National Park Service
Cultural Landscape Inventory
2015

Kennecott Aerial Tramways

Wrangell - St. Elias National Park and Preserve

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Alaska Regional Office, Cultural Landscapes Program, 2015.

Cover Photo: Jumbo Junction Station, c.1920s (Courtesy of Geoffrey Bleakley).

Inventory Unit Summary & Site Plan

Inventory Summary

The Cultural Landscapes Inventory Overview:

CLI General Information:

Purpose and Goals of the CLI

The Cultural Landscapes Inventory (CLI), a comprehensive inventory of all cultural landscapes in the national park system, is one of the most ambitious initiatives of the National Park Service (NPS) Park Cultural Landscapes Program. The CLI is an evaluated inventory of all landscapes having historical significance that are listed on or eligible for listing on the National Register of Historic Places, or are otherwise managed as cultural resources through a public planning process and in which the NPS has or plans to acquire any legal interest. The CLI identifies and documents each landscape's location, size, physical development, condition, landscape characteristics, character-defining features, as well as other valuable information useful to park management. Cultural landscapes become approved CLIs when concurrence with the findings is obtained from the park superintendent and all required data fields are entered into a national database. In addition, for landscapes that are not currently listed on the National Register and/or do not have adequate documentation, concurrence is required from the State Historic Preservation Officer or the Keeper of the National Register.

The CLI, like the List of Classified Structures, assists the NPS in its efforts to fulfill the identification and management requirements associated with Section 110(a) of the National Historic Preservation Act, National Park Service Management Policies (2006), and Director's Order #28: Cultural Resource Management. Since launching the CLI nationwide, the NPS, in response to the Government Performance and Results Act (GPRA), is required to report information that respond to NPS strategic plan accomplishments. Two GPRA goals are associated with the CLI: bringing certified cultural landscapes into good condition (Goal 1a7) and increasing the number of CLI records that have complete, accurate, and reliable information (Goal 1b2B).

Scope of the CLI

The information contained within the CLI is gathered from existing secondary sources found in park libraries and archives and at NPS regional offices and centers, as well as through on-site reconnaissance of the existing landscape. The baseline information collected provides a comprehensive look at the historical development and significance of the landscape, placing it in context of the site's overall significance. Documentation and analysis of the existing landscape identifies character-defining characteristics and features, and allows for an evaluation of the landscape's overall integrity and an assessment of the landscape's overall condition. The CLI also provides an illustrative site plan that indicates major features within the inventory unit. Unlike cultural landscape reports, the CLI does not provide management recommendations or treatment guidelines for the cultural landscape.

Inventory Unit Description

The Kennecott Aerial Tramways cultural landscape is located within the Kennecott Mines National Historic Landmark (NHL) in Wrangell-St. Elias National Park and Preserve, Alaska. The boundaries of the inventory unit encompass 3,715 acres surrounding the Bonanza, Glacier, Jumbo, and Erie aerial tramways on the west face of Bonanza Ridge.

History Overview

The steep topography and vast array of natural features on Bonanza Ridge greatly influenced the physical layout of the Kennecott mines and mill town. While the siting of the Mill Town was dependent upon access to a reliable water source and suitable topography to build upon, the siting of the mines was influenced by a Chitistone-Limestone contact which defined the location of copper ore on the upper slopes of Bonanza Ridge. This precipitous landscape characterized by deep gulches, hanging glaciers, rock glaciers, and steep talus slopes was remote, isolated, and covered in snow for the majority of the year. Bonanza Mine, the first mine to be developed at Kennecott, is situated nearly 3 miles upslope from the Mill Town clinging to the crest of a narrow traverse ledge immediately below the Bonanza outcrop at the 6,000' elevation. Glacier Mine, which consists of little more than a winch house and loading station, is located directly southwest of Bonanza Mine. This small mine was built directly upon a rock glacier that contained extremely high grade ores which had eroded from the Bonanza outcrop and slid downslope into the ice mass of the glacier. Jumbo Mine, which was also built upon a glacier, is located approximately three quarters of a mile northwest of Glacier Mine and confined to the east by a towering wall of hoodoo pinnacles. As building space was limited at Jumbo Mine, many of its support structures were built upon rollers and attached to the adjacent cliffside with cables to prevent them from falling downslope as the glacier receded. Erie Mine, the most remote of the Kennecott Mines, is perched precariously upon a jagged hillside 2,000' above the Kennicott Glacier and 4 miles north of the Mill Town. Because of the secluded and inaccessible location of Erie Mine, its support camp and workings were primarily accessed underground through a series of tunnels connecting with Jumbo Mine (Bateman, 1920: 5; Gilbert, et al., 2001: 59, Appendix H).

Consequently, the dramatic landscape of Bonanza Ridge limited circulation routes between the rich copper mines and ore processing facilities in the Mill Town. Trails and wagon roads required constant maintenance and were free from snow cover only four months out of the year, June to September, significantly limiting production. Moving wagons up and down steep slopes by horse teams was also an extremely dangerous feat. On the downhill trek from the mines, drivers had to take care that the heavy ore wagon would not break loose, run over the horses, or slide off the road. The return journey uphill was nearly as difficult as the steep wagon roads were often plagued by rock slides, mud, and loose scree. It was clear that the success of the mining operation depended on a more advanced transportation system to move ore across creeks, gulches, and ravines and natural obstacles such as snow and steep grades with ease (Gilbert, et al., 2001: Appendix H).

As soon as the Kennecott Mines Company secured ownership of the claims on Bonanza Ridge plans were underway to build a 3 mile long aerial tramway extending from the upper level of the Concentration Mill to Bonanza Mine. A 1907 conceptual plan of the Mill Town shows the proposed locations for ore handling facilities including the Tramway Terminal, Ore Shed, and Concentration Mill clustered on the hillside north of National Creek. Other features of the Bonanza Tramway were addressed in more detail. Between 1907 and 1911, the Trenton Iron Company of New Jersey in collaboration with the Kennecott Mines Company designed the entire aerial tramway system including the tramway discharge terminal at National Creek, the angle station situated mid-way up the mountain, and the loading station at Bonanza Mine. The Trenton Iron Company also provided the equipment needed to install the aerial tramway at Kennecott (Trenton Iron Company, 1907-1911; Conceptual Plan of the Mill Town, 1907; Gilbert, et al., 2001: Appendix H).

The Kennecott Mines Company hired at least 50 men to build the Bonanza Tramway over the summer of 1908. Workers cleared a 50 foot wide corridor of vegetation from either side of the aerial tramway to ensure access to the towers for repairs and reduce the risk of damage from avalanches and fallen trees. Over the course of two summers, the loading station, angle station, and an intricate system of towers, breakovers, and tension stations were built up the hillside of Bonanza Ridge. Although the aerial tramway was completed in 1909, construction was still underway on the Concentration Mill. Consequently, the aerial tramway was initially used to transport the materials and supplies needed to build a support camp at Bonanza Mine while stockpiles of ore continued to grow. Nevertheless, by 1911 the Concentration Mill was at an operational capacity and the aerial tramway was transporting up to 100 tons of ore from the mine each day to be processed (Gilbert, et al., 2001: 20, 24-25, 28, Appendix H).

Inventory Unit Description (cont.)

Once the Bonanza Tramway was regularly shipping ore, attention was extended to Jumbo Mine where encouraging discoveries had been made. A second aerial tramway was purchased and shipped to Kennecott in 1911 although major development did not occur until 1913 when a 3 mile stretch of land between Jumbo Mine and the Concentration Mill was surveyed to identify a suitable route for the aerial tramway. Tram towers, breakovers, tension stations, and a junction station complex were built later that year and by the winter of 1914 the aerial tramway was operational. The completion of the Bonanza and Jumbo tramways were significant events in preparing the mines for production as it enabled the mines to produce large quantities of ore and provided dependable transportation between the mines and Concentration Mill. Annual production more than doubled at Kennecott from a little over 81,000 tons of ore to nearly 180,000 tons in 1915. When all was working well, ore buckets (sometimes carrying as much as 300 pounds of ore per bucket) would arrive at the Concentration Mill every 2 minutes and take no longer than 45 minutes to return to the loading station on the return trip. Remarkably, the cost of running the aerial tramways amounted to only $6.27 per hour (Gilbert, et al., 2001: 29, 192, Appendix H).

With Bonanza and Jumbo mines in full production, the Kennecott Mines Company reincorporated into the Kennecott Copper Corporation to manage mining operations on a larger scale and proceeded to develop the small yet promising Erie Mine 4 miles north of the Mill Town. By 1916, a 2,000’ long aerial tramway was installed between the entrance of Erie Mine where ore was sacked, sent down the tramway, and stockpiled at a staging area for sledding to the Concentration Mill once enough snow was on the ground. However, the impacts of World War I between 1914 and 1919 caused chronic labor shortages at Kennecott forcing Erie Mine to temporarily close in 1918 and curtailing production at Bonanza and Jumbo mines up to 30 percent. Natural disasters further complicated operations at Kennecott. Both the Bonanza and Jumbo tramways were damaged by snow slides in the winter of 1918 and 1919 temporarily halting the shipment of ore. The Bonanza Tramway was later rebuilt to increase its capacity to 600 tons of ore per day, damaged sections of the Jumbo Tramway were repaired and its loading station was relocated underground to increase safety measures. Improvements were also made to the Jumbo Junction Station to support a 4,500’ long aerial tramway extending to Glacier Mine. This tramway was used to transport ore from Glacier Mine as well as service Bonanza Mine when its tramway was undergoing repairs. It is likely that a stub tramway extending from upper Glacier Mine to Bonanza Mine was built during this time to support the occasional movement of Bonanza’s ore on the Glacier Tramway (Gilbert, et al., 2001: 29, 38, 68, Appendix H; Glacier Tramway, Drawing No. T-159, 1918; Kennecott Copper Corporation, 1918: 8).

