

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

FY 2024-25 SCOPE OF WORK

PROJECT: 179

Project Title

Upper Colorado Recovery Program PIT monitoring technology

Bureau of Reclamation Agreement Number:

n/a

Reclamation Agreement Term

n/a

Note: Recovery Program FY24-25 scopes of work are drafted in May 2023. They often are revised before final Program approval and may subsequently be revised again in response to changing Program needs. Program participants also recognize the need and allow for some flexibility in scopes of work to accommodate new information (especially in nonnative fish management projects) and changing hydrological conditions.

Lead Agency:

U.S. Bureau of Reclamation

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Category:

- Ongoing project
- Ongoing-revised project
- Requested new project
- Unsolicited proposal

Expected Funding Source:

- Annual funds
- Capital funds
- Other [explain]

Relationship to RIPRAP:

General Action Plan:

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

V.A Measure and document population and habitat parameters to determine status and biological response to recovery actions.

V.A.1.a Develop basinwide razorback monitoring program (implementation to be reflected in sub-basin worksheets).

V.A.1.a.(2) Investigate improving recapture rates through passive PIT tag monitoring, nets, etc. to improve population abundance estimates.

V.A.3. Collect and submit data according to standard protocol (e.g., location, PIT tag #, length, weight, etc.) on endangered fish encountered in all field activities in order to provide annual information on population status outside of formal population estimates.

V.D Establish sampling procedures to minimize adverse impacts to endangered fishes.

V.F Assess relative biological importance of tributaries and their potential contributions to endangered fish recovery.

Green River Action Plan

II. Restore habitat

II.B.2 Screen Tusher Wash diversion to prevent endangered fish entrainment.

II.B.2.b Design.

V. Research and Monitoring

V.A Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

V.A.2 Identify additional razorback sucker spawning areas in lower Green.

V.C Conduct population estimate for Colorado pikeminnow. Sampling is conducted for 3 years, followed by no sampling for 2 years.

White River Action Plan.

V. Research and Monitoring

V.A Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

Colorado River Action Plan

II Restore Habitat

II.B.2 Restore fish passage at Price Stubb.

II.B.2.a.(5) Monitor and evaluate success.

V. Research and Monitoring

V.A Conduct research to acquire life history information and enhance scientific techniques required to complete recovery actions.

Dolores River Action Plan.

V. Research and Monitoring

V.A Survey native and nonnative fish in Dolores River

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

Study Background/Rationale and Hypotheses:

Over the last decade, Reclamation and various partners working through the Upper Colorado River Endangered Fish Recovery Program (Recovery Program) have expanded their use of passive integrated transponder (PIT tags) monitoring technology (including passive interrogation arrays of various sizes and portable submersible antennas) to improve their ability to monitor endangered fish status and trends.

PIT tags are tiny transponder tags implanted into the body cavity of the fish by various fisheries agencies (both in hatchery and field settings) and return a unique alphanumeric code when activated by radio frequency identification (RFID) scanners. Recapture PIT-tagged fish over the years has yielded substantial information on fish growth, movement, population size and survival. Hatchery reared bonytail *Gila elegans* and razorback sucker *Xyrauchen texanus* are injected with PIT tags prior to stocking. Field investigators employ manually operated PIT scanners, chargers, data loggers, PIT tags themselves, and tagging guns or syringes to mark fish of wild origin during various Recovery Program fish sampling projects.

Passive interrogation arrays (PIAs) can be configured either as pass-through (vertically mounted antenna loops) or pass-by (horizontal antenna panels mounted on the stream bed) systems. Antennas continually scan the water column for the presence of fish with PIT tags and return tag numbers to a data storage module when detected. These installations operate on solar-charged battery banks or line AC power, and usually transmit data via satellite or cell connections to a centralized database. PIAs allow for continuous data collection, providing information during times when biologists are not in the field, such as night, winter, and during flows unsafe for boating. A relatively new variety of PIA—commonly called an “autonomous” PIA—consists of a single 20’ antenna loop, operates on a smaller solar-charged battery bank than large PIAs, and usually have no remote connections and must be downloaded manually.

Valuable PIT data has also been collected remotely using portable, submersible antennas which can collect data continuously for over two weeks at a time. These portable antennas (hereafter “submersibles”) operate on lithium-ion batteries and need to be retrieved and downloaded manually. Submersibles also allow for continuous data collection when biologists are not present. They are often used in shorter durations at sites of interest, such as long-term monitoring sites and spawning locations.

