Development of a Centralized PIT tag Database for the San Juan and Upper Basin Recovery Programs

CSU cooperative agreement number R14AC00084

Period of performance Oct 1 2015– Sept 30, 2016.

Lead Agency: Colorado Natural Heritage Program, Colorado State University

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I: Abstract:

The Colorado Natural Heritage Program (CNHP) at Colorado State University is developing an online data system (Species Tracking, Research and Monitoring System, STReaMS) for the Bureau of Reclamation and the Upper Colorado and San Juan River Recovery Programs. The CNHP is beginning the third full year of the project. In Year 2, CNHP presented an overview of the website at the 37th annual researchers meeting in January 2016 at Fort Lewis College in Durango. In March 2016, 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 2 priorities. Throughout Year 2, new web pages and data tables were developed to fully implement tracking of Individual Fish, Encounters, Studies, PIA Locations, PIT Tag Lots and PIT Tags. Major data errors were identified and processes were put in place to prevent data integrity issues moving forward. PIA detections were imported on an ongoing basis. Data collected during 2015 sampling projects and stocking events were loaded into the database. Batch upload tools were activated for sampling projects and stocking events. Web pages were developed to track uploads, set rules, and manage upload errors. A new user role with limited viewing privileges was developed so any

registered user can safely access the site. While some features will continue to be refined in FY17, the database is fully functional and can be accessed at streamsystem.org (registration is required).

II.   Study schedule: FY14-FY18

III.   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.

IV.   Accomplishments during FY 2016: Tasks and Deliverables, Discussion of Initial Findings and Shortcomings:

     Deliverables thus far include the release of a standard version of the website at streamsystem.org and upload tools for sampling projects and stocking events. The website is updated periodically, with release notes, meeting minutes, and presentations all accessible on the website. Major accomplishments in Year 2 include 1) Detailed web pages for all data types such as Individual Fish, Encounters, PIA Locations, Studies, PIT Tag Lots, and PIT Tags; 2) More sophisticated search tools for querying data; 3) Identification of major data errors; 3) Batch import of all 2015 data from sampling projects and stocking events; 4) Implementation of a new role with limited viewing privileges to accommodate public use of the site; 5) Development of batch upload tools to import data from sampling projects and stocking events; and 6) Development of web pages to managed uploads, fix data errors, and resubmit rejected records. Training, webinars, and other correspondence with recovery program personnel and partners was ongoing throughout Year 2.

     Several limitations were encountered during Year 2. Changes in CNHP personnel at the onset of the year affected the timing of milestones. This limited our ability to reach milestones as originally proposed and the schedule was adjusted to allow extra time for the hiring and training of new staff. Also, the ability to clean up pre-existing data errors was limited due to the intensive amount of time needed to fix errors without custom tools to facilitate data clean-up on the website. The recovery program now has a dedicated Database Manager. This new hire, along with the development of quality control tools, will allow these data issues to be fixed in a timely manner during Year 3.

     More detailed tasks are listed below.

     List of Completed Tasks (12/1/2015-12/1/2016):
- **December 2015:**
    - Completed job description for new Web and DB Developer hire at CNHP.
    - Added data for Field Recorded Species, Field Recorded Sex and UTM

coordinates into TBL_Encounters.
  o Developed php script to import processed PIA detection data.
  o Processed and imported PIA data for Price River Woodside and Confluence, McElmo Creek, Hogback Bypass and Intake, White River Bonanza Bridge, Price-Stubb, and Green River Canal.

- **January 2016:**
  o Prepared presentation and attended Annual Researchers meeting in Durango.
  o Completed first draft of the data dictionary on the website.
  o Set up folders and tables for raw data files and linked 2014 Encounters to the raw data source files.
  o Added unique constraint to hydrological areas name field.
  o Added an inactive flag to inactivate users.
  o Tested website and pushed new release to live website on January 15, 2016.
  o Developed PIT Tag Lots list page and PIT Tag Lots Details.

- **February 2016:**
  o Added new filters to the Browse Encounters page: Harvest Type, Release Type, Year Class, Federal Status, Mortality Flag.
  o Added Recapture, Field Recorded Species and Field Recorded Sex to Encounter Details webpage.
  o Prepared exercises for the STReaMS March workshop at CSU and set up workshop logistics.
  o Finalized schema for the new Samples table to capture effort data and created xlsx template for site effort data for rare fish.
  o Trained new CSU programmer Ben Johnke on STReaMS.
  o Completed internal CSU hiring tasks, received approval for hiring and posted Web and DB Developer position.

- **March 2016:**
  o Tested website and pushed new release to live website on March 11, 2016.
  o Finalized hands-on exercises and agenda for March training workshop.
  o Updated field collection templates for rare fish and stocking data.
  o Adjusted test server specifications to handle high load for workshop.
  o Led hands-on workshop for Recovery Program staff and partners.
  o Data clean-up: Fixed fish with 3 or more tags in STReaMS (62 fish). Fixed fish with chub species discrepancies in STReaMS (271 records).
  o Identified species conflicts between basins (308 records) and within each basin (286 SJ records, 1151 UC records). Sent lists of problem records to Travis Francis and Scott Durst for review.