By the late 1920s, the Kennecott Mines were not only connected by aerial tramways, but also by an extensive system of underground tunnels making it possible to enter from Erie Mine, pass through Jumbo tunnels, and exit at Bonanza Mine several miles away. As it was not uncommon for avalanches to incapacitate an aerial tramway for months at a time, the network of underground tunnels made it possible to deliver ore to the Concentration Mill using the aerial tramways that were available. The aerial tramways continued to be actively used and serviced until the last of the great Kennecott ore bodies were in sight at the turn of the 1930s. A portion of the Glacier Tramway was disassembled after the mine closed in 1928 and the Kennecott Copper Corporation conducted limited repairs on the remaining aerial tramways after mining operations significantly declined in 1932. Subsequently, the Kennecott Copper Corporation closed all mining and tramway operations on Bonanza Ridge in 1938. Throughout the life of the Kennecott Mines, the aerial tramways were essentially the lifeline of the entire mining operation, making the transportation of large quantities of ore from the mines to the Concentration Mill profitable and incredibly efficient. Between 1909 and 1938, over 4.6 million tons of ore valued at $200 million was transported on the Kennecott aerial tramways (Gilbert, et al., 2001: 42-43; Appendix H; Saleeby, 2000: 332).

Significance Summary

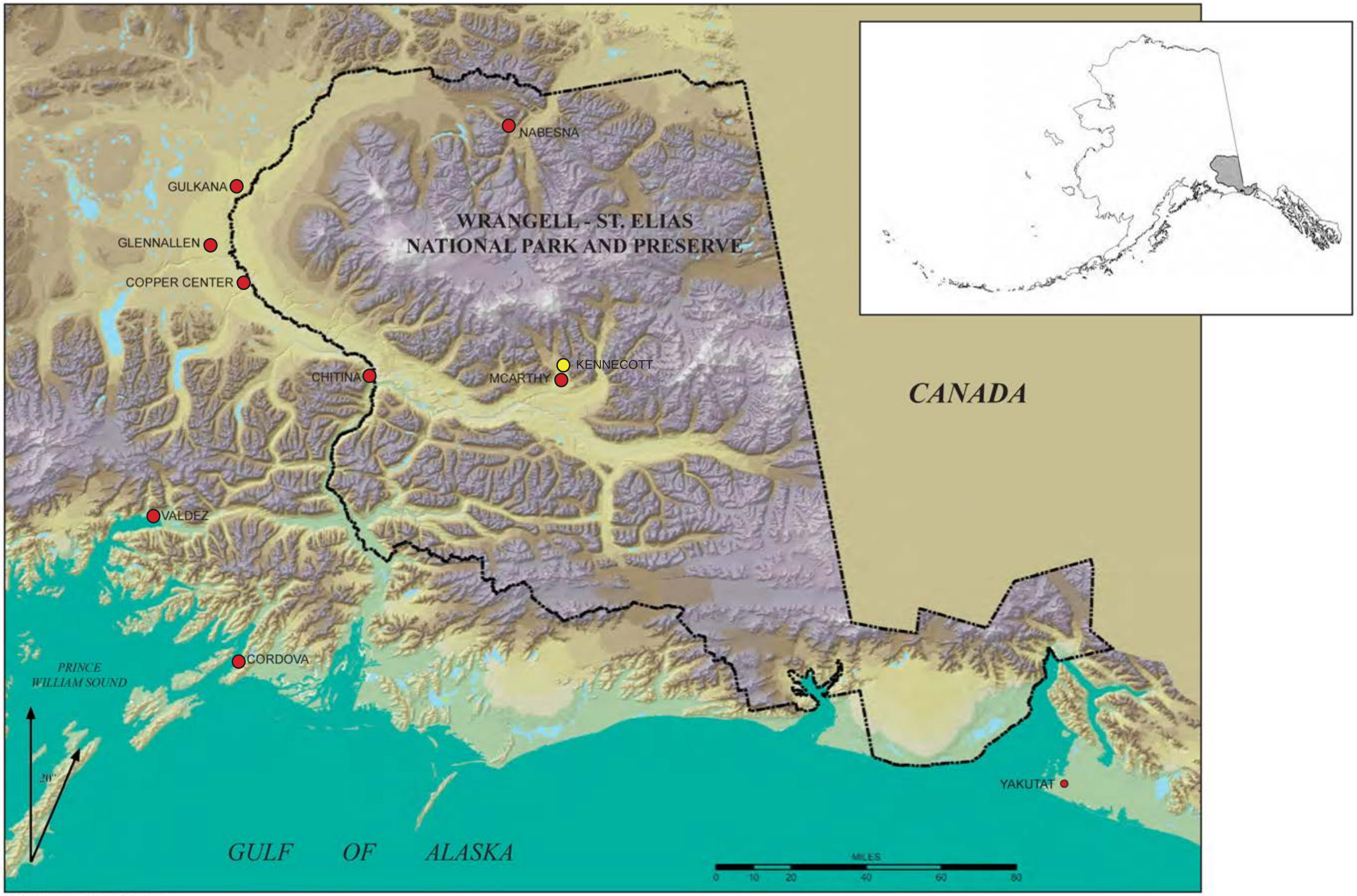
The Kennecott Aerial Tramways cultural landscape contains the remnants of the aerial tramway system on Bonanza Ridge. This includes but is not limited to towers, junction and angle stations, breakovers, tension stations, and a wide variety of equipment and objects that maintain a strong association with the Kennecott Mines. The Kennecott Aerial Tramways cultural landscape is individually eligible for the National Register of Historic Places under Criterion A at the National level and its areas of significance are industry and transportation. The historic significance of the Kennecott Aerial Tramways landscape resides in its association with the historic development, decline, and abandonment of the Kennecott Mines which were designated a National Historic Landmark (NHL) in 1986. The period of significance for the Kennecott Aerial Tramways begins in 1908 with the construction of the Bonanza Tramway and ends in 1938 with the closure of the

Inventory Unit Description (cont.):

Kennecott Mines and subsequent abandonment of the tramways.

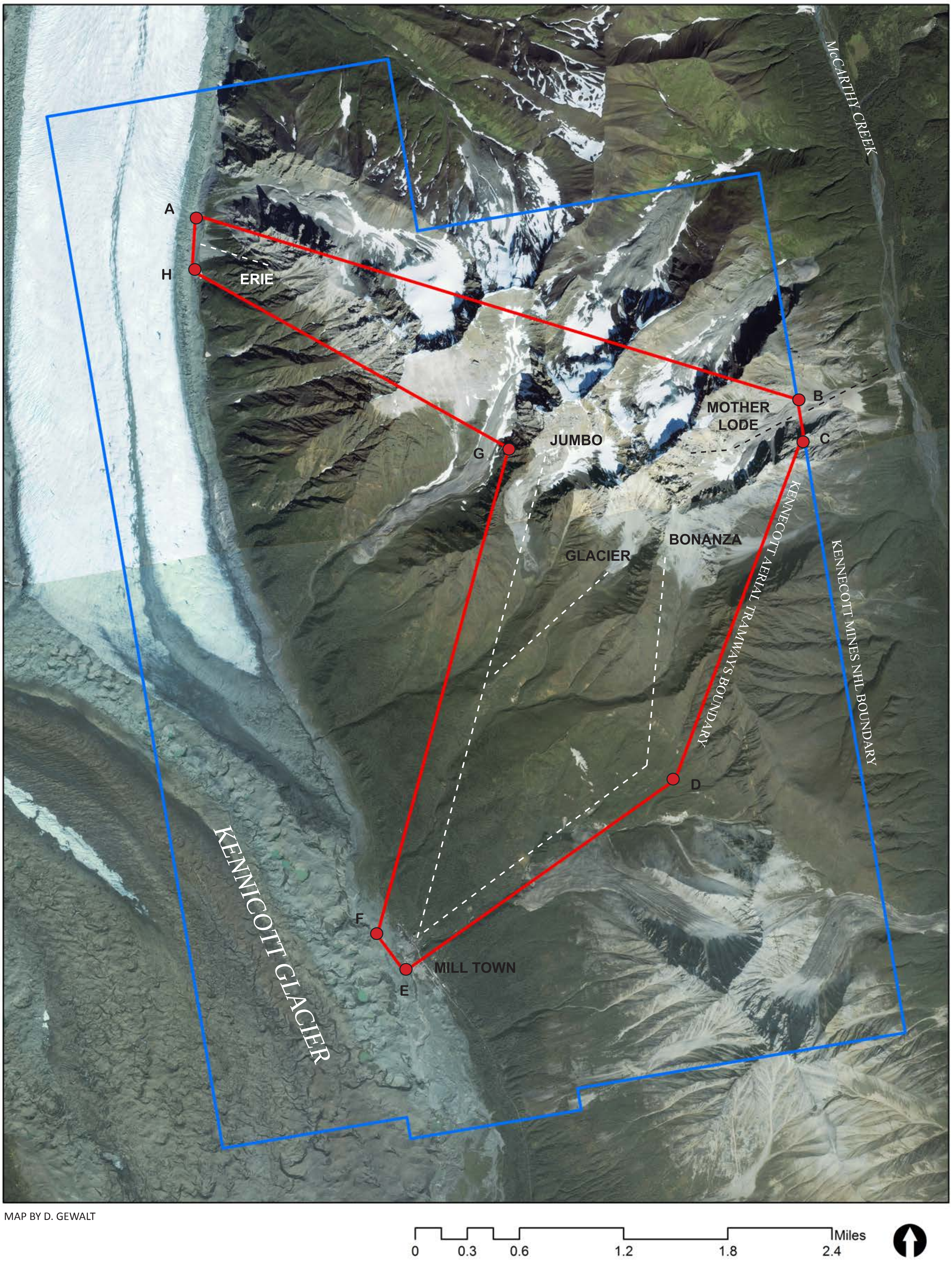
Integrity Summary

The Kennecott Aerial Tramways maintains integrity of location, association, feeling, design, materials, and workmanship. Landscape characteristics that contribute to the historic character of the Kennecott Aerial Tramways include topography, circulation, spatial organization, and cluster arrangements that are composed of buildings, structures, as well as a wide variety of objects and archeological features.