While PIAs and other equipment, in theory, generate little operation and maintenance costs when compared to those associated with active capture methods (boat- or raft-based mark/recapture surveys), exposure to extreme hydrologic and meteorological conditions in the desert Southwest nevertheless lead to unanticipated and non-trivial costs for repairs and component replacement; in-addition, expected upgrade and replacement costs for electronic and communication equipment is important to consider. Likewise, equipment used in marking and scanning individual fish for presence of PIT tags eventually wears out, breaks or gets lost, making periodic replacement a necessity. PIT tags for tens of thousands of hatchery-reared fish are also required on an annual basis.

For the last four years, funding for installation and operation/maintenance (O/M) of Upper Basin PIAs has been provided by Reclamation after approval through Recovery Program committee work plan processes. Purchase of PIT tags and associated tagging and scanning equipment (including submersibles) has also been made by Reclamation using Recovery Program-approved funds. This scope

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

of work proposes continuation of these activities to support use of PIT monitoring technology, however sources of O/M expertise will change from Utah State University (USU) to Biomark, LLC beginning in FY25.

Study Goals, Objectives, End Product(s):

Goal: The goals of this scope-of-work (SOW) are 1) to maximize continuity and performance of PIA operations by performing annual operation, maintenance, repair, and replacement activities and 2) provide Recovery Program investigators and hatchery staff with PIT tags and related tagging and scanning equipment for use on an annual basis.

Objectives:

- 1) Conduct remote monitoring and troubleshooting of PIA performance
- 2) Conduct site visits as needed to repair equipment, activate, power-up, troubleshoot and tune-up systems, and power down systems for winter months, if applicable.
- 3) Maintain cell and/or satellite connectivity with remote PIAs
- 4) Upgrade existing communication systems to allow more efficient downloads and possible cost savings.
- 5) Work with STReaMS database managers to ensure efficient downloading of data and to ensure all metadata is accurate and up to date.
- 6) Identify PIT tag and related equipment needs; procure and distribute those supplies and equipment as needed.

End Products:

- 1) Operational PIAs with minimized down-time thanks to routine preventative maintenance and repairs.
- 2) Notification to Recovery Program on needed repairs in a timely fashion.
- 3) Upgraded PIA communication systems (as needed).
- 4) Annual reports on a) PIA operation and maintenance activities; and b) weekly summarization of detection data from PIAs
- 5) Adequate stores of PIT tags and related tagging and scanning equipment for use by hatchery and field staff throughout the year.

PIA operation and maintenance

Most PIAs currently in operation in the Upper Basin consist of the following components: 1) PIT-detecting antennas (either pass-through or pass-by types) affixed to streambeds or fish infrastructure such as passages and screens; 2) master controllers or multiplexers which actuate PIT transceivers housed within the antenna panels; 3) data loggers and communications with remote computers facilitated by cell or satellite modems; and 4) a power source which is most commonly battery banks kept charged by solar panels or in some cases AC line voltage. These facilities are often located in remote areas and may require significant effort to access on occasion.

Additionally, all PIAs currently have subscriptions to BioLogic®, which is a web interface service provided by Biomark which affords a range of services directly to end users (i.e., STReaMS need not be

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

consulted to view information directly). End users interested in specific BioLogic®-monitored PIAs can monitor system diagnostics and receive system performance reports, receive reports of tagged fish and specific tag numbers, download data directly, and add upgrades as they become available which will increase data retrieval capabilities.

The following facilities currently operate in the Upper Colorado River Basin and will require operation and maintenance support in the coming years:

- 1) Colorado River: Price-Stubb Diversion Dam fish passage. This facility consists of a multiplexer running two pass-through antenna subarrays, with two antennas per sub array, on a head gate structure at the top of the Price-Stubb fish passage located at river mile (RM) 188.3 left (L) on the Colorado River near Palisade, CO. The system has been operational since 2010 and has logged 38,943 PIT detections as of April 24, 2023. The detection system is powered by solar-charged batteries, and data is transmitted via cell modem. The site is equipped with a 4G modem and Biologic® subscription (Biomark) current through Dec 2023.
- 2) Dolores River (Utah): This facility is located at the Rio Mesa Center (aka Entrada Ranch) on the Dolores River about eight miles upstream from the Colorado River in southeastern Utah. The system consists of a master controller running two pass-by antenna subarrays (five 20' antenna panels in each) which span the channel width. It has logged 45,149 PIT detections tags since it became operational in 2013. The detection system is powered by solar charged batteries and data is transmitted via Hughesnet satellite modem. Sat modem and Biologic® subscription (Biomark) is current through Dec 2023.
- 3) Green River:
 1. Green River Canal fish screen. The Green River Canal originates at RM 127.8 R near the town of Green River, Utah. Since 2013, entrainment of PIT-tagged fish in the Green River canal was monitored by two pass-through style antenna subarrays, but these were decommissioned when construction on a new fish screen began in November 2018. The new facility is equipped with a master controller running 3 pass-through antenna subarrays (2 antennas each) which monitor PIT-tagged fish entering the fish screen facility, fish which are returned to the Green River and any fish which are able to bypass the screen and enter the canal. The detection system is powered through a battery switcher system which is charged by AC power. Data is transmitted by 4G cell modem. Biologic® subscription (Biomark) is current through Dec 2023. The canal PIA (both current and previous configurations) has logged 240,602 PIT detections since monitoring began in 2013.
 2. Tusher Wash Diversion dam and fish passages. The Tusher Wash Diversion is located about a quarter mile upstream from the Green River Canal head gates and was renovated in 2016 to include fish and boat passages. PIAs were installed and became operational in May 2016 and consists of a master controller and several pass-by and pass-through antennas affixed to various features of the diversion dam that would likely to be used by fish (downstream passage notches, boat passage, fish passage, waterwheel structure). To date, antennas on this facility have collectively logged 298,841 PIT detections since it was constructed. The detection system is powered by a battery bank driven by AC power and data is transmitted via 4G cell modem. Biologic® subscription (Biomark) current through Dec 2023.

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

- 4) San Rafael River: The Chaffin Ranch PIA is not far from the confluence of the Green and San Rafael rivers (RM 97.0) in southcentral Utah; a second PIA located near Hatt Ranch (State Highway 24) operated from 2009 through 2016 but no longer exists. The Chaffin Ranch PIA consists of a multiplexer running two pass-by antenna subarrays (two 10' antenna panels each). Two new detection systems were added to the San Rafael in April and August 2020. An array was added at the Cottonwood Wash site and consists of 4 X 20' antennas. A second array was added at the original Hatts Ranch site and consists of 4 X 20' antennas. These two new sites are also powered by solar charged batteries and data is transmitted via Hughesnet satellite modems. Biologic® subscriptions (Biomark) current through Dec 2023. Collectively, antenna arrays in the San Rafael River have logged 180,032 detections since about 2009.

- 5) Price River: Three PIAs currently operate on the Price River in southcentral Utah, one about a mile upstream from the Green River (RM 138.1), one near Woodside and one near Wellington. The confluence and Woodside PIAs have detected a total of 464 individual PIT tags since 2011; both facilities were damaged beyond repair by flash floods in 2016 but were replaced in 2018. The Mounds PIA was also installed in 2018. The new confluence system consists of a master controller running 2 sub-arrays (two 10' antenna panels each). The detection system is powered by solar charged batteries and data is transmitted via Hughes Net satellite modem. The new Woodside system consists of a master controller running 2 sub-arrays (one 20' antenna panel each). The detection system is powered by solar charged batteries and data is transmitted via cell modem. The Mounds system consists of a master controller running 2 sub-arrays (two 15' antenna panels each). The detection system is powered by solar charged batteries and data is transmitted via cell modem; all PIAs in the Price River currently have BioLogic® subscriptions. Biologic subscription (Biomark) current through Dec 2023. In aggregate, Price River PIAs have logged 992,386 detections to date.

- 6) White River at Bonanza Bridge: This system is located just downstream of the Bonanza Bridge over the White River (State Highway 45) in northeastern Utah. It consists of a multiplexer running a single antenna sub-array comprised of six, 20' antenna panels. The Bonanza Bridge PIA has detected 6,207 individual tags since 2012. The detection system is powered by solar charged batteries. Data is transmitted via Hughesnet satellite modem. Biologic® subscription (Biomark) current through Dec 2023. The Bonanza Bridge PIA has logged 89,282 detections to date.

