

COLORADO RIVER RECOVERY PROGRAM
FY 2017 ANNUAL PROJECT REPORT

RECOVERY PROGRAM
PROJECT NUMBER: 170

I. Project Title: Development of a Centralized PIT tag Database for the San Juan and Upper Basin Recovery Programs

II. Bureau of Reclamation Agreement Number(s): R14AC00084

Project/Grant Period: Start date (Mo/Day/Yr): 10/1/2016
End date: (Mo/Day/Yr): 9/30/2017
Reporting period end date: 11/13/2017
Is this the final report? Yes _____ No X

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IV. Abstract: The Colorado Natural Heritage Program (CNHP) at Colorado State University is developing an online data system (the Species Tracking, Research and Monitoring System or STReAMS) for the Bureau of Reclamation and the Upper Colorado and San Juan River Recovery Programs. CNHP is beginning the fourth full year of the project. In March 2017, Program personnel and partners explored the website in detail at a hands-on, interactive workshop at Colorado State University. During the workshop, participants reviewed the data model and learned basic navigation skills. Feedback was solicited to address data needs and guide Year 3 priorities. Throughout Year 3, new tools were created for batch uploading data and for managing uploads and rejected records, website help was greatly improved, and revision tracking was activated. While some features will

FY 2017 Ann. Rpt. Project # 170 - 2

continue to be refined in Year 4, the database has enhanced functionality and can be accessed at streamsystem.org (registration is required).

Year 3 (FY2017) completes major development milestones. The focus of Year 4 and Year 5 switches to maintenance and enhancements. The current five year agreement ends on June 30 2019.

V. Study Schedule:
FY14-FY19

VI. Relationship to RIPRAP:
General Recovery Program

V.A.1. Conduct interagency data management program to compile, manage, and maintain all research and monitoring data collected by the Recovery Program.

VII. Accomplishment of FY 2017 Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

Deliverables thus far include the release of an enhanced version of the website at <https://streamsystem.org/>. The website is updated periodically, with release notes accessible on the website. Major accomplishments in Year 3 include 1) Development of batch upload tools for PIA locations, samples, stocking events, tag lots, and master tag codes; 2) New web pages and enhanced tools to manage uploads and fix rejected records; 3) New functionality to undo an upload; 4) Revision tracking to track updates, inserts or deletes made by a user or upload, and custom SQL views to easily observe and query change tables; and 5) Database-driven help content describing all data types and fields for each type on the website. Training, webinars, and other correspondence with recovery program personnel and partners was ongoing throughout Year 3.

Throughout Years 1-3, schedule adjustments have been made for two main reasons: 1) Personnel changes at CNHP, and 2) The addition of a dedicated Recovery Program Database Manager. Discussions with a dedicated Database Manager have shifted priorities slightly to help meet current needs. Lastly, the project was started once funding came through which was several months later than originally proposed. Certain features, like flagging, relied on larger discussions with Program staff, through an in-person workshop and online meetings. Other features, like upload tools and revision tracking, relied on discussions with Database Managers.

More detailed tasks for each month are listed below.

List of Completed Tasks (12/1/2016 – 11/3/2017)

- **December 2016**
 - Finalized batch upload code for rare fish and stocked fish: set permissions,

FY 2017 Ann. Rpt. Project # 170 - 3

added individual notes if encounter documents mortality, fixed deploy attributes involving multiple tags, fixed stocking fields that were not getting populated, and altered upload notes that are saved with upload.