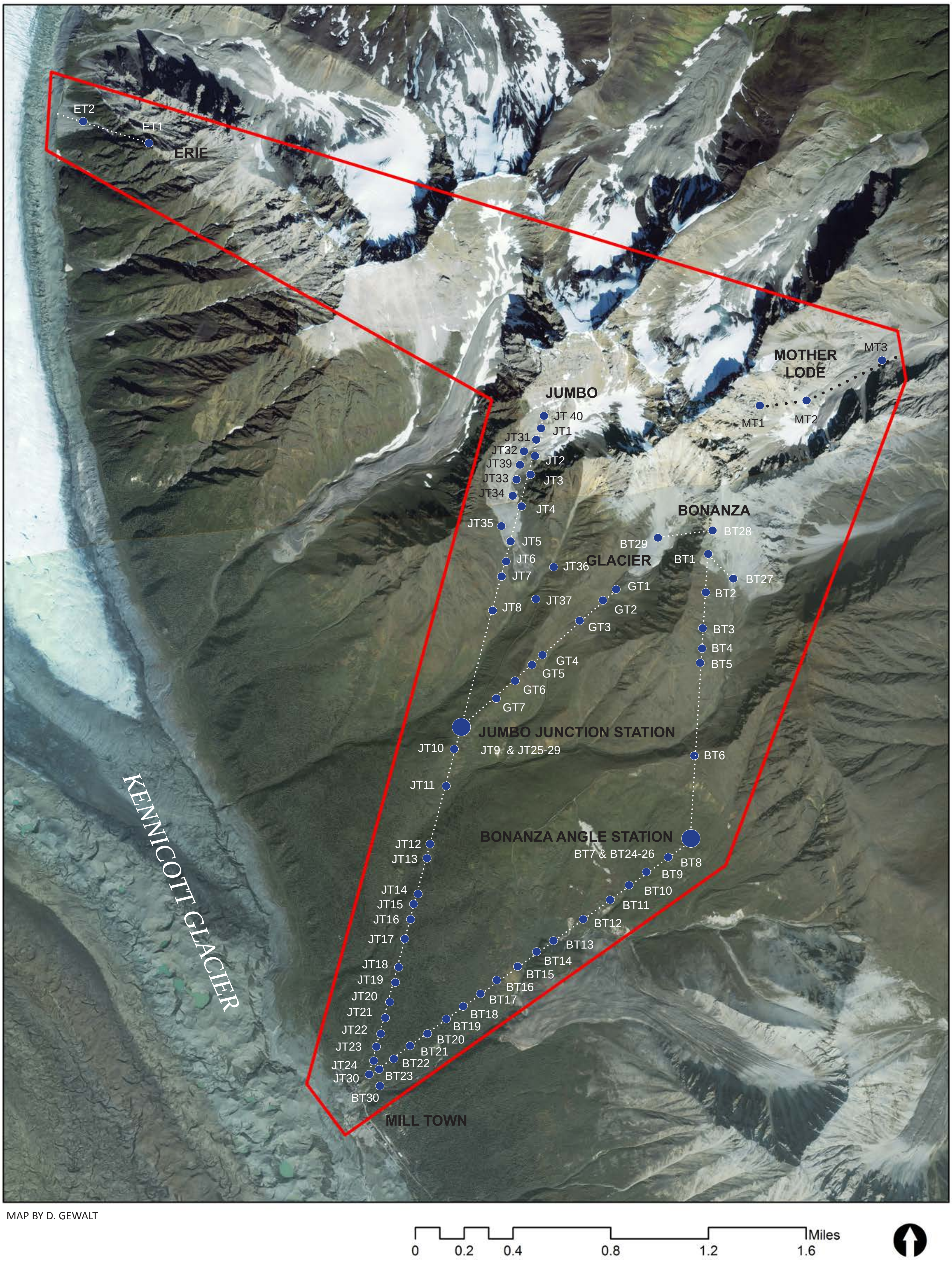
ALASKA / WRST CONTEXT

Kennecott Aerial Tramways Boundary Map

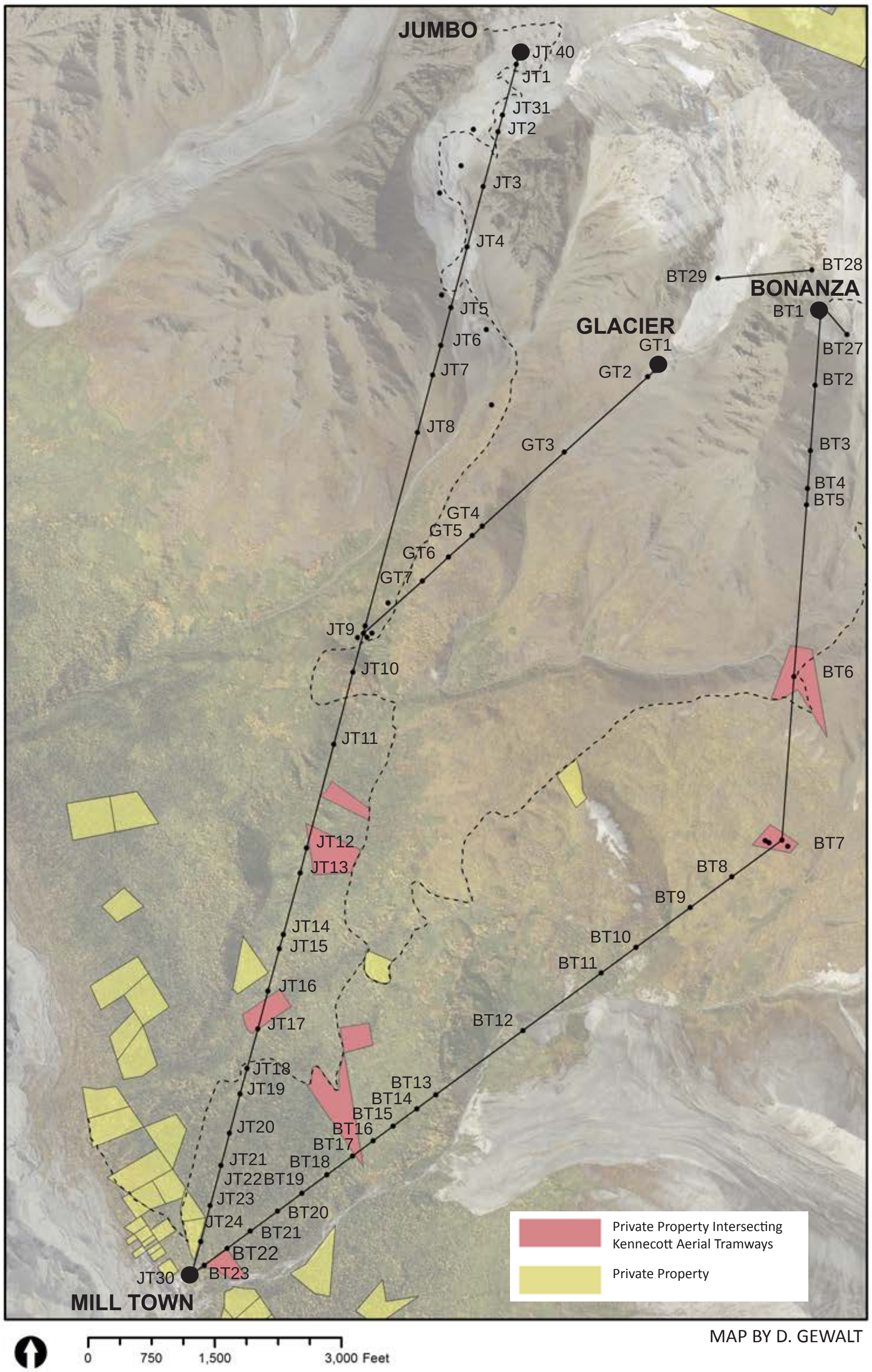


MAP BY D. GEWALT

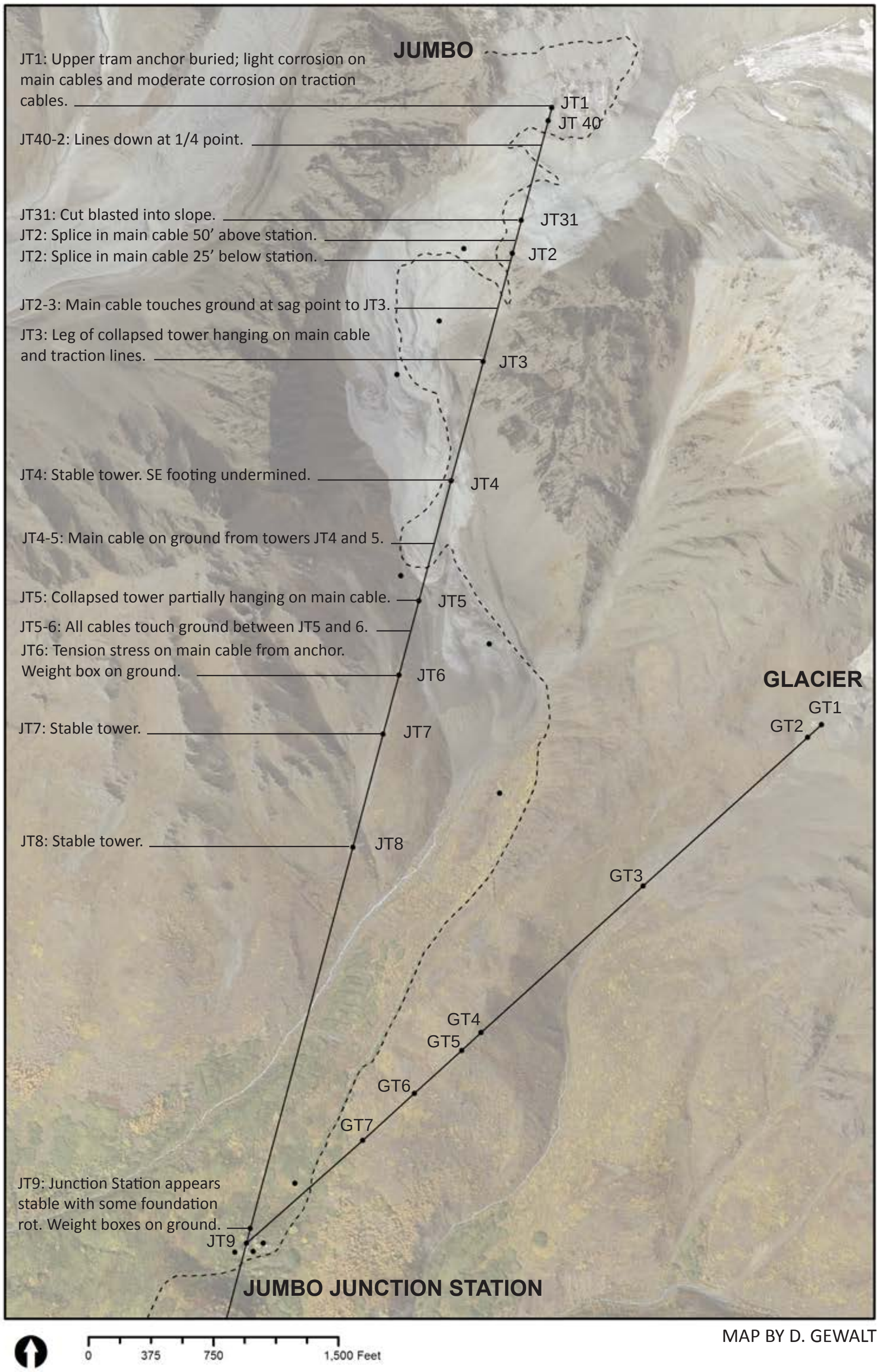
Kennecott Aerial Tramways Site Map



Bonanza, Jumbo, and Glacier Aerial Tramways Site Map

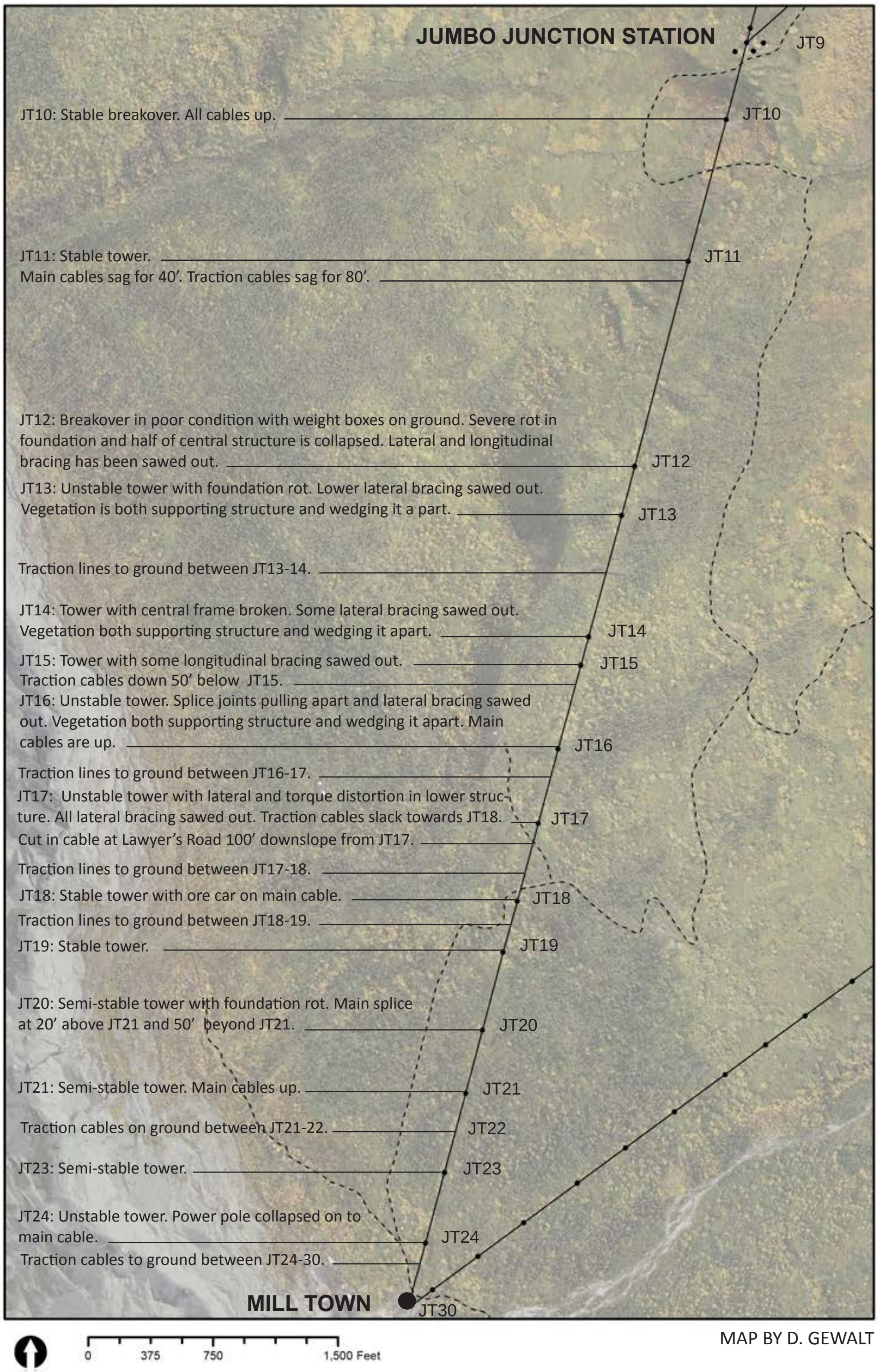


Upper Jumbo Aerial Tramway



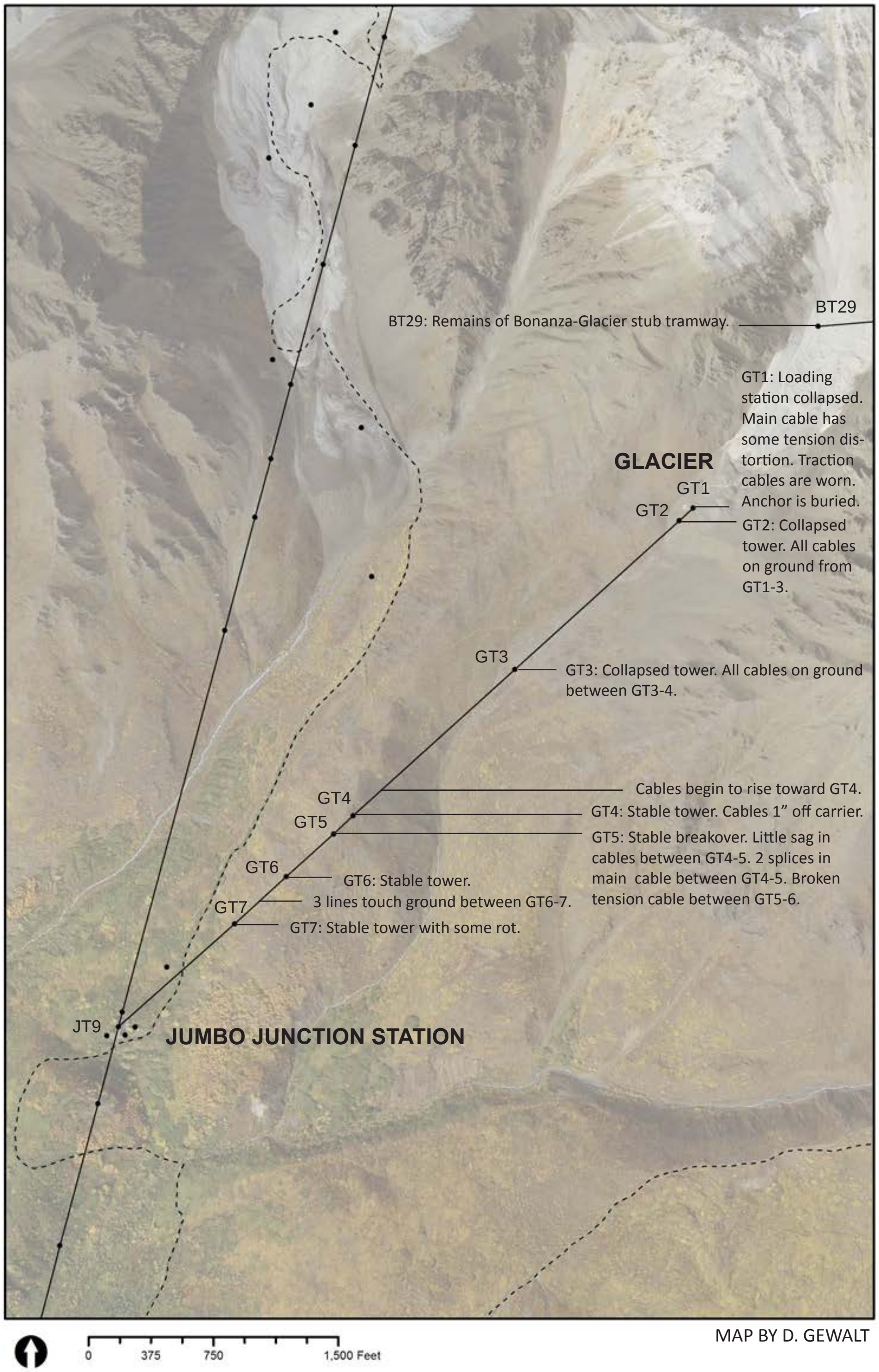
MAP BY D. GEWALT

Lower Jumbo Aerial Tramway



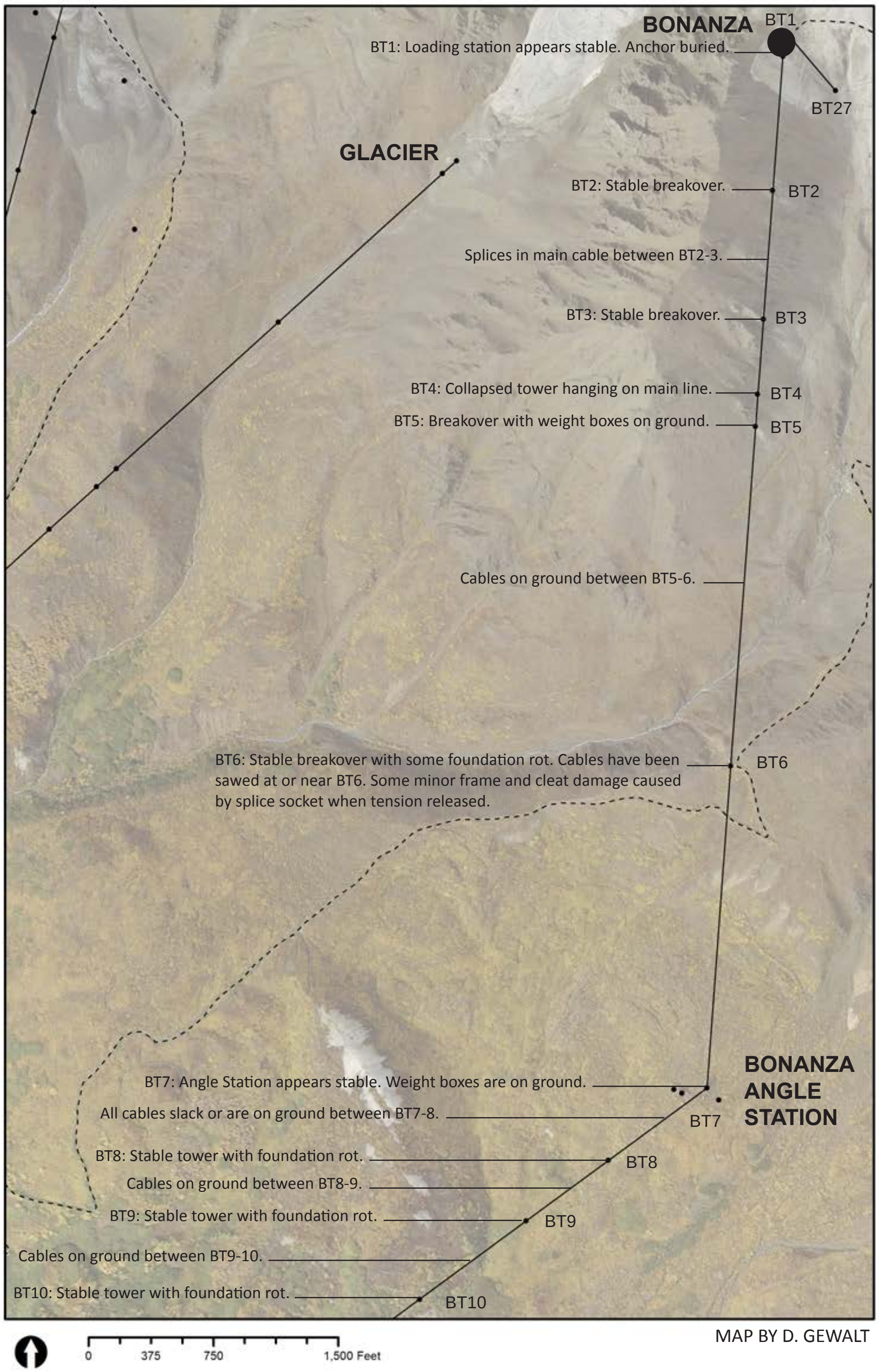
MAP BY D. GEWALT

Glacier Aerial Tramway

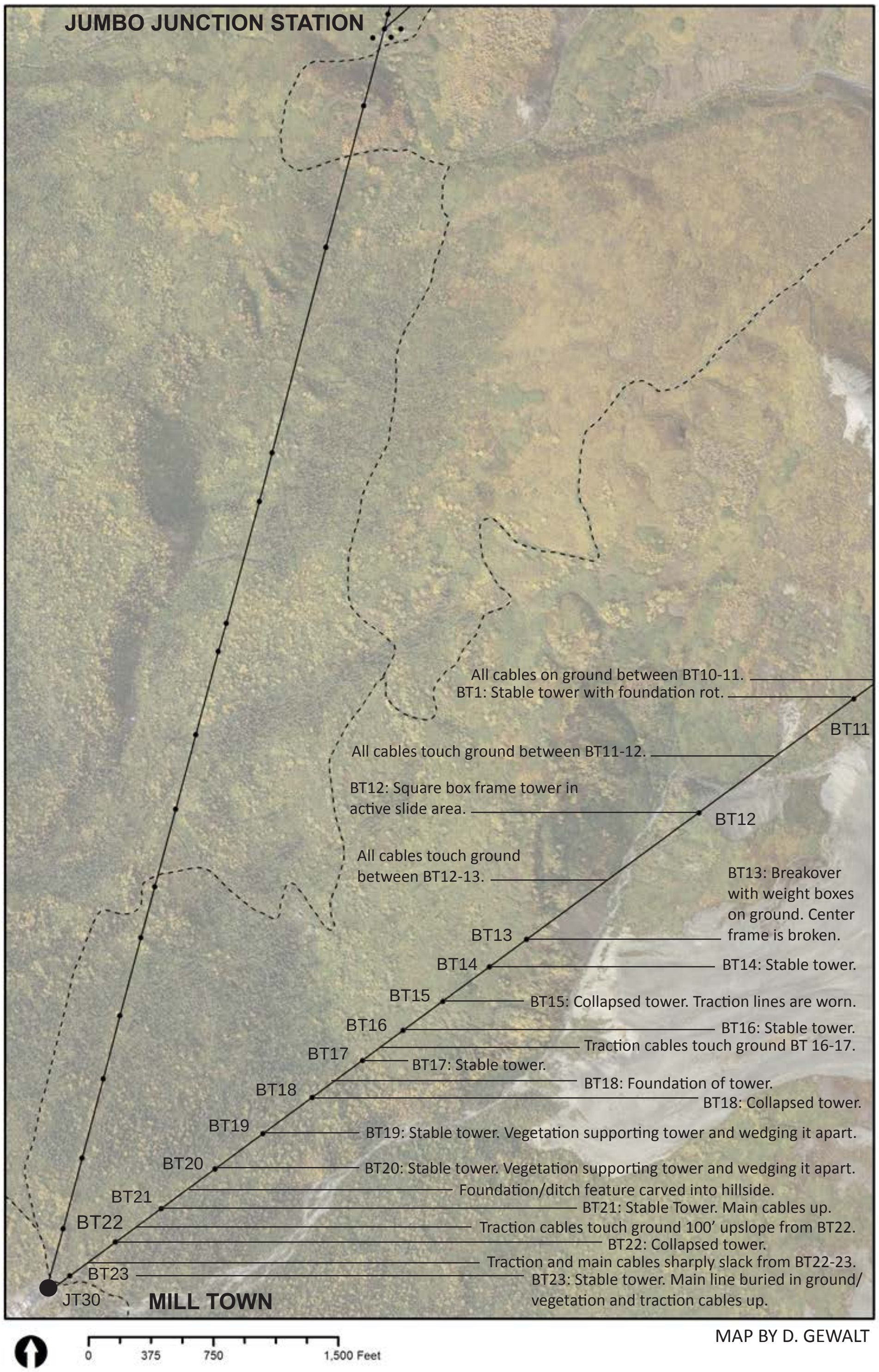


MAP BY D. GEWALT

Upper Bonanza Aerial Tramway

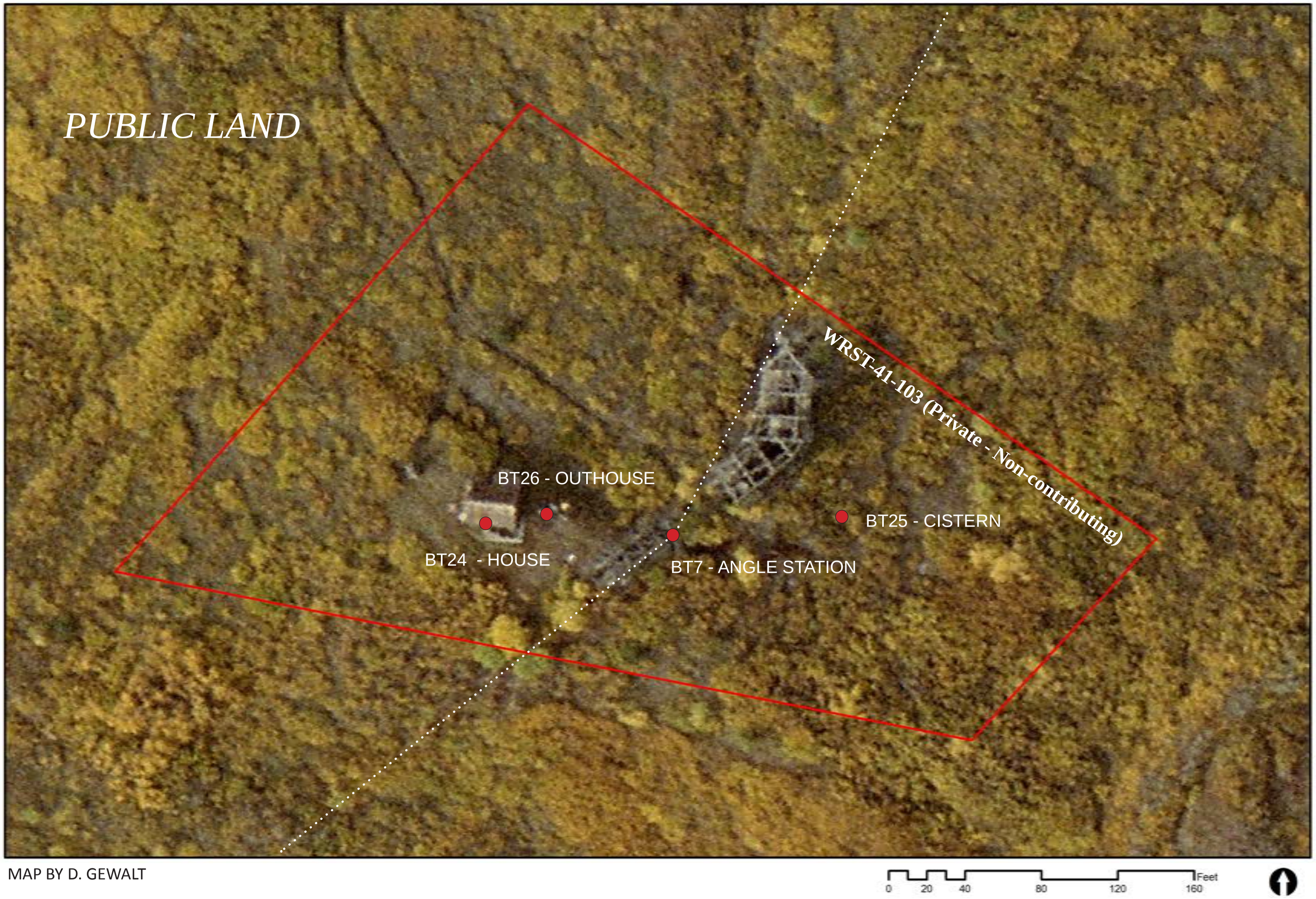


Lower Bonanza Aerial Tramway



MAP BY D. GEWALT

BONANZA ANGLE STATION (XMC-081) SITE MAP



MAP BY D. GEWALT

JUMBO JUNCTION STATION SITE MAP

MAP BY D. GEWALT

Kennecott Aerial Tramways Feature List

FEATURE #	FEATURE	OWNERSHIP	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
	Bonanza Tramway Cluster Arrangement				
BT1	Bonanza Loading Station		Yes	61.51265558	-142.83426124
BT2	Bonanza Breakover 2		Yes	61.51051170	-142.83539235
BT3	Bonanza Breakover 3		Yes	61.50845905	-142.83644916
BT4	Bonanza Tower 4		Yes	61.50726356	-142.83707819
BT5	Bonanza Breakover 5		Yes	61.50675046	-142.83733766
BT6	Bonanza Breakover 6	Private	No	61.50134611	-142.84013291
BT7	Bonanza Angle Station	Private	No	61.49621007	-142.84280629
BT8	Bonanza Tower 8		Yes	61.49530942	-142.84657168
BT9	Bonanza Tower 9		Yes	61.49455428	-142.84972116
BT10	Bonanza Tower 10		Yes	61.49358039	-142.85380436
BT11	Bonanza Tower 11		Yes	61.49295287	-142.85641702
BT12	Bonanza Tower 12		Yes	61.49153615	-142.86233894