- **April 2016:**
  o Performed interviews, made final hiring decision and completed paperwork for new hire.

- **May 2016:**
  o Developed conceptual design for batch upload process which includes: data validation, data reconciliation, conflict detection and conflict resolution.

- o Adjusted templates to facilitate batch uploads and cross-walked templates to SQL Server data tables.
  - o Made data entry templates downloadable from website.
  - o With the help of DB Managers, identified rules for each data field in the templates.
  - o Added related Tags and Encounters to the Tag Lots Details page and activated downloads for PIT Tag Lots.
  - o Added 7 program elements to the Study table.
  - o Translated values in True/False fields and domain constants in download files from integers to meaningful labels.
  - o Adjusted downloads to accommodate fish with more than two tags.
- **June 2016:**
  - o Populated TBL_Encounters with disposition types.
  - o Added new look-up table web page for Disposition Types.
  - o Added the ability to toggle between Fish and Encounter lists.
  - o Added new fields to Encounter Details and download files: Study, Standard Length, Disposition Type, and Detection Frequency.
  - o Created Samples table and Sample Edit page under Studies.
  - o Added new role to Studies called Data Lead.
  - o Developed conceptual design for Stocking Events in STReaMS.
  - o Added a new page for PIT Tags, with the ability to search Tags, View Details, and download Tag Details.
  - o Start of new hire Puja Gurung. Trained Puja on STReaMS.
  - o Worked with Peter MacKinnon at USU to connect more PIAs to Loggernet.
- **July 2016:**
  - o Developed detailed error list for batch upload errors and flags.
  - o Created tables to store data for Analyze and Reconciliation processes.
  - o Added new table to store Upload Rules.
  - o Began coding Analyze and Reconciliation processes for batch uploads.
  - o Created Upload page for Sampling projects and Stocking data.
  - o Developed new Role of Registered User with limited viewing privileges.
  - o Improved filtering capabilities on Browse Fish and Browse Encounters pages so multiple values can be selected at once.
  - o Added a new filter for Recaptures to Browse Encounters page.
  - o Processed and imported PIA data for Green River Canal and White River – Bonanza Bridge.
  - o Connected to outside server through CNHP Cloud to download PIA data that are only accessible through the new Biomark Service.
  - o Tested new features on website.
- **August 2016:**
  - o Added Tag attributes for Tag Type, Tag Status, Deploy Date, Deploy River, Deploy River Mile, and Deploy Encounter.
  - o Sent list of bad tag codes (305 records) to Travis Francis and Scott Durst.
  - o Redesigned web pages so clicking Details from a List page opens a

new tab. Adjusted bread crumbs on all pages to accommodate new tab behavior.
- o Added a new download for Look-up table values and codes.
- o Conceptually reconfigured PIA data pages to better match data.
- o Created new database tables for an enhanced Database Dictionary and tool tips so content can be managed by the Database Manager.
- o Continued to write code for the batch uploads Analyze and Reconciliation process.
- o Processed and imported PIA data for Tusher Diversion.
- o Performed extensive testing on the website and wrote release notes for upcoming release.
- **September 2016:**
  - o New release of STReaMS on September 1, 2016.
  - o Continued to write code for the batch uploads Analyze and Reconciliation process.
  - o Added Uploads list to My Profile page and developed Upload Details page.
  - o Configured Uploads as jobs so they can run off-line and distribute emails.
  - o Reconfigured webpage for PIA Locations and Arrays and added the ability to toggle between PIA Locations and Arrays in the list.
  - o Added a new table to track Array Outages.
  - o Added Stocking Events list to the Study page. Added Stocking Event Details page and the ability to create new Stocking Events.
  - o Created domain tables for all domain constants in STReaMS so these can eventually be managed by the Database Manager instead of hard coded in php.
  - o Added new search boxes to the Browse Fish and Browse Encounters pages so users can search on a list of IDs.
  - o Added Other Details to the Tag Details page so users can see associated Tag Lot and Encounters.
  - o Activated the link to Tag Lots on the Organization page.
  - o Added a new filter for Tag Status on the Browse Tags page.
  - o Worked with Kevin McAbee to test the new FWS conferencing software, Vidyo.
- **October 2016:**
  - o Continued to write code for the batch uploads Analyze and Reconciliation process.
  - o Developed Manage Uploads page to help Database Manager track and fix errors.
  - o Met with new Database Manager, Julie Stahli, and investigated ways she can gain access to SQL server.
  - o Discussed shed tags stuck on antennas with Peter MacKinnon and how to represent them in STReaMS. Removed all PIA detections for these tags, except for the first detection, from STReaMS.
  - o Worked with Julie Stahli, Travis Francis, and Scott Durst to reformat 2015 datasheets to meet new specifications for batch uploads and

identify Studies for each datasheet.
- o Met with Cameron Walford to review Samples in STReaMS and clean-up the Study list.
- o Processed and imported PIA data for Hogback Bypass Facility and Intake, and Price River Confluence and Woodside.
- o Performed extensive testing on batch uploads for sampling projects and stocking data.