Additionally, numerous portable submersible PIT scanners (“submersibles” or “wagon wheels”) are deployed during the spring-fall sampling season at a range of river locations. These units and/or their power sources and download equipment may also periodically require maintenance, although site visits are likely not necessary for this. Submersibles have been employed to identify sites of spawning activities, collect additional resight data to improve population and survival estimates, monitor fish use of tributaries, and other monitoring purposes in discrete areas. Examples of submersible deployment include monitoring of Colorado pikeminnow spawning movements in Yampa Canyon, use of Vermillion Creek (CO) by Colorado pikeminnow, Colorado pikeminnow spawning below Split Mountain (UT),

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

humpback chub population estimates (Black Rocks, Westwater, Desolation/Gray canyons), razorback sucker spawning near Jensen UT, and other locations.

PIT tags and related tagging and scanning equipment

PIT tags and equipment are utilized for marking and identifying individual hatchery-reared fish (mostly bonytail and razorback sucker at present, plus broodstock of humpback chub *Gila cypha* and Colorado pikeminnow *Ptychocheilus lucius*) as well as wild specimens captured during field investigations. Fish hatcheries which supply propagated endangered fish for stocking according to Recovery Program stocking plans include:

Ouray National Fish Hatchery, U.S. Fish and Wildlife Service (USFWS): Grand Valley Unit (Grand Junction, CO) and Randlett Unit (Ouray National Wildlife Refuge, Ouray, UT).

Wahweap State Fish Hatchery, Utah Division of Wildlife Resources (UDWR), Wahweap, UT.

J. W. Mumma Native Aquatic Species Restoration Facility, Colorado Division of Parks and Wildlife (CPW), Alamosa, CO.

In most cases, field investigators are directed to implant all captured endangered fish individuals with PIT tags, regardless of the objective of the field investigation which include mostly mechanical removal of non-native fish and abundance estimates of endangered fish. These investigations take place throughout the Upper Colorado River Basin, including large portions of the Colorado, Gunnison, Dolores, Green, White, and Yampa rivers. Submersible antennas are also typically deployed and retrieved at ca. two-week intervals during abundance estimation or surveys of spawning activity throughout the Upper Colorado River Basin.

Study Methods/Approach:

Task 1. PIA Operation and maintenance:

Between weekly updates from STReAMS as well as monitoring by principal investigators, stationary PIAs will be monitored periodically to check settings, download data, and perform diagnostics of the systems. Sometimes problems arise that cannot be solved remotely, in which cases a site visit must be conducted by a technician to assess and repair the system. Once a site visit is deemed necessary, principal investigators (including project leaders, if appropriate) will meet by phone to develop a response plan. Promptness of site visits will vary with accessibility of sites which is often governed by seasonal factors (snow, ice, precipitation), physical attributes of the problem (e.g., submerged antenna loops vs. streamside equipment), weather events, streamflow levels, and occasionally facility or land ownership. If more than one site requires attention at the same time, sites which are integral to high-priority research and monitoring activities will be dealt with first. Typical problems which have arisen in the past include drainage of batteries due to lack of sun, inadequate solar panel output or age of batteries, antenna panels are washed away or damaged by ice, wires are cut, excessive ambient noise, data downloading is disrupted or intermittent, and vandalism/theft.

For the purposes of this SOW, equipment and components for PIA O/M was selected to cover the most common repairs associated with these incidents and includes replacement costs of two, 20' antenna

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

sections per year plus equipment to operate them. Funds will not be obligated to purchase of this equipment until it is determined that repairs or replacement are required. Much like O/M requirements for infrastructure such as fish passages and screens, a **placeholder** for repair and replacement costs should be included Recovery Program annual budgets. Equipment used by field investigators (such as scanners and tagging guns) should be treated in a similar manner, as required quantities will vary from year to year. Recommended **placeholder amounts** are shown at the bottom of the budget table (see Excel spreadsheet for more detail), although these funds will not be expended unless required. **Foreseeable costs** or the amount most likely to be spent in any given year (regardless of repair and field equipment costs, which vary) include labor and travel for PIA maintenance, communication charges, and PIT tags.

If antenna system repair/replacement or other equipment are not needed, the funding will be used to purchase additional PIT tags, other PIT equipment or supplies, or other purposes determined with input from the Program Director's Office. Availability of unspent PIA O/M funds will be determined no later than July-August of each year and steps will be taken to obligate those funds if appropriate.