BT13	Bonanza Breakover 13		Yes	61.48996513	-142.86892128
BT14	Bonanza Tower 14		Yes	61.48961964	-142.87034748
BT15	Bonanza Tower 15		Yes	61.48919057	-142.87214006
BT16	Bonanza Tower 16		Yes	61.48883070	-142.87365517
BT17	Bonanza Tower 17		Yes	61.48845696	-142.87520460
BT18	Bonanza Tower 18		Yes	61.48799538	-142.87713257
BT19	Bonanza Tower 19		Yes	61.48754425	-142.87901672
BT20	Bonanza Tower 20		Yes	61.48710508	-142.88085077
BT21	Bonanza Tower 21		Yes	61.48661297	-142.88290574
BT22	Bonanza Tower 22		Yes	61.48619467	-142.88465630
BT23	Bonanza Tower 23	Private	No	61.48577792	-142.88639169
BT24	Bonanza House	Private	No	61.49619434	-142.84368794
BT25	Bonanza Cistern	Private	No	61.49598219	-142.84246796
BT26	Bonanza Outhouse	Private	No	61.49628024	-142.84393537
BT27	Bonanza Stub Tower 1		No	61.51289968	-142.83394848
BT28	Bonanza Stub Terminal 2		No	61.51419273	-142.83429531
BT29	Bonanza Stub Tower 3		Yes	61.51444275	-142.84068238
BT30	Bonanza Stockpile Ore Bin	Private	No	61.48585991	-142.88575913
	Erie Tramway Cluster Arrangement				
ET1	Erie Loading Terminal		Yes	61.54208774	-142.89391830
ET2	Erie Collapsed Tower		Yes	61.54284374	-142.89734202
	Glacier Tramway Cluster Arrangement				
GT1	Glacier Loading Terminal		Yes	61.51185465	-142.84598258
GT2	Glacier Tower 2		Yes	61.51168857	-142.84653145

Kennecott Aerial Tramways Feature List (cont.)

#	FEATURE	OWNERSHIP	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
GT3	Glacier Tower 3		Yes	61.50973798	-142.85297671
GT4	Glacier Tower 4		Yes	61.50781632	-142.85933182
GT5	Glacier Breakover		Yes	61.50757837	-142.86010412
GT6	Glacier Tower 6		Yes	61.50701907	-142.86195775
