



Placer Mine Impacts in Denali National Park & Preserve, Wrangell-St. Elias National Park & Preserve, and Yukon-Charley Rivers National Preserve

2019 Summary Report



ON THE COVER

Failed restoration of a placer-mined stream in Denali National Park
NPS Photo by Paul Burger

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2019 Summary Report

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Executive Summary

Placer mining over the past century has significantly altered stream systems in DENA, YUCH, and WRST, resulting in persistent erosion, degraded water quality, sparse riparian vegetation, and reduced aquatic habitat. This project represents an initial, systemwide effort to identify and quantify the extent of mining-related impacts on wetlands and streams, providing foundational data to guide restoration planning and to assess the ecological recovery potential of disturbed areas.

Using existing databases, park-specialist input, and geospatial analyses—including imagery, soils, and vegetation—the project mapped historic and active placer-mined streams across the three parks and developed a comprehensive geodatabase describing disturbance type, extent, and site conditions. These assessments were based on remote data rather than field visits and produced GIS-ready layers that have been integrated into the NPS OTTER database, supporting national tracking of degraded wetlands and restoration opportunities.

Results indicate extensive mining-related disturbance: 1,472.75 acres and 100.86 km of affected streams in DENA, 988.42 acres and 146.07 km in YUCH, and 153.14 acres and 63.26 km in WRST. Building on this mapping, the next phase will involve quantitative stream-function and biological assessments to measure functional impairment, develop region-specific hydraulic curves, and help determine restoration priorities. These standardized assessments will support more effective, defensible, and cost-efficient restoration decisions across Alaska's most heavily mined parklands.

Introduction

DENA, YUCH, and WRST each have over a hundred years of placer mining history, which has to varying degrees disturbed the natural function of streams – in many mined reaches, significant erosion still occurs, water quality issues persist, riparian vegetation is sparse or non-existent, and the aquatic habitat is poor. Recent work in DENA has shown that mining in some streams has resulted in the near complete loss of fish and other aquatic organisms.

This project was the first step in the process; to identify and quantify the impacts of mining and other activities on National Park Service wetlands. These data will inform future studies to quantify those impacts and evaluate the restoration potential of the different sites. Based on the current state of degradation and restoration potential, parks will be able to prioritize future work to improve hydrologic function and habitat.

Purpose of Condition Assessment

Map all historic and active placer mined streams in the three most disturbed parks: YUCH, DENA, WRST. These maps can be used for planning and prioritizing stream restoration projects, and will be used as a base for focusing the stream quantification project starting in 2021.

Methodology and Workflow

- 1) Query existing databases described above to identify potential disturbed areas.
- 2) Contact park specialists for additional information on these and other sites they may be aware of, information on past restoration activities and ongoing management concerns.
- 3) Use GIS information (imagery, soils maps, vegetation maps, etc.) to document the current condition of these sites.
- 4) Develop a geodatabase of sites, including cause and nature of disturbance, affected area, current conditions, and ongoing management concerns.
- 5) Integrate the developed database into GIS as disturbed area polygons and associated metadata.

The detailed workflow steps are included in Appendix A of this document.

Results

All of the areas were assessed based on the information described in the Methodology section and not from field visits or assessments. In some cases, park staff were able to provide additional information to help refine the numbers. A summary of the study results is presented in Table 1. A more detailed description of each site, including wetland types and general cost estimates are included in Excel format in the project collection in the datastore linked below.

Table 1. Summary of impacted areas in Alaska parks

Park	Project	Type	Acres	km
DENA	Kantishna area	Stream	1472.75	100.86
YUCH	Park-wide	Stream	988.422	146.07
WRST	Park-wide	Stream	153.14	63.26

DENA and YUCH:

Disturbed Length derived from digitized stream line shape_length

Disturbed Riparian area derived from digitized disturbed polygon shape_area

WRST: Coarse estimates from georeferenced maps (07/12/2019)

A geodatabase and GIS files for each of the parks have been created and are included in the datastore project created in IRMA ([NPS Datastore - Condition Assessment of Mining-Impacted Riparian Areas in the Alaska Region](#)).

These data were incorporated into the NPS Otter Database, identifying degraded wetlands throughout the National Park System ([WRD - OTTER - Operational Tool for Tracking Environmental Resources](#)). This system has been built to demonstrate restoration opportunities throughout the NPS for wetland mitigation projects.

Denali National Park and Preserve

Most impacts are the result of placer mining in the Kantishna Hills area (Figure 1). While there has been some lode mining, those activities have had more limited impacts on stream function and ecology. One exception is the Slate Mine in the upper Eldorado Creek watershed where there are issues with turbidity and heavy metal contamination.

