field	411	11-Jul-19
135	tblProjectProtection	ProjectID	A Unique Project ID was given to each project within this database.	dbText	50	1		{0B4E96A9-2478-4B8F-88A6-417350E9EFCF}, Ukey1			Field	412	11-Jul-19
136	tblProjectProtection	Attribute	This attribute either directly or indirectly protected by the project.	dbText	60	1		{84E74A07-B3E8-494F-B7BD-226A8356B2A3}, Ukey1			Field	413	11-Jul-19
137	tblProjectProtection	ProtectionType	The protection (D-Direct, I-Indirect and DI-Both) were assigned to COMIDS based on whether the existing/ongoing/completed project has a form of protection for the specific attribute.	dbText	2	1					Field	414	11-Jul-19
145	tblSegment										Table	422	11-Jul-19
146	tblSegment	COMID	A COMID is a unique value associated to USGS National Hydrography Dataset	dbLong	4	0		COMID, PrimaryKey			Field	423	11-Jul-19
147	tblSegment	Basin	Basin	dbText	50	1		{E850880D-F81E-449C-8E0A-11DBC509CFB}			Field	424	11-Jul-19
148	tblSegment	CandidateFocusAreaYN	This field determines if the COMID is located within an Environmental and Recreational Stream Segment designated by the Basin Round Table.	dbBoolean	1	10					Field	425	11-Jul-19
149	tblSegment	SegmentLengthMiles	Length of the segment calculated in GIS.	dbDecimal	16	1					Field	426	11-Jul-19
150	tblSegment	Source	Original data source of segment	dbText	50	1					Field	427	11-Jul-19
151	tblSegment	SegmentSeqN	Autonumber generated by database	dbLong	4	1			1	1	Field	428	11-Jul-19