GT7	Glacier Tower 7		Yes	61.50639739	-142.86399078
	Jumbo Tramway Cluster Arrangement				
JT1	Jumbo Breakover Station 0		Yes	61.52234963	-142.85179882
JT2	Jumbo Breakover Station 1		Yes	61.52030009	-142.85378206
JT3	Jumbo Tower 1		Yes	61.51863194	-142.85540020
JT4	Jumbo Tower 2		Yes	61.51679708	-142.85717958
JT5	Jumbo Tower 3		Yes	61.51494762	-142.85896980
JT6	Jumbo Breakover A/T Station 2		Yes	61.51380327	-142.86007453
JT7	Jumbo Tower 4		Yes	61.51290200	-142.86095097
JT8	Jumbo Tower 5		Yes	61.51115958	-142.86263517
JT9	Jumbo Tower 6 and Station 3		Yes	61.50528137	-142.86832352
JT10	Jumbo Breakover Station 4		Yes	61.50387071	-142.86967383
JT11	Jumbo Tower 7		Yes	61.50168091	-142.87178230
JT12	Jumbo Breakover A/T Station 5		Yes	61.49851643	-142.87478635
JT13	Jumbo Tower 8		Yes	61.49776192	-142.87550440
JT14	Jumbo Tower 9		Yes	61.49588899	-142.87732922
JT15	Jumbo Breakover Station 6		Yes	61.49545313	-142.87775670
JT16	Jumbo Tower 10		Yes	61.49417460	-142.87900671
JT17	Jumbo Tower 11		Yes	61.49302679	-142.88011163
JT18	Jumbo Tower 12		Yes	61.49182697	-142.88127680
JT19	Jumbo Tower 13		Yes	61.49104502	-142.88204162
JT20	Jumbo Tower 14		Yes	61.48984142	-142.88319801
JT21	Jumbo Tower 15		Yes	61.48886638	-142.88413249
JT22	Jumbo Tower 16		Yes	61.48840163	-142.88464939
JT23	Jumbo Tower 17		Yes	61.48764025	-142.88531276
JT24	Jumbo Tower 18		Yes	61.48655206	-142.88636071
JT25	Jumbo Operator’s House		Yes	61.50498324	-142.86798694
JT26	Jumbo Collapsed Bunkhouse 1		Yes	61.50490298	-142.86869223
JT27	Jumbo Transformer Tower		Yes	61.50490251	-142.86834771
JT28	Jumbo Collapsed Bunkhouse 2		Yes	61.50490298	-142.86869223