- Finalized manage uploads page for rare fish and stocked fish: scrolling and CSS (styling) updates, added new filters to rejected records, made rejected records lists editable by Database Managers, and set rejected records table to load via server side.
 - Coded stocking event and sample batch uploads.
 - Quality controlled duplicate issues discovered by Julie Stahl where the same records were in different templates (loaded in on 3 spp and 126B), and duplicate detections that were imported after activating PIA location uploads. Some of the detections had daily summaries in the old Access db and had already been loaded in during the initial upload. Compared records and sent spreadsheets to Julie Stahl and Travis Francis for review along with recommended fixes.
 - Fixed duplicate detections for White River and Price-Stubb. Left in old encounters where raw PIA data were missing and linked those encounters to the PIAs. Deleted the two PIA “studies”, which were not real studies.
 - Reviewed all keys in the database and set foreign keys for new tables.
 - Identified records with more than one stocking encounter and sent to Database Managers for review.
 - Fixed upload errors from Nov 2016 upload where deploy attributes for 400 khz tags were erroneously set based on the deploy attributes of the 134 khz tag when both tags are associated with the same fish (50 records). Fixed existing individuals missing stocking attributes (160 records). (these bugs were fixed in Dec before the upload tool was released, but after CNHP had uploaded all of the 2016 project data)
 - Reformatted tag lot field on tag page so it preselects lots based on text typed by the user instead of listing all 13,000+ lots which was bogging down the page.
 - Fixed issues with breadcrumbs after saving on an edit page.
 - Received PIA status download from Peter Mackinnon (permanent outages, temporary outages, new configurations, etc.) and updated information about PIAs in the database accordingly.
 - Processed and imported PIA data for Green River Canal and Tusher Diversion PIA for program projects
 - Logistics for March workshop at CSU
- **January 2017**
 - Deleted Tusher Diversion duplicate encounters from 8/14/2016 – 8/30/2016 that were accidentally added twice during the manual PIA upload process.
 - Added user flags to webpages
 - Fixed Date bugs on PIA location page
 - Fixed bug where exceeding tag code filter limit resulted in empty download with no notification to user.
 - Exported and reviewed studies with Database Manager to start clean-up

FY 2017 Ann. Rpt. Project # 170 - 4

process.

- Researched how to connect the database tools directly to Loggernet to update PIA data on the fly.
 - Fixed issues with Manage Uploads page: scrolling in full screen mode, length of field names, and pop-ups for all fields with domain lists.
 - March workshop RSVPs.
 - Deleted encounters in STReAMS that were linked to test tags and changed tag status to test to prevent future issues (test tag list came from Peter Mackinnon).
 - Added DBA notes in batch for records with Gila discrepancies that were reviewed by Travis Francis (110 records).
 - Began coding PIA batch uploads. Reformatted data in PIA data tables and added fields to accommodate PIA batch upload tool. Consolidated dat files and applied naming convention.
 - Php upgrades to server.
 - Performed extensive testing on the website and wrote release notes.
 - New release on 1/13 activating batch uploads for rare fish, stocked fish, samples, and stocking events
 - Fixed permissions on live server which prevented batch uploads from working
- **February 2017**
 - Added new field for Other Tag 134 to rare fish template to accommodate fish with multiple 134 khz tags and changed batch upload code to search on three tag fields when determining whether new records are warranted, plus added error-checking to the new tag field.
 - Added new field for Source Org (larval source) to stocking template and updated batch upload code to error-check and populate this field.
 - Fixed bug to prevent resubmits from being run twice on the same record and importing duplicate encounters. Changed refresh rate to prevent confusion.
 - Added search boxes for tag codes to all rejected records lists.
 - Changed flagging design to incorporate permanent flags (stored in core tables) and temporary flags (stored in related tables) and changed batch upload code to set flagging to new way. Change temp flags to cascade delete using a composite key (data type + data type ID).
 - Added unique constraints to all code fields in the lookup tables used during batch uploads to prevent the wrong code from getting selected (if duplicate codes existed, the system was picking the first one).
 - Reset project biologist to require first and last name to prevent the wrong person from getting selected (if duplicate last names existed, the system was picking the first one)
 - Work with Database Managers on how to deal with Transfers in the database.
 - Create mini-Access databases of STReAMS data for Mark McKinstry to take into the field.
 - Tweaks to downloads: changed download message, fixed disposition in

FY 2017 Ann. Rpt. Project # 170 - 5

download file, added DBA flag and DBA notes. Made these updates to popular downloads too.

- Added lakes as valid hydro selections in the pop-up box during the batch uploads analyze phase.
- Backend deleted records from bad upload that incorrectly had tag codes missing.
- Fixed date sorting bug on detail pages.