ID	Table	Field	Description	DataType	Length	Nulls	Default	IndexList	Seed	Increment	Table_or_Field	Dictionary	RecordDateEnd
152	tblSegment	ReachID	Reach IDs were developed in NCNA Phase I to identify Basin Roundtable Attributes (please note these are only associated to a couple of basins).	dbLong	4	1		ReachID			Field	429	11-Jul-19
153	tblSegmentAttributeClass										Table	430	11-Jul-19
154	tblSegmentAttributeClass	COMID	A COMID is a unique value associated to USGS National Hydrography Dataset	dbLong	4	1		{9E8393E8-B13A-4B38-9C9A-8411A467EDED}, UKey1			Field	431	11-Jul-19
155	tblSegmentAttributeClass	Attribute	These are the Basin Roundtables environment and recreational attributes developed in Phase I NCNA	dbText	60	1		{00F38929-CF70-41E1-B1DD-153E65B8DAA7}, UKey1			Field	432	11-Jul-19
156	tblSegmentAttributeClass	AttributeClass	Attribute categories also developed in Phase I NCNA	dbText	100	1		{445CE058-EACA-437C-B769-7FEB4D3E0EDB}			Field	433	11-Jul-19
157	tblSegmentAttributeClass	SegmentAttributeClassSeqN	Autonumber generated by database	dbLong	4	1		PrimaryKey	1	1	Field	434	11-Jul-19
158	tblSegmentIDXRef										Table	435	11-Jul-19
159	tblSegmentIDXRef	ID		dbLong	4	1		ID			Field	436	11-Jul-19
160	tblSegmentIDXRef	OBJECTID		dbDouble	8	1		OBJECTID			Field	437	11-Jul-19
161	tblSegmentIDXRef	COMID		dbLong	4	1		{93CA24E0-83B4-43E1-B8E1-20AB41B12620}, COMID			Field	438	11-Jul-19
162	tblSegmentIDXRef	FDATE		dbDate	8	1					Field	439	11-Jul-19
163	tblSegmentIDXRef	RESOLUTION		dbText	255	1					Field	440	11-Jul-19
164	tblSegmentIDXRef	GNIS_ID		dbText	255	1		GNIS_ID			Field	441	11-Jul-19
165	tblSegmentIDXRef	GNIS_NAME		dbText	255	1					Field	442	11-Jul-19
166	tblSegmentIDXRef	FLOWDIR		dbText	255	1					Field	443	11-Jul-19
167	tblSegmentIDXRef	LENGTHKM		dbDouble	8	1					Field	444	11-Jul-19
168	tblSegmentIDXRef	REACHCODE		dbText	255	1		REACHCODE			Field	445	11-Jul-19
169	tblSegmentIDXRef	WBAREACOMI		dbDouble	8	1					Field	446	11-Jul-19
170	tblSegmentIDXRef	FTYPE		dbText	255	1					Field	447	11-Jul-19
171	tblSegmentIDXRef	FCODE		dbDouble	8	1		FCODE			Field	448	11-Jul-19
172	tblSegmentIDXRef	SHAPE_LENG		dbDouble	8	1					Field	449	11-Jul-19
173	tblSegmentIDXRef	Shape_Le_1		dbDouble	8	1					Field	450	11-Jul-19
174	tblSegmentProject										Table	451	11-Jul-19
175	tblSegmentProject	COMID	A COMID is a unique value associated to USGS National Hydrography Dataset	dbLong	4	1		{ADF251B5-E304-40C1-B8DA-E1320DBE3F53}, UKey1			Field	452	11-Jul-19
176	tblSegmentProject	ProjectID	A Unique Project ID was given to each project within this database.	dbText	50	1		{2F6CAE17-E79F-41AD-8A88-24EDA1E9ABC7}, UKey1			Field	453	11-Jul-19
177	tblSegmentProject	SegmentLength	Length of the segment that was calculated in GIS.	dbDecimal	16	1	0				Field	454	11-Jul-19
178	tblSegmentProject	SegmentProjectSeqN	Autonumber generated by database	dbLong	4	1		PrimaryKey	1	1	Field	455	11-Jul-19
179	tblSegmentReach										Table	456	11-Jul-19
180	tblSegmentReach	ID	Autonumber generated by database	dbLong	4	1		PrimaryKey	1	1	Field	457	11-Jul-19
181	tblSegmentReach	COMID	A COMID is a unique value associated to USGS National Hydrography Dataset	dbLong	4	1		{CC6866CF-B5C7-4F29-978F-7EA5404AFAE8}, COMID			Field	458	11-Jul-19
182	tblSegmentReach	ReachID	Reach IDs were developed in Phase I NCNA to identify Basin Roundtable Attributes (please note these are only associated to a couple of basins).	dbLong	4	1		ReachID			Field	459	11-Jul-19



Appendix A-3: Database Template for Adding or Updating

Appendix A-3: Database Template

Field -->	Project_ID	Project_Name	Project_Description	Project_Start_Date	Project_End_Date
Data Type/Size -->	Text(200)	Text(200)	Text(63,999)	Date	Date
Description ---> LEAVE THIS COLUMN BLANK	Unique project identifier in the format of Basin-Year-Number (i.e., ARK-2015-00001) that also allows for cross-reference between datasets and use by software tools.	Name of project (Required)	Brief description of project	Start date of project	End date of project

Appendix A-3: Database Template

Field -->	Status	Keywords	Project_Location	Project_Type	Project_Category
Data Type/Size -->	Look up	Text(200)	Text (200)	Look up	Look up
Description ---> LEAVE THIS COLUMN BLANK	See look up values	Keywords are used for searching projects.	Brief description of location	See look up values	There were 5 major project categories developed by CDM/CWCB (Instream Flow, CWCB Restoration Projects, Interviewed/Surveyed Projects, Water Supply Reserve Account Projects, Stewardship Projects, and Colorado Division of Wildlife Projects).