Kennecott Aerial Tramways Feature List (cont.)

#	FEATURE	OWNERSHIP	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
JT29	Jumbo Outhouse		Yes	61.50494228	-142.86897374
JT30	Tramway Turnhouse		Yes	61.50496984	-142.86862904
JT31	Cut		Yes	61.52080789	-142.85329304
JT32	Can Scatter		Yes	61.52051173	-142.85541379
JT33	Ladder		Yes	61.51940899	-142.85666631
JT34	Fuel Drums		Yes	61.51866222	-142.85841628
JT35	TD-24		Yes	61.51539981	-142.85944456
JT36	Tent Frame		Yes	61.51405938	-142.85681830
JT37	Heavy Equipment Sled		Yes	61.50588661	-142.86653946
JT38	Sled		Yes	61.51162828	-142.85732528
JT39	Slide Fence		Yes	61.52031093	-142.85386928
JT40	Jumbo Underground Loading Terminal		Yes	61.52254864	-142.85160232
	Mother Lode Tramway Cluster Arrangement				
MT1	Mother Lode Terminal	Private	No	61.52083484	-142.82483317
MT2	Mother Lode Tower 1	Private	No	61.52083174	-142.81887790
MT3	Mother Lode Tower 2		Yes	61.52209525	-142.80980041
	Additional Landscape Characteristics				
	Topography		Yes		
	Circulation		Yes		
	Spatial Organization		Yes		

Property Level and CLI Numbers

Inventory Unit Name: Kennecott Aerial Tramways

Property Level: Component Landscape

CLI Identification Number: 975582

Parent Landscape: 100123

Park Information

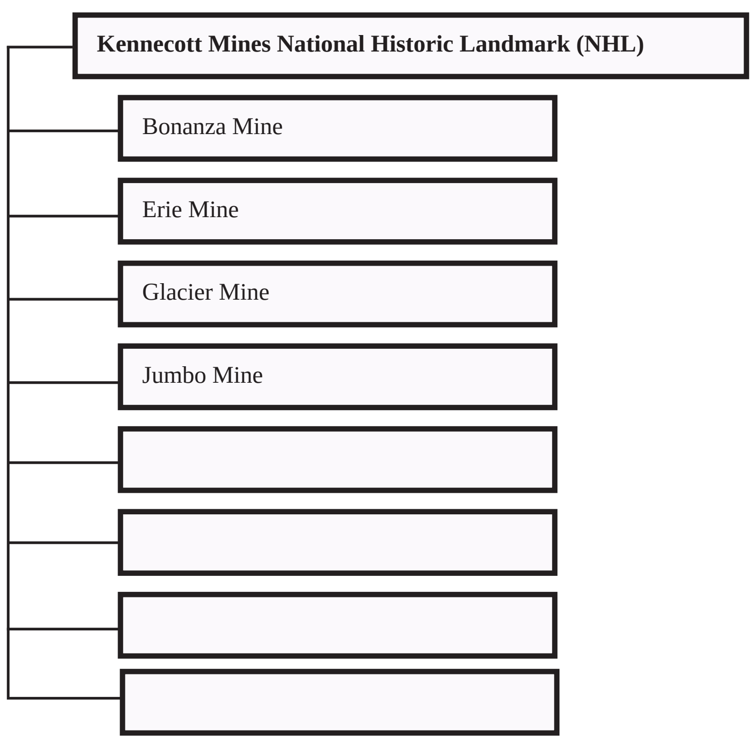
Park Name and Alpha Code: Wrangell-St. Elias National Park and Preserve

Park Organization Code: 9865

Park Administrative Unit: Wrangell-St. Elias National Park and Preserve

CLI Hierarchy Description

The Kennecott Aerial Tramways (975582) is a component landscape of the Kennecott Mines National Historic Landmark parent landscape (100123).