Approximately 1,473 acres of park land, including 100 km of active streams have been adversely affected by mining activity. Twenty-three sites in the area have been surveyed using the BLM Lotic Assessment Inventory and Monitoring protocols to evaluate the levels of disturbance in mined streams. Restoration work is currently (2026) being planned for Eldorado, Eureka, and Friday Creeks and are in various stages of evaluation and design.



Figure 1. Map showing a sample of the mapping done in the Kantishna Hills area of Denali National Park

Wrangell-St. Elias Park and Preserve

There has been extensive lode and placer mining in the park, primarily in the Nabesna area and centered around McCarthy and Kennicott (e.g. Figure 2). There are active claims in the park that are still being mined that continue to impact riparian areas.

Approximately 153 acres of park land, including 63 km of active streams have been adversely affected by mining activity. Nineteen sites in the area have been surveyed using the BLM Lotic Assessment Inventory and Monitoring protocols to evaluate the levels of disturbance in mined streams. The park is in the process of evaluating its portfolio of impacted sites to determine the level of stream degradation, the potential for improved habitat and stream function, and the possible adverse impacts of restoration. This evaluation will inform park management and help to evaluation priorities throughout the park.

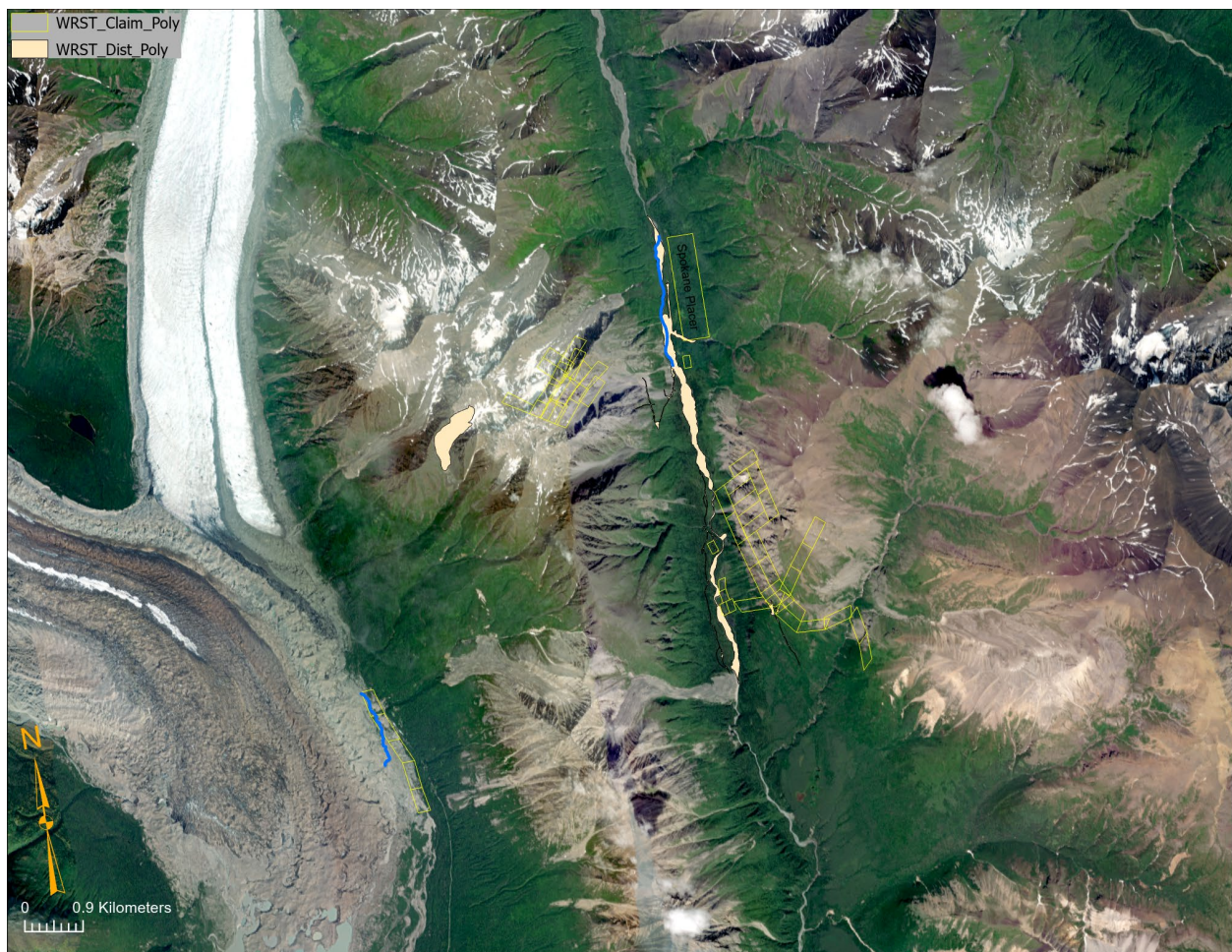


Figure 2. Map showing a sample of the mapping done in Wrangell-St. Elias National Park and Preserve