Appendix A-3: Database Template

Field -->	Lead_Proponent	Lead_Contact	Municipal_Ind_Need	Agricultural_Need
Data Type/Size -->	Text(200)	Text(200)	Percentage	Percentage
Description ---> LEAVE THIS COLUMN BLANK	Indicates main entity proposing/leading project. Name/Email/Phone	Person that can be contacted regarding the project and their affiliation. Name/Organization	% of project dedicated to need	% of project dedicated to need

Appendix A-3: Database Template


Field -->	Envr_Rec_Need	Admin_Need	Latitude_Longitude	County
Data Type/Size -->	Percentage	Percentage	Text(200)	Text(200)
Description ---> LEAVE THIS COLUMN BLANK	% of project dedicated to need	% of project dedicated to need	Latitude and Longitude of the project's general point location in decimal degrees.	County where project is located

Appendix A-3: Database Template

Field -->	Water_District	Estimated_Yield	Yield_Units	Estimated_Capacity
Data Type/Size -->	Text(200)	Text(200)	Text(200)	Text(200)
Description ---> LEAVE THIS COLUMN BLANK	Water District where project is located	Average yield of a project that may be estimated using BIP modeing. Or how much water will be kept in a stream (average flow rate). Additional guidance will need to be provided.	Unit of measure for yield; either acre-feet per year (AFY) or cubic-feet-per- second (cfs).	Maximum amount of water the project store, divert, convey, etc. For E&R project, this could be linear miles of stream or area of watershed effected.

Appendix A-3: Database Template

Field -->	Capacity_Units	Estimated_Cost
Data Type/Size -->	Text(200)	Currency
Description ---> LEAVE THIS COLUMN BLANK	Unit of measure for capacity; either acre-feet (AF), acre-feet per year (AFY), million gallons (MG), million gallons per day (MGD), cubic-feet-per- second (cfs), stream miles, area (acres).	Total cost to implement the project including capital and operations and maintenance (O&M).



Appendix B: Environmental and Recreational Attribute Data

Table B-1 NCNA Focus Area Mapping Attributes

Attribute	Source(s)
Active Bald Eagle Nests	NHDPlus V2, USFWS, CPW
Arkansas Darter	CNHP, CPW, USFWS
Arkansas Wilderness Areas	
Audubon Important Bird Areas	Audubon
Birding Trails	Audubon
BLM – Wilderness Study Areas	
Bluehead Sucker	CNHP, CPW, USFWS
Boreal Toad	CNHP, CPW, USFWS
Brassy Minnow	CNHP, CPW, USFWS
Colorado Outstanding Waters	CDPHE WQCD
Colorado Pikeminnow	CNHP, CPW, USFWS
Common Garter Snake	CNHP, CPW, USFWS
Common Shiner	CNHP, CPW, USFWS
CWCB Instream Flow Water Rights	
CWCB Natural Lake Level Water Rights	
Ducks Unlimited Projects	Ducks Unlimited
Eligible Wild and Scenic	
Federally Listed Critical Habitat	NHDPlus V2, USFWS
Flannelmouth Sucker	CNHP, CPW, USFWS
Flatwater Boating	
GMUG Wilderness Area Waters	
Hebron Slough Ponds	
High Recreation Lakes and Reservoirs	
High Recreation Rivers	
Humpback Chub	CNHP, CPW, USFWS
Important Reservoirs, Lakes, and Ponds	
Iowa Darter	CNHP, CPW, USFWS
Lake Chub	CNHP, CPW, USFWS
Lake Fishing	
Least Tern	CNHP, CPW, USFWS
Lesser Prairie Chicken	CNHP, CPW, USFWS
Northern Cricket Frog	CNHP, CPW, USFWS
Northern Leopard Frog	CNHP, CPW, USFWS
Northern Redbelly Dace	CNHP, CPW, USFWS
Other Fishing Streams and Lakes	
Peregrine	CNHP, CPW, USFWS
Piping Plover	CNHP, CPW, USFWS