- **March 2017**
 - Added pop-ups to display results of resubmitted records on the Manage Uploads page.
 - Wrote code to connect database to Loggernet to grab PIA dat files and restart coding PIA batch uploads.
 - Connected drop downs on the site directly to domain (D_) tables in the SQL database instead of hard coding values.
 - Increased tag code limit on Browse Encounters and Browse fish pages to 10,000 tags. Involves storing tag codes in text fields instead of database fields with restricted field lengths. Changed tag code filter box to use “=” instead of “like” for > 100 tag codes to improve performance.
 - Changed default sorting of all lists to improve performance.
 - Cleaned up tag lot attributes with Travis and Julie (noticed while writing exercises for workshop).
 - Prepared exercises for STReAMS workshop and worked with Database Manager on agenda.
 - Performed extensive testing on the website and wrote release notes.
 - New release on 3/10
 - Hosted workshop at CSU and final logistics (computer lab changes), plus four days total at workshop for Database Developer and PI to attend.
 - Collected and organized feedback and consulted with Database Managers to turn feedback into action items.

- **April 2017**
 - Added gear type filter to encounter page.
 - Disallow users to change their org.
 - Disallow duplicate grow out ponds on the individual details page.
 - Created Manage PIA Uploads page.
 - Created feedback emails and pop-ups for PIA upload data.
 - First round of testing PIA batch uploads and tweaked upload code based on testing results.
 - Performed extensive testing on the PIA batch upload tool.
 - Imported all available PIA data on live site using “update now” tool but kept page hidden.
 - Investigated performance issues on the test server and replaced problematic query.

- **May 2017**

FY 2017 Ann. Rpt. Project # 170 - 6

- Added additional filters and search boxes to Manage PIA Uploads page.
 - Fixed bug where encounter type was not getting set to detection during PIA uploads. Batch fixed encounter type for all PIA encounters uploaded in May.
 - Quiet release of PIA uploads and trained Database Manager on managing them.
 - Investigated oddities of McElmo Creek Aneth PIA data, confirmed it to be ok, and uploaded data.
 - Imported missing Flume PIA data from 3/29/2017 - 4/9/2017. Was able to get missing data from Peter Mackinnon.
 - Developed conceptual design for PIT tag distribution batch upload tools and developed templates (xlsx) for tag lot and master tag uploads. Ran logic by Travis.
 - Batch fixed Ray values that got imported as dates.
 - Fixed bugs on public registered user role (searching for list columns that had changed).
 - Cross-walked project biologists in old Access databases to real people in STReaMS. Batch imported project biologist to encounters (115,141 records)
- **June 2017**
 - Tweaks to PIA batch uploads: added error-checking on tag codes, changed warning and error feedback text, on “update now” button added user ID to upload table, captured upload errors in upload notes field, changed users who are emailed weekly about scheduled uploads, changed code to update next sequence ID after each record is processed instead of the end of the upload in case of an unforeseen interruption, fixed sorting issues, and incorporated tag status into the logic so shed or stuck tags are not added as encounters.
 - Full release of PIA Batch Uploads, with weekly scheduled import activated on Sunday nights.
 - New release on 6/2 with PIA uploads and wrote release notes.
 - Batch fixed PIA rejected records for McElmo Creek UT/CO line (615 records). The leading letter in the antenna codes changed in the middle of the dat file causing the records to be rejected.
 - Fixed bug on encounter page where study was constraining project biologist and encounter river.
 - Added new batch upload page for tag lots and master tags and added error-checking for the analyze process.
 - Wrote code to push tag lot and master tag data into database and reject records.
 - Developed Manage Lot Uploads page.
 - Split Hab1 and Hab2 into two fields in stocking events and samples to be consistent with the rest of the site.
 - Changed PIT tag lot terminology to be consistent everywhere on the site.
 - Performed extensive testing on the website and wrote release notes for PIT Distribution uploads.

FY 2017 Ann. Rpt. Project # 170 - 7

- New release on 6/27/2017 with PIT Distribution uploads.