Yukon-Charley Rivers National Preserve

Most impacts are the result of placer mining in tributaries of the Yukon River (Figure 3). While there has been some lode mining, those activities have had more limited impacts on stream function and ecology..

Approximately 988 acres of park land, including 146 km of active streams have been adversely affected by mining activity e.g. Figure 3). Twenty sites in the area have been surveyed using the BLM Lotic Assessment Inventory and Monitoring protocols to evaluate the levels of disturbance in mined streams. Restoration work is currently (2026) being planned for Coal Creek and is in the evaluation and design stage.

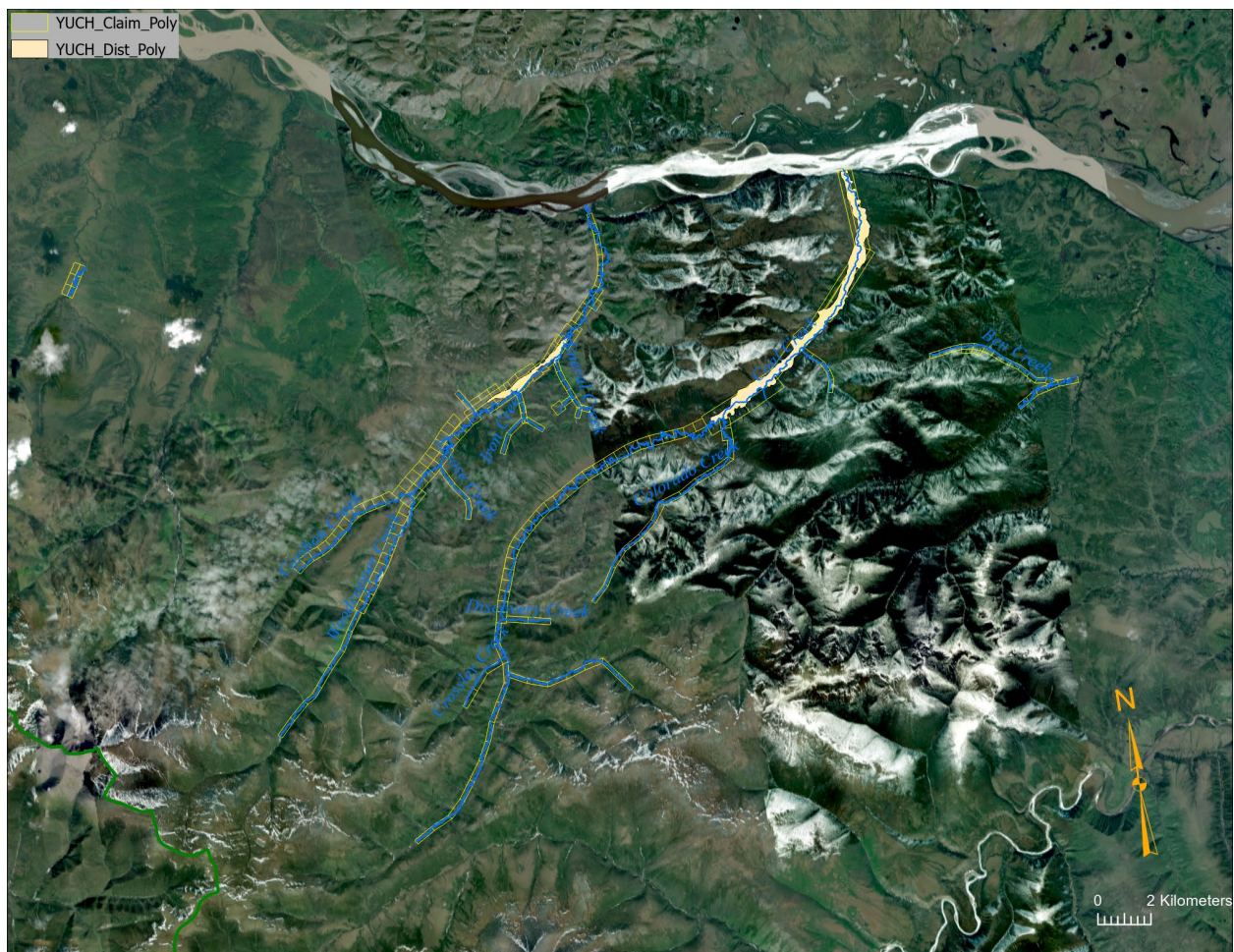


Figure 3. Map showing a sample of the mapping done in Yukon-Charley National Preserve