Attribute	Source(s)
Plains Minnow	CNHP, CPW, USFWS
Preble's Meadow Jumping Mouse	CNHP, CPW, USFWS
Pueblo Fishing	
Rafting / Kayaking / Flatwater Reaches	
Rare Plants	
Razorback Sucker	CNHP, CPW, USFWS
Recreational In-Channel Diversion Structures	
Reservoir and Lake Fishing	
Rio Grande Chub	CNHP, CPW, USFWS
Rio Grande Sucker	CNHP, CPW, USFWS
River and Stream Fishing	
River Otter	CNHP, CPW, USFWS
Roundtail Chub	CNHP, CPW, USFWS
Sandhill Crane	CNHP, CPW, USFWS
Significant Plant Communities	
Stonecat	CNHP, CPW, USFWS
Suckermouth Minnow	CNHP, CPW, USFWS
Waterfowl Habitat	
Waterfowl Hunting / Viewing	
Whitewater Boating OR Rafting	
Wood Frog	CNHP, CPW, USFWS
Yellow Mud Turtle	CNHP, CPW, USFWS
Additional Wilderness Areas and Wilderness Study Areas	
Arkansas Headwaters Recreation Areas	
Arkansas State Wildlife Areas and State Fishing Units	
Bald Eagle Sites	NHDPlus V2, USFWS, CPW
Bald Eagle Winter Concentrations	NHDPlus V2, USFWS, CPW
Bonytail Chub	CNHP, CPW, USFWS
Camelback Roubideau Wilderness Study Area Waters	
Colorado River Cutthroat Trout	CNHP, CPW, USFWS
Durango Natural Studies	
Fish Hatchery	
Gold Metal Trout Lakes	
Gold Metal Trout Streams	
Greater Sandhill Crane	CNHP, CPW, USFWS
Greenback Cutthroat Trout	CNHP, CPW, USFWS
Important Wetlands	NHDPlus V2, FEMA, NLCD, Landfire, NWI
Kayaking	

Attribute	Source(s)
National Wetlands Inventory	NHDPlus V2, FEMA, NLCD, Landfire, NWI
Osprey Active Nest Site	NHDPlus V2, USFWS, CPW
Osprey Foraging Area	NHDPlus V2, USFWS, CPW
Plains Leopard Frog	CNHP, CPW, USFWS
Plains Orangethroat Darter	CNHP, CPW, USFWS
Rafting / Kayaking	
Rare Aquatic-Dependent Plants	
Rare Plant Communities	
Razorback Sucker, Humpback Chub, Colorado Pikeminnow	CNHP, CPW, USFWS
Rio Grande Cutthroat Trout	CNHP, CPW, USFWS
Riparian / Wetlands	NHDPlus V2, FEMA, NLCD, Landfire, NWI
River Otter Sightings	CNHP, CPW, USFWS
Sandhill Crane Staging / Nesting Areas	NHDPlus V2, USFWS
Significant Fishing Waters	
Significant Riparian / Wetland Communities	NHDPlus V2, FEMA, NLCD, Landfire, NWI
Significant Riparian / Wetland Plants	NHDPlus V2, FEMA, NLCD, Landfire, NWI
Signification Fishing Waters	
Southwestern Willow Flycatcher	CNHP, CPW, USFWS
Stream Fishing	
Wetlands	NHDPlus V2, FEMA, NLCD, Landfire, NWI
Whitewater Boating	
Wilderness Area Waters	
Wildlife Viewing and Waterfowl Hunting	
WQCD Outstanding Waters	CDPHE WQCD
Aquatic_Ec	
Geomorph_F	
Rec_Boatin	
RICD	
RipWet_Eco	NHDPlus V2, FEMA, NLCD, Landfire, NWI
Trout Lakes	
Trout Streams	
Water_Qual	CDPHE WQCD
Waterfowl Hunting	