- **July 2017**
 - Revised basins to include only 4 basins. Assigned all hydro areas to a basin. Updated cross-basin download filters and filters on Encounters page.
 - Made pervasive revisions to database schema (dropped tables, renamed fields, etc.) for consistency in preparation for advanced query builder. Updated all downloads, web pages, batch uploads, filters, etc. accordingly.
 - Tweaked PIA outage tables to not require both a begin and end outage date and added sequence IDs and notes.
 - Started Database Manager User Guide.
 - Tested specifications for file upload size and memory limits and reviewed huge data file from Scott.
 - Researched design for revision tracking.
 - Performed extensive testing on the website and wrote release notes.
 - New release on 7/20.
 - Wrote basic Undo upload code.
 - Added DBA flag, DBA notes, and user flags to tag page.
 - Added “none” as a filter option to many filters on Encounter page.
 - Beta testing on revision tracking using tag lots.
 - Added pop-up boxes to rejected records lists to accommodate date entry rules that span multiple fields (e.g. UTM zone must be filled out if UTM X and UTM Y have data).
 - Added new PIA error, “Invalid Data String”. Modified code to check length of data string as an extra QC measure.
 - Reviewed Tag Lot upload process with Travis Francis in preparation for the first batch upload of PIT distribution data by Travis. Ran it on test site first.

- **August 2017**
 - Batch calculated flags and DBA notes for existing invalid tag codes (codes with incomplete digits or symbols).
 - Incorporated error checking into resubmit for rejected records to prevent introducing new errors.
 - Added DBA and Temp flag filters on Browse Encounters and Browse Fish.
 - Discussed override options with Database Manager. Created override tool option to push invalid tag codes into the system.
 - Added DBA flags and notes to rejected records table so flags can get updated before resubmit or override.
 - Added upload detail pages for PIA uploads, stocking event uploads, and sample uploads.
 - Tightened up permissions, hid Sample details from all user except for Database Managers.

FY 2017 Ann. Rpt. Project # 170 - 8

- Changed lists to only show View Details button. All Deletes must now occur on a details page.
 - Fixed bug where resubmit was not calculating upload ID.
 - Added table of contents to tag details, sample details, and stocking event details
 - Revised batch upload tools to retain field recorded species and field recorded sex exactly as they were written in the field. These are now text fields with no error checking. The actual species and sex assigned to the individual goes into a separate field and is error-checked.
 - Created help database tables and developed help content for each data type. Revised web pages to pull field labels and tool tips directly from help database tables.
 - Wrote scripts to turn revision tracking on and off, and replace change tables when table schema changes occur.
 - Created BIN table in SQL Server to store non-native and non-tagged fish data.
 - Php upgrades to server.
 - Worked with Peter Mackinnon to set up connections to his new computer so CNHP can acquire dat files for PIAs on Biomark's new service plan.
 - Worked with Julie Stahli on SQL server connections.
 - Continued to develop content for the Database Manager User Guide.
- **September 2017**
 - Updated Delete button tool tips throughout the website to more clearly describe what is being deleted.
 - Finished online help content and hyperlinked help pages to detail pages.
 - Performed extensive testing on the website and wrote release notes
 - New release on 9/12
 - Created feedback emails and pop-ups for undo upload.
 - Added revision upload ID and revision person ID to each table participating in revision tracking.
 - Reformatted PNM Weir to have one array (instead of two) since the arrays use the same dat file. Uploaded all data using "Update Now" (2 new tags, 163 new fish, 19,722 encounters), added sequence gaps to outages.
 - Inactivated old Hogback Intake array and added new array for newly configured location. Ran uploads to update data accordingly, 2,970 encounters to wrap up old array, new array had 1 new tag, 6 new fish and 1,881 encounters.
 - Modified Undo upload code to incorporate more sophisticated logic. Tested and tweaked code based on testing results.
 - Updated web pages to capture revision person ID every time someone makes an edit to a page.
 - Turned on and tested revision tracking.
 - Wrote custom SQL views to easily query revisions and interpret results in change tables.
 - Continued to develop content for the Database Manager User Guide.

