Kenai Thermal Imagery

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# Preface

This is a Quarto book.

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# 1. Introduction

This document contains data and analysis related to the Kenai River Thermal Imagery project. This work is a collaborative effort between three Kenai Peninsula Nonprofits: Cook Inletkeeper, Kachemak Bay Heritage Land Trust, and Kenai Watershed Forum.It is funded by the Alaska Sustainable Salmon Fund (project #53003).

A two-page project summary titled, “Science Based Land Conservation: Cold Water Stepping Stones” is outlined below. A full size version of this information sheet is accessible at this link: [Project Summary Sheet Link](https://github.com/Kenai-Watershed-Forum/kenai_thermal_imagery/blob/master/documents/Kenai%20Thermal%20Imagery%20Project%20Overview%202021.pdf).

All code used to generate this report is available in the project’s GitHub repository at <https://github.com/Kenai-Watershed-Forum/kenai_thermal_imagery>.

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| Project summary sheet |

# 2. Project Map

The ArcGIS Online project map may be accessed below or at [ArcGIS Online (Click Here: https://arcg.is/0vaueq)](https://arcg.is/0vaueq).

The online map contains layers with the following data:

* Project Watershed Boundaries
* National Hydrography Database (rivers, lakes, streams, etc)
* Anadromous Waters Catalog
  + Streams
  + Lakes
* Kenai Peninsula Borough Parcel Boundaries
* Thermal Imagery Data from NV5 Geospatial consultants report
  + Significant Thermal Features (identified from thermal imagery)
  + Longitudinal Temperature Profiles (main channel temperatures of study streams)
  + Water Temperature Logger Sites

# 3. Thermal Imagery Data

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| Example of airborne thermal infrared imagery showing temperature contrast in a stream. A cold water inflow (purple and blue colors) enters the main channel (yellow color). Figure from NV5 Geospatial consultants report. |

On July 5, 2020, [NV5 Geospatial](https://www.nv5.com/geospatial/) collected thermal infrared imagery from a helicopter-mounted camera for four steams on the Kenai Peninsula in southcentral Alaska. These streams included:

* Kenai River Tributaries
  + Beaver Creek
  + Funny River
  + Moose River
* Kasilof River Tributary
  + Crooked Creek

All streams were flown during the afternoon hours in order to maximize the thermal contrast between the river’s water and the banks.

The surveys extend for a total length of 59.1 km of the streams. Flight transects proceeded from the mouth of each stream in an upstream direction. The data were collected to aid the team in identifying the spatial variability in surface temperatures as well as thermal influence of point sources, tributaries, and surface springs.

Specific deliverables generated by NV5 Geospatial from the thermal imagery data include:

* Rasters (map image files; .tif and .jpg formats)
* Shapefiles (longitudinal temperature profiles, stream centerlines, others; .shp format)
* Other supplemental items (coordinates of significant thermal features, maps and figures, and others)

The full technical report from NV5 Geospatial describing detailed methods and interpretation can be accessed at the following link:

The image raster files are of a large size (~3 GB) and may be acquired by contacting staff at Cook Inletkeeper (sue@inletkeeper.org), Kenai Watershed Forum (hydrology@kenaiwatershed.org), or Kachemak Heritage Land Trust (info@kachemaklandtrust.org).

## 3.1 Parcel data summary

We generated a table in GIS (ArcMap Pro 10.8.1) of parcels in the Kenai Peninsula Borough that intersect with cold-water inputs (e.g. seeps, springs) within the surveyed areas of Beaver Creek, Crooked Creek, Moose River, and Funny River.

Figure @ref(fig:parcel-plot) summarizes the ownership type of these parcels by general category of owner type.

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| Parcel ownership |

## 3.2 Ground truth data

On July 7-8, 2021 we visited a subset of sites identified by the NV5 Geospatial Consultants report as cold water features. We visited 12 of 63 total sites. We recorded surface water temperatures of the identified features as well as the adjacent main stem using a using a Hach Sension 5 portable meter. The average time difference between main stem temperature observation and off-channel observation was 13.9 minutes. We created a graphic sketch of the layout of each feature, and recorded site photos.

Field forms, including site sketches, can be accessed at the following link:

Figures @ref(fig:gt-obs) through @ref(fig:gt-tir-obs-funny) visualize water temperature data sourced from the significant features in aerial imagery on July 20, 2020 along with ground-truthed measurements from July 7-8, 2021.

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| Cold Feature vs. Mainstem, ground truth observations water temperature data. |

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| Cold Feature vs. Mainstem, thermal infrared water temperature data. |

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| Beaver Creek water temperatures, ground truth and thermal infrared imagery observations. |

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| Beaver Creek water temperatures, ground truth and thermal infrared imagery observations. |

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| Funny River water temperatures, ground truth and thermal infrared imagery observations. |

## 3.3 Collaborative Assessment

Researchers with participating organizations used data from several sources to assess conservation strategies within each study watershed, and recorded their notes on a shared platform. These collective notes are being used internally to inform strategy for outreach approaches with local property owners.

Data sources used to assess parcel-specific conservation strategies include:

* Custom maps for each significant thermal feature, including information about the parcel or parcels that it occupies
* Information about individual thermal features from the [NV5 Geospatial Consultants Report](https://github.com/Kenai-Watershed-Forum/kenai_thermal_imagery/blob/master/documents/TIR_Technical_Data_Report_Kenai_Rivers_20210107.pdf), including mean value and contrast with the main stem
* The [ArcGIS Online project map](https://arcg.is/fzn14)

**Project collaborators may access the Thermal Imagery Database Google Sheet using the link below:**

**Link:** [**Thermal Imagery Collaborative Assessment**](https://docs.google.com/document/d/1TZcTMBOL6WDCyvOODZlGeuCd-1sPWzYsurWtx7MJoUE/edit)

An example map is shown in figure @ref(fig:example-map).

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| Example of airborne thermal infrared imagery map with parcel overlay |

# 4. Summary

In summary, this book has no content whatsoever.

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# References