Table B-2 Attribute Consolidation

Original Attributes	Consolidated Attribute	Source(s)
Colorado Outstanding Waters	Colorado Outstanding Waters	CDPHE WQCD
WQCD Outstanding Waters		
Gold Medal Trout Lakes	Gold Medal Trout Lakes	CPW
Trout Lakes		
Gold Medal Trout Streams	Gold Medal Trout Streams	CPW
Trout Streams		
Lake Fishing	CPW Fishing Atlas	CPW
Reservoir and Lake Fishing		
Other Fishing Streams and Lakes		
Pueblo Fishing		
Significant Fishing Waters		
River and Stream Fishing		
Stream Fishing		
Arkansas State Wildlife Areas and State Fishing Units		
Rec_Boatin	Recreational Boating/Kayaking/Rafting	BLM, USFS
Flatwater Boating		
Rafting / Kayaking / Flatwater Reaches		
Kayaking		
Rafting / Kayaking		
Whitewater Boating OR Rafting		
Whitewater Boating		
Arkansas Headwaters Recreation Areas		
Significant Riparian / Wetland Communities	National Wetlands Inventory	NWI
Significant Riparian / Wetland Plants		
Riparian / Wetlands		
RipWet_Eco		
National Wetlands Inventory		
Important Wetlands		
Wetlands		
Aquatic_Ec		
Rare Plants	Plant Communities	
Rare Plant Communities		
Significant Plant Communities		
Rare Aquatic-Dependent Plants		
Audubon Important Bird Areas	Important Bird Areas	Audubon
Birding Trails		
Waterfowl Habitat	CPW Fishing and Hunting	CPW
Wildlife Viewing and Waterfowl Hunting		
Waterfowl Hunting / Viewing		
Waterfowl Hunting		
Sandhill Crane	Sandhill Crane Habitat	CPW
Sandhill Crane Staging / Nesting Areas		
River Otter	River Otter Habitat	CPW
River Otter Sightings		
Additional Wilderness Areas and Wilderness Study Areas	Wilderness Areas	BLM
Wilderness Area Waters		
Arkansas Wilderness Areas		
BLM Wilderness Study Areas		

GMUG Wilderness Area Waters

Table B-3 Archived Attributes

Original Attribute	Reason for Dropping
Razorback Sucker, Humpback Chub, Colorado Pikeminnow	Separate attribute layers for Razorback Sucker, Humpback Chub, and Colorado Pikeminnow already exist
Important Reservoirs, Lakes, and Ponds	No public data sources/datasets available
Recreational In-Channel Diversion Structures	An RICD dataset already exists
Durango Natural Studies	No public data sources/datasets available
High Recreation Lakes and Reservoirs	No public data sources/datasets available; other attributes related to water recreation (ex. RICD, recreational boating/kayaking/rafting, CPW fishing atlas) provide associated information
High Recreation Rivers	No public data sources/datasets available; other attributes related to water recreation (ex. RICD, recreational boating/kayaking/rafting, CPW fishing atlas) associated related information
Brassy Minnow	No public data sources/datasets available
Colorado River Cutthroat Trout	No public data sources/datasets available; other attributes related to cutthroat trout (ex. gold medal trout lakes and streams) provide associated information
Hebron Slough Ponds	No public data sources/datasets available
High Recreation Lakes and Reservoirs	No public data sources/datasets available; other attributes related to recreational waters (ex. CPW fishing atlas, Recreational Boating/Kayaking/Rafting, and CPW fishing and hunting) provide associated information
High Recreation Rivers	No public data sources/datasets available; other attributes related to recreational waters (ex. CPW fishing atlas, Recreational Boating/Kayaking/Rafting, and CPW fishing and hunting) provide associated information
Northern Redbelly Dace	No public data sources/datasets available
Rio Grande Cutthroat Trout	No public data sources/datasets available; other attributes related to cutthroat trout (ex. gold medal trout lakes and streams) provide associated information