FY 2017 Ann. Rpt. Project # 170 - 9

- **October 2017**
 - Rewrote all downloads as SQL views to centralize downloads and make future updates more efficient.
 - Created new download for individuals.
 - Tweaked encounter download file: removed obsolete fields, split encounter date and time into two fields, and rearranged flagging.
 - Added error-checking to new tag codes added on the website using the New Encounter and New Fish buttons.
 - Added query to grab records related to rejected records for new download on Manage Uploads page.
 - Added Other Tag 134 to rejected records table.
 - Imported old Dolores River PIA data prior to 5/2016 that had not previously been imported to STReaMS (5,625 encounters).
 - Tested and tweaked revision tracking based on testing.
 - Tweaked Undo upload code based on revision tracking testing.
 - Continued to develop content for Database Manager User Guide.
 - Performed extensive testing on the website and wrote release notes.

- **November 2017 (through 11/3/2017)**
 - Investigated updates displaying on multiple change rows from the batch upload code (essentially changes are made in steps instead of all at once resulting in multiple pairs of change rows instead of one pair).
 - Upgraded live SQL database to support revision tracking features and rebooted server.
 - New release on 11/3.

VIII. Additional noteworthy observations:

As of November 10, 2017 the database has:

- 1,628,254 PIT Tags
- 1,079,525 Individual Fish
- 1,717,729 Encounters

IX. Recommendations: Server maintenance will continue to be the responsibility of CNHP. Recommendations for new database features in Year 4 are listed below. CNHP will continue to work closely with Database Managers to adapt to emerging needs.

- Develop advanced SQL Query Builder and Query Builder User Guide
- Create a collaborative resources page to share SQL queries and other helpful information
- Develop QC Tools
 - Change relationships (merge/split records)
 - QC Encounter attributes
 - Recalculate spatial attributes
- Create calculated fields

FY 2017 Ann. Rpt. Project # 170 - 10

- Known distance travelled (based on Encounter history)
- Days in river
- Batch Upload enhancements
- Bug fixes
- Internal testing and stress tests
- Update online help, data dictionary, user manuals, and system documentation
- Train Recovery Program participants on new features and enhancements
- Other priorities identified by Recovery Program Database Managers

X. Project Status:

Ongoing

XI. FY 2017 Budget Status

- A. Funds Provided: \$0 (FY17 tasks were covered with previous years' funding)
- B. Funds Expended: \$0
- C. Difference: \$0
- D. Percent of the FY 2017 work completed, and projected costs to complete: 100%
- E. Recovery Program funds spent for publication charges: \$0

XII. Status of Data Submission (Where applicable):

Not Applicable

XIII. Signed: Amy Greenwell /s/ 11/13/17
Principal Investigator Date

FY 2017 Ann. Rpt. Project # 170 - 12

Managers, it was determined that getting data in and cleaned was the biggest priority. In line with these priorities, we developed web pages and tools to manage rejected records and developed a flagging system to track data issues and clearly communicate issues to users. The Advance Query Builder and custom functions have been pushed to Year 4.

See Appendix 1-4 for status of work accomplished compared to proposed tasks in original proposal, and year 4 task list.

FY 2017 Ann. Rpt. Project # 170 - 13

Appendix 1. Proposed schedule for Year 1 and status of actual work accomplished. Shaded boxes indicate the proposed start of tasks in original proposal.

YEAR 1	Oct-14 - Dec-14	Jan-14 - Mar-15	Apr-15 - Jun15	Jul-15 - Sep-15
Work closely with investigators to assess database needs and design	Ongoing	Ongoing	Ongoing	Ongoing
Purchase and set up server to host database	Complete			
Server security, database backups and server maintenance		Ongoing	Ongoing	Ongoing
Prepare database mockups		Complete		
Develop SQL server database		In Progress	Complete	
QA/QC existing MS Excel and MS Access databases and reformat as needed				Complete
Import existing fishes data into MS SQL Server				Complete
Code web interface for entering and retrieving data				Complete
Code management system for managing users and permissions		In Progress	In Progress	Complete
Develop canned queries for basic downloads				Complete
Create online help, user manual and system documentation			In Progress	In Progress
Internal testing and stress tests		Ongoing	Ongoing	Ongoing
Post basic version of database online				Complete
Train USFWS and BOR personnel to use the database				Ongoing
Prepare quarterly, semi-annual and annual reports		Complete		
Project Management and CSU Compliance	Ongoing	Ongoing	Ongoing	Ongoing

FY 2017 Ann. Rpt. Project # 170 - 14

Appendix 2. Proposed schedule for Year 2 and status of actual work accomplished through September 2016. Shaded boxes indicate the proposed start of tasks in original proposal.

