**Alaska Sustainable Salmon Fund**

**Statement of Work**

1. **Project Title:** Kenai Mountains to Sea: Using Thermal Infrared Imagery to Implement Long-Term Salmon Conservation
2. **Project Number:** 53003
3. **Principal Investigator**

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1. **Project Period:** 3/1/20-11/30/22
2. **AKSSF Objective:** 3A-2 **PCSRF Objective:** P&A
3. **Project Description**
4. Synopsis

The Kenai Watershed Forum and Cook Inletkeeper will acquire and analyze thermal infrared (TIR) imagery for four salmon streams on the Kenai Peninsula. These streams comprise four of 20 anadromous streams under consideration by the Kenai Mountains to Sea partnership, which has developed a land conservation strategy for streams that pass from federal landownership through nonfederal lands to reach the sea. Using TIR imagery, project partners will identify high-value salmon habitats (particularly cold water refugia) within the four streams and implement an educational outreach initiative to find private landowners interested in incorporating their land into contiguous protected corridors.

1. Introduction

**Background**

The Kenai Mountain to Sea (M2S) partnership was established in 2012 as a collaborative, science-based, large landscape project to address strategic, long-term conservation on the Kenai Peninsula. Included in the partnership are the Kenai Watershed Forum (KWF), Cook Inletkeeper (CIK), Kachemak Heritage Land Trust (KHLT), U.S. Fish and Wildlife Service’s (USFWS’s) Partners for Wildlife and Coastal Program, Kenai National Wildlife Refuge, Audubon Alaska, Kenai Peninsula Borough, Natural Resources Conservation Service, and the Alaska Department of Environmental Conservation (ADEC). The partnership has successfully identified unprotected land along 20 priority salmon stream corridors for future land conservation efforts by working with willing landowners, agencies, and tribal entities in a non-regulatory fashion. The project is designed so that this mosaic of conservation efforts will provide sustainable corridors for fish and wildlife throughout a time of a changing climate.

Within this partnership, CIK and KHLT successfully collected TIR imagery along the Anchor and Ninilchik Rivers. Using this imagery, KHLT worked with CIK and the Kachemak Bay Research Reserve to incorporate identified areas of cold water refugia into KHLT'S land conservation prioritization on lower Kenai Peninsula watersheds. This drove KHLT's conservation efforts, most notably to the purchase of 38 acres of critical salmon habitat along the Anchor River Salmon Conservation Area. This project will expand upon these efforts through the M2S partnership.

**Activities, objectives, and benefits**

This project, coordinated by the KWF, incorporates the expertise of and tools developed by numerous agencies and organizations, including CIK and other partners within the M2S partnership. Based on the thermal data and outreach efforts of this project, future collaborations will ensue for parcel acquisition and conservation easements; less-than-fee-simple approaches such as voluntary compliance; voluntary short-term agreements on private parcels as part of publicly-funded restoration or stewardship projects; and voluntary land agreements or exchanges with tribal and local governments.

KWF continues to receive federal funding from USFWS to coordinate the M2S partnership. These monies are currently in use to employ the M2S coordinator as they host meetings, conduct outreach and education, and, currently, develop a powerful M2S mapping tool for future priority parcel identification based on critical fish and wildlife habitat qualities. This position will supervise project coordination moving forward. The knowledge gathered from the mapping tool will complement the cold water refugia data collected using TIR. In concert, they will produce a robust spatially explicit database for future land conservation and M2S corridor connectivity efforts.

1. Locations

* Beaver Creek: 60.551564, -151.135861
* Crooked Creek: 60.310794, -151.278581
* Funny River: 60.508906, -150.768169
* Moose River: 60.596703, -150.640856

1. Related Projects

44628, 53004

1. **Objectives**

* Identify areas of cold water refugia within four streams on the Kenai Peninsula using TIR imagery
* Initiate discussion with landowners about potential land conservation efforts

1. **Methods**

**TIR imagery collection**

TIR imagery will be collected on Beaver Creek, Crooked Creek, Funny River, and Moose River by a qualified contractor; investigators will work with the contractor to develop flight schedules to be carried out mid-day when solar loading is maximized during summer months. These schedules will be adjusted according to weather-based requirements and planned to optimize ground coverage while maintaining desired spatial resolution of imagery. TIR imagery will be collected with TIR radiometer under the following specifications:

* + Spectral band: 8-9 um
  + Target radiant accuracy: +/- 0.5 degrees Celsius
  + Pixel resolution: <0.5 m
  + Vertical overlap: 60%
  + Pixel values: degrees Celsius\*10
  + Delivery format: 16-bit, Tiled Geo-Tiff

Instream temperature loggers will be placed throughout the four streams for temperature calibration of TIR imagery as access permits. Along approximately 28 miles of the four streams, TIR will be recorded from the sensor to the on-board computer as raw counts, which will be converted to radiance values and subsequently to surface temperatures. Image rectification will be completed using Leica Photogrammetry Suite and integrated into GIS for interpretation by an analyst. Ground-truthing efforts will be conducted for 20% of identified cold-water refugia. Success will be measured by production of deliverables including calibrated TIR image frames, a geo-rectified image mosaic, flight log, longitudinal profiles, and general reporting. TIR imagery will be publicly available.

**Identification of parcels of interest**

Investigators will work with CIK and the M2S partnership to identify and incorporate areas of cold water refugia in planning efforts of M2S priority corridors. TIR imagery will be integrated with the M2S mapping tool to identify parcels adjacent to cold water refugia and critical habitat associated with these parcels. Educational tools will be developed surrounding the importance of cold water refugia and other critical habitat. In turn, these tools will be used to engage landowners in discussion regarding land conservation and identify those interested in future land planning efforts. Success will be measured by the documentation of parcel identification, development of educational outreach tools, and documentation of landowner contacts.

1. **Benefits**

This project will identify cold water habitat critical for salmon through thermal infrared imagery and begin the process of protecting it through land conservation and outreach efforts. Conservation of thermal refugia important to salmon will improve landscape-scale resilience to climate and land use changes.

1. **Products, Milestones, and Timelines**

March – December 2020:

* Establish flight plans; deploy data loggers for temperature verification
* Acquire TIR imagery of surface water temperatures
* Review and finalize datafiles

January 2021 – December 2021:

* Analyze TIR imagery of surface water temperatures and identify areas containing cold water refugia
* Conduct ground-truthing efforts for 20% of identified cold water refugia
* Integrate TIR with M2S mapping tool; identify priority parcels

January 2021 – November 2022:

* Develop creative educational materials and tools for outreach to landowners
* Engage landowners of priority parcels in conversation surrounding potential for future land conservation as it relates to their property and the M2S corridor initiative
* Present findings and the results of landowner outreach and education efforts at M2S quarterly meetings

1. **Project Budget**

|  |  |
| --- | --- |
| **Summary Budget** | **Total** |
| 100 Personnel | $23,130 |
| 200 Travel | $1,740 |
| 300 Contractual | $41,000 |
| 400 Supplies | $900 |
| 500 Equipment | $0 |
| Subtotal | $66,770 |
| 600 Indirect | $7,157 |
| Total | $73,927 |

This project will fund the following entities:

* + KWF: $13,516
  + CIK: $56,897
  + KHLT: $3,514

**KWF Budget**

|  |  |
| --- | --- |
| **KWF Budget** | **Total** |
| 100 Personnel | $8,331 |
| 200 Travel | $1,740 |
| 300 Contractual | $0 |
| 400 Supplies | $900 |
| 500 Equipment | $0 |
| Subtotal | $10,971 |
| 600 Indirect | $2,545 |
| Total | $13,516 |

KWF Budget Narrative:

Line 100: Personnel ($8,331)

Maggie Harings will oversee the project, assist with coordination of TIR imagery as needed, develop educational outreach materials for landowners, conduct outreach to engage landowners in discussion about parcel conservation, and assist with integration of TIR imagery with the M2S mapping tool: 300 hours @ $27.77/hour = $8,331.

Line 200: Travel ($1,740)

Transportation to and from meetings with landowners, M2S partnership meetings, etc.: 120 miles/trip @ 0.58/mile (federal rate) x 25 trips = $1,740

Line 400: Supplies ($900)

* Education and outreach materials (e.g., brochures, online maps): $500
* Tablet to display maps for landowner engagement: $400

Line 600: Indirect ($2,545)

Kenai Watershed Forum’s federally negotiated indirect rate through December 31, 2019, is 23.2% on total direct costs less capital expenditures and subawards in excess of the first $25,000.