It was discovered in April 2021 two of the ten antenna panels at the White River PIA at Bonanza Bridge are not functioning and may need to be replaced. In FY22 we had decided to upgrade the entire array upgrade from the existing (obsolete) multiplexing system to a master controller configuration but stream flow conditions prevented us from doing the work. Funds for the upgrade are still present in our budget and it is scheduled to take place in FY23.

We will work to ensure that efficient and consistent data downloading occurs, which involves occasional troubleshooting and coordination between the database and PIT technical personnel on the ground. Data coming out of automated systems should be formatted consistently to allow for easy upload by STReAMS.

While submersibles generally require the least amount of maintenance of all existing systems, some upkeep may be necessary on occasion. Currently some submersible users are maintaining their equipment using their own financial resources. Large lithium-ion batteries can no longer be shipped via UPS or Fedex, so we will coordinate transportation of this equipment for repairs if necessary.

Task 2. PIT tags and related tagging and scanning equipment

Currently, all PIT tags and related equipment are shipped from the manufacturer to the USFWS Fish and Wildlife Conservation Office (FWCO) in Grand Junction, CO where they are inventoried, stored and distributed to end users according to hatchery fish tagging schedules or on request by field offices on an "as-needed" basis. To determine the latter, field offices will coordinate with the USFWS FWCO (Travis Francis) and Reclamation (Dave Speas) prior to the coming field season with enough lead time to place orders and receive and distribute supplies and equipment (i.e., January-February of each year). During this same time frame, equipment for repairs or replacements will also be purchased if requirements have been determined. In most cases, Reclamation will coordinate purchases.

PIT Tags are usually 12.5 mm, glass encapsulated 134.2 kHz PIT tags which are available both in pre-loaded injection needles and as loose tags without needles. There are currently about 28,000 loose tags in our inventory, so we do not propose buying loose tags for the foreseeable future. PIT tag lot numbers

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

(usually 100 tags per lot, either in trays or loose), their individual PIT tag numbers and their recipients will be entered and tracked in STReaMS

Annual PIT tag requirements for hatcheries are estimated as follows (all tags are pre-loaded in needles, 100 per tray, unless otherwise noted):

Ouray NFH Grand Valley Unit (24 Road; USFWS): 20,000/year.

ONFH Randlett Unit (USFWS): 20,000/year

Wahweap State Fish Hatchery (UDWR): 10,000/year

Mumma Native Aquatic Species Restoration Facility (CPW): 6,000/year

Field investigators (CPW, UDWR, CSU) in aggregate typically require 4,000 tags in needles/trays per year, and we recommend purchase of an additional 5,000 tags/trays for unforeseen needs. We currently estimate that we have an adequate number of PIT tags in our inventory to satisfy hatchery and field requirements FY23 through FY25, so no funds will be required for tags in those years.

Scanners are usually available in two configurations, one consisting of a handheld scanning and data logging device with a circular “tennis racquet” antenna (Biomark HPR) attached to the scanner with a flexible chord, and the other is a one-piece scanner/antenna “stick reader”. Data logging software is either developed by individual investigators or procured from the manufacturer. Scanners are powered by rechargeable lithium ion batteries and 120VAC chargers are typically included along with a water- and shockproof carrying case. The Biomark HPR Lite is a newer model which has most features of the regular HPR but is more streamlined and may also feature enhanced capabilities to detect older 400 kHz tags.

In summary, while we currently have significant numbers of PIT tags and scanners in our inventory, after FY25 we estimate annual equipment needs for a given year to consist of 65,000 PIT tags in needles/trays per year.

Although we will coordinate with field offices to procure needed equipment on a year-by-year basis, we believe the following are likely necessary for any given year:

12 gun-style PIT tag implanters

5 HPR lite scanners

12 MK10 readers

200 M125 needles

We had initially proposed that at least four submersibles and double as many batteries would be needed on an annual basis. However, due to a large submersible purchase in FY23 (made with funds from the 2021 Bipartisan Infrastructure Law), large existing inventories and uncertainty about future requirements, purchase of submersibles under this SOW are put on-hold indefinitely until priorities for such equipment can be formally established.

We emphasize that **quantities of equipment are estimates only** and are meant to approximate needs for an average year. While quantities of PIT tags are relatively certain for a given year, quantities of

UPPER COLORADO RIVER ENDANGERED FISH RECOVERY PROGRAM

equipment and other supplies will vary according to discussions with field crews which will take place early in January of each calendar year.