Next Steps – Future Work

Stream Assessment

Proposed Alaska mega-projects may require a large amount of wetlands mitigation, and the NPS has recently received requests from the EPA and ACOE to contribute information to a database of potentially reclaimable streams in preparation for these projects. To be in a position to receive these funds, and better prioritize NPS project funds, we have started to conduct a stream function and biological assessment of the potentially reclaimable mined reaches identified by this preliminary work.

Stream reclamation projects on NPS lands, costing millions of dollars, have often failed, partly due to inadequate functional assessments that fail to capture baseline conditions and the natural range of reference reaches prior to design and construction. This baseline range is critical for quantifying the extent of impairment on placer-mined streams, and for setting defensible restoration goals. Many projects have been designed based solely on modeled, theoretical channel dimensions instead of empirically determined, regionalized hydraulic curves that reference naturally occurring, relevant channel structure. The proposed assessments would help quantify functional conditions and prioritize impaired sites in anticipation of future funding; developing regional specific curves would also inform evaluation of non-mining stream impacts such as ORV trail crossings, bridges, and culverts. Site-specific designs for stream restoration, based on naturally occurring and comparable conditions, offer a much greater chance of success, and significant cost savings.

The NPS plans to assess and quantify stream function issues and create clearly defined and defensible reclamation goals to better prioritize NPS project funds and the use of potential wetland mitigation credits. By leveraging the Bureau of Land Management's aquatic Assessment, Inventory, and Monitoring strategy across three of the most heavily mined Alaskan parks, we can efficiently and systematically perform a quantitative condition assessment of placer mined streams, previously reclaimed reaches, and natural reference reaches. Through an interagency agreement with BLM, NPS would utilize trained BLM crews to complete stream assessments.

These assessments have been useful for BLM managers in quantifying the deviation of disturbed streams from reference conditions. Once the deviation of the mined or reclaimed reaches from the range of natural variation found in reference condition streams has been quantified, the restoration potential can then be determined and mined streams prioritized for restoration.

The AIM National Aquatic Monitoring Framework will assist NPS to fulfill many of the project goals and is a standardized, scalable approach already being used within Alaska, by both state and federal agencies. AIM protocols:

- Quantifies the impacts of placer mining and effectiveness of stream reclamation
- Establishes baseline conditions for state-wide condition and trend reporting across state and federal lands; AK DEC and EPA use compatible protocols in Alaska
- Provides key information for decision makers that can be collected once and used many times

Obtaining these data and establishing a consistent method for evaluating stream impacts, not just from mining, but from other activities within parks, will help to inform restoration project design throughout the region. Understanding the potential functional lift of restoration projects is vital for resource management staff to make informed decisions as to whether to actively pursue expensive restoration efforts or to allow streams to recover naturally over time. In some cases, active restoration may have ancillary adverse impacts that outweigh the functional lift potential of a project, so limited resources could be allocated to those projects with more potential.

- Quantitative conditions assessment of placer mined streams, reclaimed streams, and reference reaches in DENA, YUGA, and WRST
- Establishment of baseline conditions in reference reaches
- Functional assessment of placer mined and reclaimed streams in DENA, YUGA, and WRST – functional lift and functional loss (difference between existing conditions and reference condition/proposed condition); includes restoration potential of mined sites
Inventory of mined sites – determine level of impairment to prioritize projects
- Development of regional/park specific hydraulic curves
- Complete risk and cost/benefit assessment to aid in prioritizing sites

Appendix 1: AML Digitizing Guide

Overview:

Digitize disturbed areas and claim blocks in ArcMap of placer mined areas in DENA, YUCH, and WRST for the purpose of having this information compiled in a single space, to eventually be put in a nationwide database which will be used to determine areas of reclamation potential available on federally (NPS) managed land.

Data mining:

- Check claim data spreadsheet from Bob for mining areas
- Go through folder on the X drive (cad data folder) for relevant .dwg files and mining areas
- Locate relevant EIS reports
- Contact park employees for their knowledge (see google doc)
- Contact Bob Strobe for .dwg files of mining areas if we don't have them on X (and check email thread)
- Contact Stephanie Devenny in Lands for CAD to GIS file conversions
- Compile source data: converted autoCAD, imagery, etc.