Table B-4 Updated Attributes

Attribute	Source(s)	Year Data Last Updated
Active Bald Eagle Nests	CPW	2017
Arkansas Darter	IUCN	2018
Important Bird Areas	Audubon	
Bluehead Sucker	IUCN	2018
Boreal Toad	CPW	2017
Colorado Outstanding Waters	CDPHE WQCD	2018
Colorado Pikeminnow	USFWS	2018
Common Garter Snake	CPW	2017
Common Shiner	IUCN	2018
CWCB Instream Flow Water Rights	CWCB	2014
CWCB Natural Lake Level Water Rights	CWCB	2014
Ducks Unlimited Projects	DU	2008
Eligible Wild and Scenic	USFS	2018
Federally Listed Critical Habitat	USFWS	2018
Flannelmouth Sucker	IUCN	2018
Recreational Boating / Kayaking / Rafting	BLM	2018
Humpback Chub	USFWS	2018
Iowa Darter	IUCN	2018
Lake Chub	IUCN	2018
CPW Fishing Atlas	CPW	2015
Least Tern	CPW	2017
Lesser Prairie Chicken	CPW	2017
Northern Cricket Frog	USGS	2013
Northern Leopard Frog	USGS	2013
Peregrine	CPW	2017
Piping Plover	CPW	2017
Plains Minnow	IUCN	2018
Preble's Meadow Jumping Mouse	CPW	2017
Plant Communities		
Razorback Sucker	USFWS	2018
Rio Grande Chub	IUCN	2018
Rio Grande Sucker	IUCN	2018
River Otter Habitat	CPW	2017
Roundtail Chub	IUCN	2018
Sandhill Crane Habitat	CPW	2017
Stonecat	IUCN	2018
Suckermouth Minnow	IUCN	2018
CPW Fishing and Hunting	CPW	2017
Wood Frog	USGS	2013
Yellow Mud Turtle	USGS	2013
Wilderness Areas	BLM	2018
Bald Eagle Sites	CPW	2017
Bald Eagle Winder Concentration	CPW	2017
Bonytail Chub	USFWS	2018
Camelback/Roubideau Wilderness Study Area	BLM	2018

Attribute	Source(s)	Year Data Last Updated
Fish Hatchery	USFWS	2018
Gold Medal Trout Lakes	CPW	2018
Gold Medal Trout Streams	CPW	2018
Greater Sandhill Crane	CPW	2017
National Wetlands Inventory	USFWS	2018
Osprey Active Nest Site	CPW	2017
Osprey Foraging Area	CPW	2017
Plains Leopard Frog	IUCN	2017
Plains Orangethroat Darter	IUCN	2018
Southwestern Willow Flycatcher	USGS	2013
Geomorphology	USGS	1992
RICD		
Water Quality	CDPHE WQCD	2016

Table B-5 Macro-Attribute Classifications

Updated E&R Attribute	Macro-Attribute Classification
Arkansas Darter	Fish
Bluehead Sucker	
Bonytail Chub	
Colorado Pikeminnow	
Common Shiner	
Flannelmouth Sucker	
Humpback Chub	
Iowa Darter	
Lake Chub	
Plains Minnow	
Plains Orangethroat Darter	
Razorback Sucker	
Rio Grand Sucker	
Rio Grande Chub	
Roundtail Chub	
Southwestern Willow Flycatcher	
Suckermouth Minnow	Wildlife
Active Bald Eagle Nests	
Bald Eagle Sites	
Boreal Toad	
Common Garter Snake	
Greater Sandhill Crane	
Important Bird Areas	
Least Tern	
Lesser Prairie Chicken	
Northern Cricket Frog	
Northern Leopard Frog	
Osprey Active Nest Site	
Osprey Foraging Area	
Peregrine	
Piping Plover	
Plains Leopard Frog	
Preble's Meadow Jumping Mouse	
River Otter Habitat	
Sandhill Crane Habitat	
Stonecat	
Woodfrog	
Yellow Mud Turtle	Recreation and Economy
CPW Fishing and Hunting	
CPW Fishing Atlas	
Fish Hatchery	
Gold Medal Trout Lakes	
Gold Medal Trout Streams	
Recreational Boating / Kayaking / Rafting	
RICD	

CWCB Instream Flow Water Rights	Water Rights
CWCB Natural Lake Level Water Rights	
Camelback/Roubideau Wilderness Study Area	Important Wilderness Areas
Ducks Unlimited Projects	
Eligible Wild and Scenic	
Federally Listed Critical Habitat	
Wilderness Areas	Physical Environment
Colorado Outstanding Waters	
Geomorphology	
National Wetlands Inventory	
Plant Communities	
Water Quality	