Task 3. Annual reports We will report to the Recovery Program each year on PIA operation and maintenance.

Task Description, Deliverables and Schedule:

Task 1: Year-round: Monitor PIA performance. Base flow periods (fall, spring, late summer): perform PIA maintenance as needed. December: Pay communication fees.

Task 2: January-February: coordinate with field offices to identify equipment and supplies needed for the coming field season. Equipment should be ordered and distributed prior to the field season.

Task 3: Submit annual report in November of each year.

Budget Summary:

Next page

SUMMARY OF PROPOSED COSTS

Name of Servicing Agency:	Utah State University/USBR/Biomark
Project Name:	Operation and Maintenance of Upper Colorado River Basin PIA infrastructure.

	YEAR 1		YEAR 2		YEAR 3		YEAR 4		YEAR 5		TOTAL	
	10/1/2023		9/30/2024		9/30/2025		10/1/2026		10/1/2027			
	Through		Through		Through		Through		Through			
	9/29/2024		9/29/2025		9/30/2026		9/30/2027		9/29/2028			
DIRECT LABOR AND FRINGE BENEFIT COSTS:												
Direct Labor - Hourly	\$	7,490.88	\$	17,265.32	\$	17,566.68	\$	17,874.07	\$	18,187.60	\$	78,384.55
Fringe Benefits - Hourly	\$	3,520.71	\$	-	\$	-	\$	-	\$	-	\$	3,520.71
Subtotal of Direct Labor & Fringe Benefits:	\$	11,011.59	\$	17,265.32	\$	17,566.68	\$	17,874.07	\$	18,187.60	\$	81,905.26
OTHER DIRECT COSTS:												
Materials (PIT tags)	\$	-	\$	-	\$	152,158.50	\$	155,201.67	\$	158,305.70	\$	465,665.87
Communications	\$	26,221.22	\$	26,745.63	\$	27,280.54	\$	27,826.16	\$	28,382.69		
Travel Costs	\$	3,343.68	\$	3,410.55	\$	3,478.76	\$	3,548.34	\$	3,619.31	\$	17,400.65
Field equipment (scanners, tagging guns, etc)	\$	5,419.30	\$	5,277.99	\$	5,491.23	\$	5,491.23	\$	6,411.44		
PIA repair/replacement equip	\$	23,298.23	\$	24,631.20	\$	25,123.82	\$	25,626.30	\$	26,138.82	\$	124,818.37
Contractors	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
Subtotal of Other Direct Costs:	\$	58,282.44	\$	60,065.38	\$	213,532.85	\$	217,693.69	\$	222,857.97	\$	772,432.32
INDIRECT/OVERHEAD COSTS:												
Subtotal of Labor and Other Direct Costs:	\$	69,294.03	\$	77,330.70	\$	231,099.53	\$	235,567.76	\$	241,045.57		
Total dollars exempt from indirect/overhead base:	\$	54,938.76	\$	56,654.82	\$	210,054.09	\$	214,145.35	\$	219,238.66		
<Enter Description of Indirect/OH Cost #1>	17.50%	\$ 2,512.17	#####	\$ 3,618.28	#####	\$ 3,682.95	#####	\$ 3,748.92	#####	\$ 3,816.21	\$	17,378.53
Total dollars exempt from indirect/overhead base:	\$	-	\$	-	\$	-	\$	-	\$	-	\$	-
<Enter Description of Indirect/OH Cost #2>	0.00%	\$ -	0.00%	\$ -	0.00%	\$ -	0.00%	\$ -	0.00%	\$ -	\$	-
Subtotal of Indirect/Overhead Costs:	\$	2,512.17	\$	3,618.28	\$	3,682.95	\$	3,748.92	\$	3,816.21	\$	17,378.53

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	TOTAL
Subtotal:	\$ 71,806.20	\$ 80,948.97	\$ 234,782.48	\$ 239,316.68	\$ 244,861.78	\$ 871,716.12
Foreseeable costs (PIA O/M (labor, travel), communications (minimum amt/yr), PIT tags)	\$ 40,576.49	\$ 47,421.50	\$ 200,484.48	\$ 204,450.24	\$ 208,495.30	\$ 701,428.02
Placeholder recommended for equipment (field and repairs)	\$ 28,717.54	\$ 29,909.19	\$ 30,615.05	\$ 31,117.52	\$ 32,550.27	\$ 152,909.57