Data Sources (dist areas and claims):

YUCH – AutoCAD: W:\CAD_YUCH.gdb (GIS-YUCH-Wood-All.dwg?); Theme Manager: YUCH Charley Fire Orthophoto 16cm SfM 2018, YUCH Aerial Photomosaic – True Color, Color IR, YUCH Woodchopper Creek AutoCAD Basemap; Reports: YUCH environmental overview and analysis of mining effects July 1982

WRST - W:\CAD_WRST.gdb

DENA - W:\CAD_convert.gdb (kantishna.dwg)

Digitizing:

Bring in source data to the .mxd – AutoCAD, imagery, etc.

To differentiate lines in the “raw” autoCAD conversion file:

- Delete points, poly, and multipatch

- Open symbology tab in properties for lines > categories > value field = “layer” from drop-down menu > ok
 - o Use definition query to separate out the lines which are helpful in the lines layer
 - Keep a lines layer as an archive under the AutoCAD file layer (includes ALL lines)
 - Make disturbed lines a color that will stand out (bold red)
 - Make claim lines a color that will stand out (bold black)
 - Give all other lines “no color” to tell them apart
 - Keep a definition query lines layer with disturbed ONLY – use this to create/save the Dist_Line feature class which will be edited further (see next step)
 - Keep a definition query lines layer with claims ONLY – use this to create/save the Claim_Line feature class which will be edited further (see next step)

To fix Topology:

- Export data (def query layer) as a line feature class to the home geodatabase.
 - o Open Arc Toolbox > Features toolbox > Feature to Line tool > select cad line layers > drop into tool > select the output folder > click OK
- Save the ORIGINAL Line layers as an archive layer (CAD_archive).
 - o Do not make topo edits the CAD_archive.
 - o Save a copy as dist_line or claim_line
 - Use these feature classes as participants in their respective topologies.
- Before creating a new topology, try and connect any major gaps in lines (dangles)
- Topology rules:
 - o Disturbed area: no dangles, no pseudo nodes, no intersections, no overlaps.
 - o Claim boundaries: no dangles, no pseudo nodes, no overlapping lines
- Pseudo nodes do not necessarily need to be fixed, fixing them just makes it look neater. Dangles, intersections, and overlaps MUST be fixed.

- After fixing topology, make a copy of the Claim_line and Dist_line layers.
 - o Save the copy as an archive layer named topo_archive.
 - o Do not edit the topo-archive layer further.
 - o Continue editing on the Claim_Line and Dist_Line layers.

Editing Data:

- After fixing topology from the “Dist_line” sourced from the autoCAD data: edit lines where necessary using source imagery from Theme Manager and digitize around other disturbed areas.
 - o Do this if an area has been obviously mined but there is no map data including claims for that area.
- Make a “Stream_Line” feature class.
 - o Make sure boxes are checked to include M and Z values when creating the feature
 - o This will be kept in line format. Its purpose is to show the stream line digitized from the modern imagery.

Convert to Polys:

- After converting to Polygon, fix claims so they are overlapping but not intersecting.
- Save a “Poly_archive”
- Make attribute fields for the Attribute table in ArcCatalog

Filling in attributes:

- Make the fields
 - o Stream: Name, Source, Notes
 - o Disturbed: Disturbed area, source, notes, disturbance level
 - o Claims: Claim name, stream name, BLM number, type, operator, source, year last mined, disturbance level, restoration effort year, notes
- Refer to the excel document from Bob Strobe to cross check info (claim names, BLM number)
 - o Make a table join/relate to fill in the BLM number (not sure how, ask Chad)

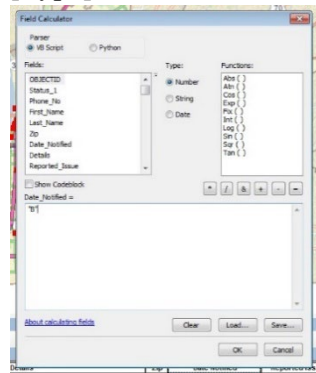
- Makes sure claim names in the attribute table and the ClaimData table match, then do the join?

After filling in attributes...

- Double check everything and make sure it is correct. Make sure there is no missing information. Add notes where necessary.

Fill in column with same value:

- Use the field calculator, go to attribute table, right click on the table header, and choose field calculator
[Type] = "Placer"



Create a final version of the .mxd for the park that includes the following disturbed layers: Stream Line, Dist area polygon, and claim boundaries polygon. Make sure to label the features for each layer. Make sure to update the layer link source and path so the links are not broken on the W drive (need to add a .gdb to the respective park W drive folders?)

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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National Park Service
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