YEAR 2	Oct-15 - Dec-15	Jan-15 - Mar-16	Apr-16 - Jun-16	Jul-16 - Sep-16
Work closely with investigators to assess database needs and design	Ongoing	Ongoing	Ongoing	Ongoing
Update online help, user manual and system documentation	In Progress	In Progress	In Progress	In Progress
Server security, database backups and server maintenance	Ongoing	Ongoing	Ongoing	Ongoing
Develop online Data Management System for quality control and database administration	Ongoing	Ongoing	Ongoing	Ongoing
Develop online Query Builder for customizing data downloads				
Develop upload capabilities for batch files and data recorded by PIAs			In Progress	In Progress
Develop revision tracking component				
Set up GitHub defect tracking	-	-	-	-
Set up tracking system using Google Analytics to track public use of the site	Complete			
Internal testing and stress tests	Ongoing	Ongoing	Ongoing	Ongoing
Post advanced version of the database online				Ongoing
Train USFWS and BOR personnel on using and managing the database	Ongoing	Ongoing	Ongoing	Ongoing
Prepare quarterly, semi-annual and annual reports	Complete			
Project Management and CSU Compliance	Ongoing	Ongoing	Ongoing	Ongoing

FY 2017 Ann. Rpt. Project # 170 - 15

Appendix 3. Proposed schedule for Year 3 and status of actual work accomplished through November 3, 2017. Shaded boxes indicate the proposed start of tasks in original proposal.

YEAR 3	Oct-16 - Dec-16	Jan-16 - Mar-17	Apr-17 - Jun-17	Jul-17 - Nov-17
Work closely with investigators to assess database needs and design	Ongoing	Ongoing	Ongoing	Ongoing
Server security, database backups and server maintenance	Ongoing	Ongoing	Ongoing	Ongoing
Develop online Data Management System for quality control and database administration	In Progress	In Progress	In Progress	In Progress
Develop online Query Builder for customizing data downloads				Pushed back to Year 4
Develop upload capabilities for batch files and data recorded by PIAs	In Progress	Complete		
Finalize online help, user manual and system documentation	In Progress	In Progress	In Progress	Complete
Enhance features and functionality based on user feedback	In Progress	In Progress	In Progress	Ongoing
Internal testing and stress tests	Ongoing	Ongoing	Ongoing	Ongoing
Develop revision tracking component		In Progress	In Progress	Complete
Set up GitHub defect tracking	-	-	-	-
Post enhanced version of the database online				Complete
Train USFWS and BOR personnel on using and managing the database	Ongoing	Ongoing	Ongoing	Ongoing
Transfer server and database to BOR or setup maintenance agreement				Complete
Prepare quarterly, semi-annual and final reports	Complete			Complete
Project Management and CSU Compliance	Ongoing	Ongoing	Ongoing	Ongoing

Appendix 4. Proposed tasks for Year 4.

Server Maintenance

- Maintain the server, server security, and perform regular database backups
- Maintain the test server and development environment
- Perform necessary software upgrades including Windows Updates, SQL Server updates, and PHP Updates. Ensure all code performs as expected following updates.
- Assess overall performance and optimize resources as needed
- Maintain Database Manager credentials to access SQL Server

Website Maintenance and New Features

- Develop advanced SQL Query Builder and Query Builder User Guide
- Create a collaborative resources page to share SQL queries and other helpful information
- Develop QC Tools
 - Change relationships (merge/split records)
 - QC Encounter attributes
 - Recalculate spatial attributes
- Create calculated fields
 - Known distance travelled (based on Encounter history)
 - Days in river
- Batch Upload enhancements
- Bug fixes
- Internal testing and stress tests
- Update online help, data dictionary, user manuals, and system documentation
- Train Recovery Program participants on new features and enhancements
- Other priorities identified by Recovery Program Database Managers

Project Management

- Prepare annual reports
- Perform project management and CSU compliance
- Maintain regular communication with Database Managers