- **November 2016:**
  - o Completed batch upload process for sampling projects and stocking data.
  - o Imported all 2015 sampling and stocking data for UC and SJ.
  - o Compiled and sent summary details of 2015 batch uploads and rejected records to Julie Stahli, Travis Francis, and Scott Durst for review.
  - o Added tools to fix and resubmit rejected records on the Manage Uploads page. Added the ability to submit or delete multiple records at once.
  - o Added filters to the Manage Uploads page to assist in data-cleanup.
  - o Added the ability to upload multiple source ponds for one stocking record during batch uploads.
  - o Added the ability to submit multiple datasheets at one setting on the Uploads page.
  - o Reconfigured pop up boxes during batch upload Analyze process so they are more user friendly.
  - o Reconfigured how Flags are tracked and created a new table specifically for data Flags.
  - o Created conceptual design for PIA batch upload process.
  - o Enhanced performance of lists so Encounter lists display quickly on all pages.
  - o Added the ability to set a Tag Lot on the Tag Details page.
  - o Added Upload Flag to Individual Details so the Database Manager can unflag records once they have been reviewed and deemed ok.
  - o Processed and imported PIA data for McElmo Creek, San Rafael Chaffin Ranch and Hatt Ranch, White River Bonanza Bridge, PNM Weir, San Juan Restoration Site, Colorado River - Price Stubb, Green River Canal Flume and Below Siphon, and Tusher Diversion.
  - o Tested new features.

V.   Recommendations:

Key priorities for the third year of development include (in order of importance)

1) Develop batch upload tool for PIA Detections
2) Develop batch upload tool for PIT Tag Distribution Data
3) Develop QA/QC tools to identify data issues
4) Develop Advanced Query Builder for custom downloads

5) Implement revision tracking
6) Develop functions to support data analysis needs of the Recovery Programs (distance between Encounters, days in river, etc.)
7) Train staff, partners and Database Managers
8) Generate DB Manager Guide and database diagram.
9) Improve online Help.
10) Work with Recovery Programs to identify important tools and functionality.
11) Work with Recovery Programs to track Sample data as deemed appropriate.

We recommend following the schedule proposed in Appendix 3.

VI.   Project Status: Ongoing

VII.   FY 2016 Budget Status

A.   Funds Provided in FY 2016: $109,099 (Upper Colorado $72,733; San Juan $36,366)
B.   Funds Expended as of October 1, 2016: $109,099
C.   Difference: $0
D.   Percent of the FY 2016 work completed, and projected costs to complete: 100%
E.   Recovery Program funds spent for publication charges: $0

VIII. Status of Data Submission (where applicable): Not Applicable

Signed: /s/ Dave Speas   Nov 29, 2016
Principal Investigator

ANNUAL PERFORMANCE PROGRESS REPORT (PPR)

BUREAU OF RECLAMATION AGREEMENT NUMBER: R14AC00084

UPPER COLORADO RIVER RECOVERY PROGRAM PROJECT NUMBER: 170

Project Title: Development of a centralized recovery program database

Principal Investigator: Amy Greenwell
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Project/Grant Period: Start date (Mo/Day/Yr): 10/01/2014
End date: (Mo/Day/Yr): 6/30/2019

Reporting period end date (Mo/Day/Yr): 10/1/2015 through 9/30/2016

Is this the final report? Yes _____ No __X__

Performance:
Schedule adjustments have been made due to personnel changes at CNHP but overall performance thus far has been satisfactory. See Appendix 1 for the proposed schedule compared to actual work completed for Year 1, Appendix 2 for the proposed schedule compared to actual work through November 2015 for Year 2, and Appendix 3 for the proposed schedule in Year 3.

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

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

Appendix 3. Proposed schedule for Year 3. 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 - Sep-17
Work closely with investigators to assess database needs and design	Ongoing	Ongoing	Ongoing	Complete
Server security, database backups and server maintenance	Ongoing	Ongoing	Ongoing	Complete
Develop online Data Management System for quality control and database administration	In Progress	In Progress	In Progress	Complete
Develop online Query Builder for customizing data downloads		In Progress	Complete	
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	Complete
Internal testing and stress tests	Ongoing	Ongoing	Ongoing	Complete
Develop revision tracking component		In Progress	Complete	
Set up GitHub defect tracking			In Progress	Complete
Post enhanced version of the database online				Complete
Train USFWS and BOR personnel on using and managing the database	Ongoing	Ongoing	Ongoing	Complete
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	Complete