**CIK Budget**

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| --- | --- |
| **CIK Budget** | **Total** |
| 100 Personnel | $11,905 |
| 200 Travel | $0 |
| 300 Contractual | $41,000 |
| 400 Supplies | $0 |
| 500 Equipment | $0 |
| Subtotal | $52,905 |
| Expenses subject to indirect | $11,905 |
| 600 Indirect | $3,992 |
| Total | $56,897 |

CIK Budget Narrative:

Line 100: Personnel ($11,905)

Sue Mauger, Science Director, will coordinate TIR imagery acquisition and interpretation: 250 hours @ $47.62/hour = $11,905.

Line 300: Contractual ($41,000)

CIK will contract for collection of TIR imagery data on approximately 28 river miles: $41,000

Line 600: Indirect ($12,374)

Cook Inletkeeper’s federally negotiated indirect rate through December 31, 2020, is 33.53% on salaries, wages, and benefits.

**KHLT Budget**

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| --- | --- |
| **KHLT Budget** | **Total** |
| 100 Personnel | $2,894 |
| 200 Travel | $0 |
| 300 Contractual | $0 |
| 400 Supplies | $0 |
| 500 Equipment | $0 |
| Subtotal | $2,894 |
| 600 Indirect | $620 |
| Total | $3,514 |

KHLT Budget Narrative:

Line 100: Personnel ($2,894)

Lauren Rusin, Conservation Projects Manager, will provide assistance with landowner consultation, outreach efforts, and other tasks as needed: 85.44 hours @ $33.87/hour = $2,894.

Line 600: Indirect ($620)

Kachemak Heritage Land Trust’s federally negotiated indirect rate through December 31, 2019, is 21.43% on total direct costs less capital expenditures and subawards in excess of the first $25,000.

1. **Match Budget**

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| --- | --- |
| **Summary Match Budget** | **Total** |
| 100 Personnel | $16,001 |
| 200 Travel | $71 |
| 300 Contractual | $5,000 |
| 400 Supplies | $0 |
| 500 Equipment | $0 |
| Subtotal | $21,072 |
| 600 Indirect | $4,803 |
| Total | $25,875 |

The following entities will provide match:

* KWF: $6,698
* CIK: $19,177

**KWF Match Budget**

|  |  |
| --- | --- |
| **KWF Match Budget** | **Total** |
| 100 Personnel | $5,437 |
| 200 Travel | $0 |
| 300 Contractual | $0 |
| 400 Supplies | $0 |
| 500 Equipment | $0 |
| Subtotal | $5,437 |
| 600 Indirect | $1,261 |
| Total | $6,698 |

KWF Match Budget Narrative:

Line 100: Personnel ($5,437)

KWF staff will collect temperature data within the four streams:

* Maggie Harings, Environmental Scientist: 75 hours @ $27.77/hour = $2,083
* Branden Bornemann, Executive Director: 75 hours @ $44.72/hour = $3,354

Line 600: Indirect ($1,261)

Kenai Watershed Forum’s federally negotiated indirect rate through December 31, 2019, is 23.2% on total direct costs less capital expenditures and subawards in excess of the first $25,000.

**CIK Match Budget**

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| --- | --- |
| **CIK Match Budget** | **Total** |
| 100 Personnel | $10,564 |
| 200 Travel | $71 |
| 300 Contractual | $5,000 |
| 400 Supplies | $0 |
| 500 Equipment | $0 |
| Subtotal | $15,635 |
| Expenses subject to indirect | $10,564 |
| 600 Indirect | $3,542 |
| Total | $19,177 |

CIK Match Budget Narrative:

Line 100: Personnel ($10,564)

* Sue Mauger will perform field work associated with instream calibration and ground truthing of thermal imagery and complete reporting: 200 hours @ $47.62/hour = $9,524.
* A summer intern will perform field work associated with instream calibration and ground truthing of thermal imagery: 80 hours @ $13/hour = $1,040.

Line 200: Travel ($71)

Sue Mauger will travel by car to perform field work associated with instream calibration and ground truthing of thermal imagery: 122.5 miles @ $0.58/mile = $71.

Line 300: Contractual ($5,000)

CIK will contract for collection of TIR imagery data on approximately 28 river miles: $5,000

Line 600: Indirect ($3,542)

Cook Inletkeeper’s federally negotiated indirect rate through December 31, 2020, is 33.53% on salaries, wages, and benefits.