Concurrence Status

Inventory Status: Incomplete

Concurrence Status:

Park Superintendent Concurrence:

Park Superintendent Date of Concurrence:

National Register Concurrence:

Date of Concurrence Determination:

Recorders:

Primary Author(s):	Dinah Gewalt
Site Visit Conducted:	Yes
Data Collection Date:	6/8/2015-6/19/2015
Recorder:	Grant Crosby
Data Collection Date:	5/27/2015
Recorder:	Lee Reininghaus and Dinah Gewalt
Database Entry Date:	9/30/2015
Recorder:	Dinah Gewalt

Geographic Information & Location Map

State & County:

State: Alaska

County: Valdez-Cordova Census Area

Size (Acres): **3,715 acres**

Boundary Description:

The boundary has been drawn to encompass all known features related to the Kennecott Aerial Tramways during the period of significance. All coordinates of the boundary are in NAD 83, Alaska Albers, and the boundary points are keyed to the map on page 8.

The boundary begins at point A (61.54731968/-142.90480020) on the west side of Root Glacier. From there, the boundary strikes 19,137 feet northeast to meet with point B (61.52391339/-142.80644982) on the east side of Bonanza Ridge. From point B the boundary extends 1,056 feet south to meet with point C (61.52103366/ -142.80644659). The boundary then travels across rugged terrain for approximately 11,200 feet to meet point D (61.49461300/-142.83864932) on the west side of Bonanza Ridge below the Bonanza Angle Station. From point D the boundary strikes southwest for approximately 10,070 feet to meet with point E (61.48269571/ -142.89073146) at the moraine of the Kennicott Glacier below the Mill Town. The boundary strikes north for approximately 1,370 feet to meet point F (61.48600064/-142.89439586). From there, the boundary continues approximately 15,331 feet northeast to meet with point G (61.52396390/-142.85760571) at Amazon Gulch. The boundary then continues approximately 11,033 feet downslope to meet with point H (61.54283254/-142.90700234) at the moraine of Root Glacier. Finally, from point H the boundary extends north across the moraine for approximately 1,690 feet to meet once again with point A.

Boundary Points:

BOUNDARY UTM SOURCE	UTM DATUM	UTM ZONE	LATITUDE (D/D)	LONGITUDE (D/D)	BOUNDARY POINT
GPS-Differentially Corrected	NAD 83	7	61.54731968	-142.90480020	A
GPS-Differentially Corrected	NAD 83	7	61.52391339	-142.80644982	B
GPS-Differentially Corrected	NAD 83	7	61.52103366	-142.80644659	C
GPS-Differentially Corrected	NAD 83	7	61.49461300	-142.83864932	D
GPS-Differentially Corrected	NAD 83	7	61.48269571	-142.89073146	E
GPS-Differentially Corrected	NAD 83	7	61.48600064	-142.89439586	F
GPS-Differentially Corrected	NAD 83	7	61.52396390	-142.85760571	G
GPS-Differentially Corrected	NAD 83	7	61.54283254	-142.90700234	H

Geographic Information & Location Map (cont.)

Regional Context

Type of Context: Political

Description:

Upon the discovery of copper on Bonanza Ridge in 1901, the Alaska Coal Company established itself with the intent to invest in the mineral wealth of the site. The company later renamed itself the Alaska Copper Company and began seeking out wealthy investors to develop a mine. In 1906, the company secured the financial interests of the Guggenheims, House of Morgan, Havemeyers, and Kuhn, Loeb & Company to finance the development of the claims and the construction of a 196 mile long railroad extending from Cordova to Kennecott. Upon this partnership, the Alaska Copper Company reincorporated into the Kennecott Mines Company.

After further investigation of Bonanza Ridge, it was clear that the challenging topography of the mountainside would significantly limit the ability to transport ore from the mines to the site of a proposed mill town 3 miles away. As moving wagons up and down steep slopes by horse teams was costly and dangerous, plans to develop an aerial tramway system were formulated by the Kennecott Mines Company during the early development of Kennecott. A 1907 conceptual plan of the Mill Town shows the proposed locations for various buildings and structures; residential and support buildings were to be built alongside National Creek, and ore handling facilities such as a tramway terminal, ore shed, and concentration mill were clustered on the hillside north of the creek. Other areas of an aerial tramway were addressed in more detail during this time. Between 1907 and 1911, several drawings were prepared by the Trenton Iron Company of New Jersey in collaboration and the Kennecott Mines Company for the tramway discharge terminal at National Creek, an angle-station mid-way up the mountain, and loading station at Bonanza Mine (1907 Conceptual Plan; Bonanza Tramway, Trenton Iron Company, 1907-1911).

The Kennecott Mines Company hired at least 50 men to build the Bonanza Tramway and Concentration Mill over the summer of 1908. The mill was built from top to bottom to support the construction of the tramway terminal on the upper level. Workers cleared a 50 foot wide corridor of vegetation from either side of the aerial tramway to ensure access to the towers for repairs and reduce the risk of damage from avalanches and fallen trees. Over the course of two summers, they built a loading station, angle station as well as an intricate system of towers, breakovers, and tension stations. Although the aerial tramway was complete in 1909, construction was still underway on the Concentration Mill. Consequently, the aerial tramway was initially used to transport materials and supplies for the construction of a support camp at Bonanza Mine while stockpiles of ore continued to grow. Nevertheless, by 1911 the Concentration Mill was operational and the aerial tramway was transporting up to 100 tons of ore per day to be processed. That same year, the Copper River and Northwestern Railway reached Kennecott and a second tramway was purchased and shipped to service Jumbo Mine. Construction of the Jumbo Tramway began in 1913 and finished the following year (Gilbert, et al., 2001: 20; 68; Appendix H).

With both the Bonanza and Jumbo aerial tramways in operation, annual production greatly increased from 81,000 tons of ore to nearly 180,000 tons in 1915. The Kennecott Mines Company reincorporated into the Kennecott Copper Corporation to handle mining operations on a larger scale and attention was extended to develop the small yet promising Glacier and Erie mines. Between 1918 and 1920, the Jumbo Junction Station was improved to link an aerial tramway extending from Glacier Mine to the Concentration Mill and another aerial tramway connecting Erie Mine to a staging area situated 2,000’ below was also built around this time (Gilbert, et al., 2001: 29-30, 38, 68, Appendix H; Glacier Tramway, Drawing No. T-159, 1918).

The aerial tramways continued to be actively used and serviced until the last of the great Kennecott ore bodies were in sight. A portion of the Glacier Tramway was disassembled after the mine closed in 1928 and the Kennecott Copper Corporation conducted limited repairs on the remaining aerial tramways as mining operations declined in the 1930s. Subsequently, the Kennecott Copper Corporation closed all mining and tramway operations on Bonanza Ridge in 1938 (Gilbert, et al., 2001: 42-43; Appendix H; Saleeby, 2000: 332).

Geographic Information & Location Map (cont.)

Regional Context

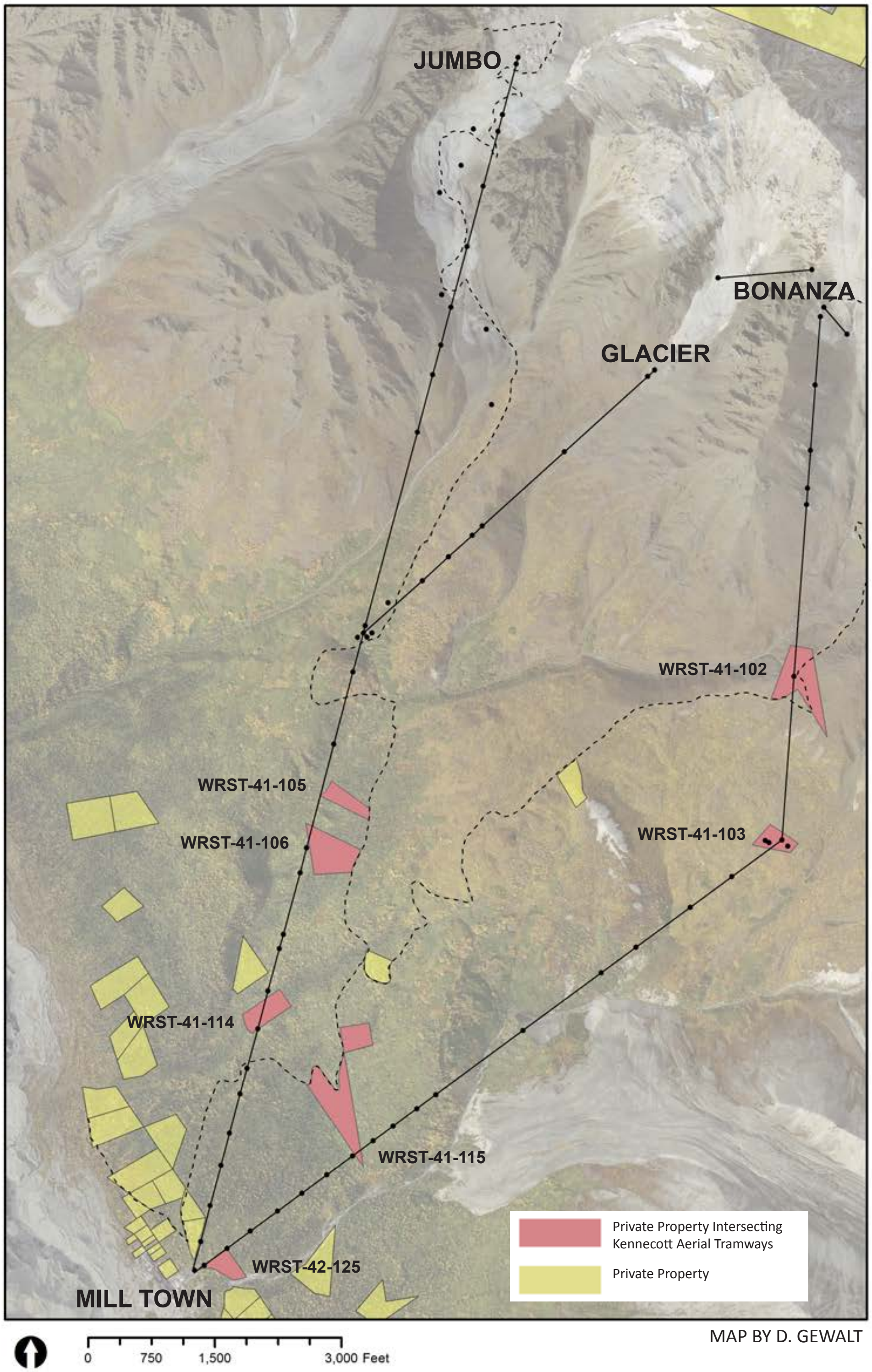
Type of Context: Political

Description:

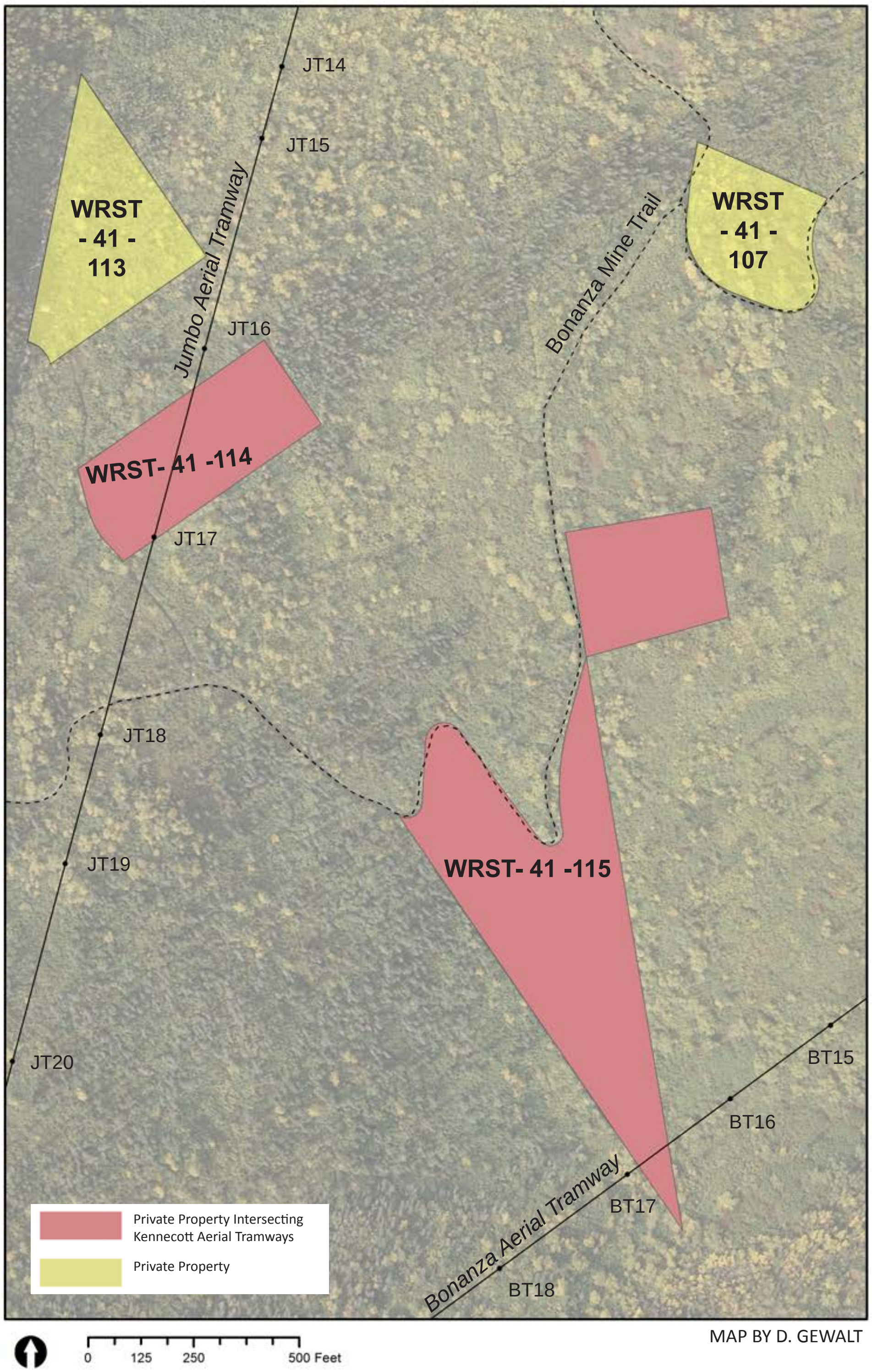
Kennecott remained a ghost town for the next 20 years until the Kennecott Copper Corporation awarded a contract to Ray Trotochau to demolish buildings in the Mill Town. In 1965, the Consolidated Wrangell Mining Company purchased 3,000 acres of the Kennecott property and began working surface ore deposits below Bonanza Mine until the mid-1970s. The Great Kennicott Land Company acquired rights to the lower half of Consolidated Wrangell's property in 1976 and proceeded to subdivide the land for sale to the public. As a result, many parcels in the Mill Town were purchased by private individuals in the 1970s and 1980s, including several parcels that contain aerial tramway related structures and buildings (Gilbert, et al., 2001: 44, 47).

As historic buildings were deteriorating beyond repair, demolished and replaced with new structures a number of local property owners became increasingly concerned about the welfare of Kennecott. Subsequently, in 1988 a group of locals formed a nonprofit entitled the Friends of Kennicott to facilitate emergency stabilization of buildings in the Mill Town and National Park Service acquisition of Kennecott. On July 12, 1978, the Kennecott Mines were listed on the National Register of Historic Places and later incorporated within the boundaries of Wrangell-St. Elias National Park and Preserve in 1980. 7,700 acres including the mines, mill town, and adjacent landscape were designated a National Historic Landmark (NHL) in 1986. The National Park Service later acquired 2,839 acres including much of the mill town and mines in 1998 (Kennecott Operations Management Plan, 2013: 2, 5; Gilbert, et al., 2001: 44, 47; Friends of Kennicott, 2013).

Geographic Information & Location Map (cont.)



Geographic Information & Location Map (cont.)



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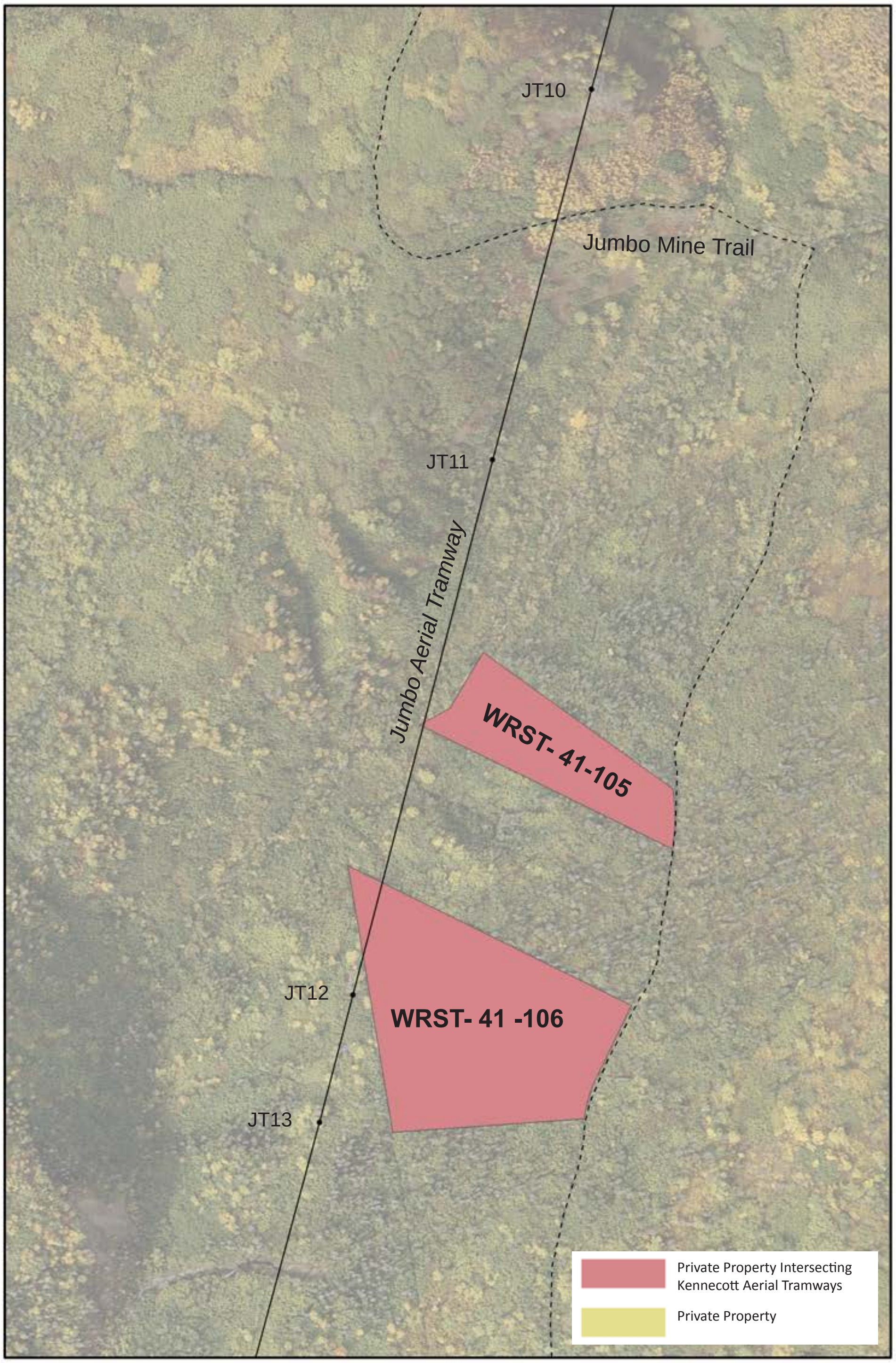
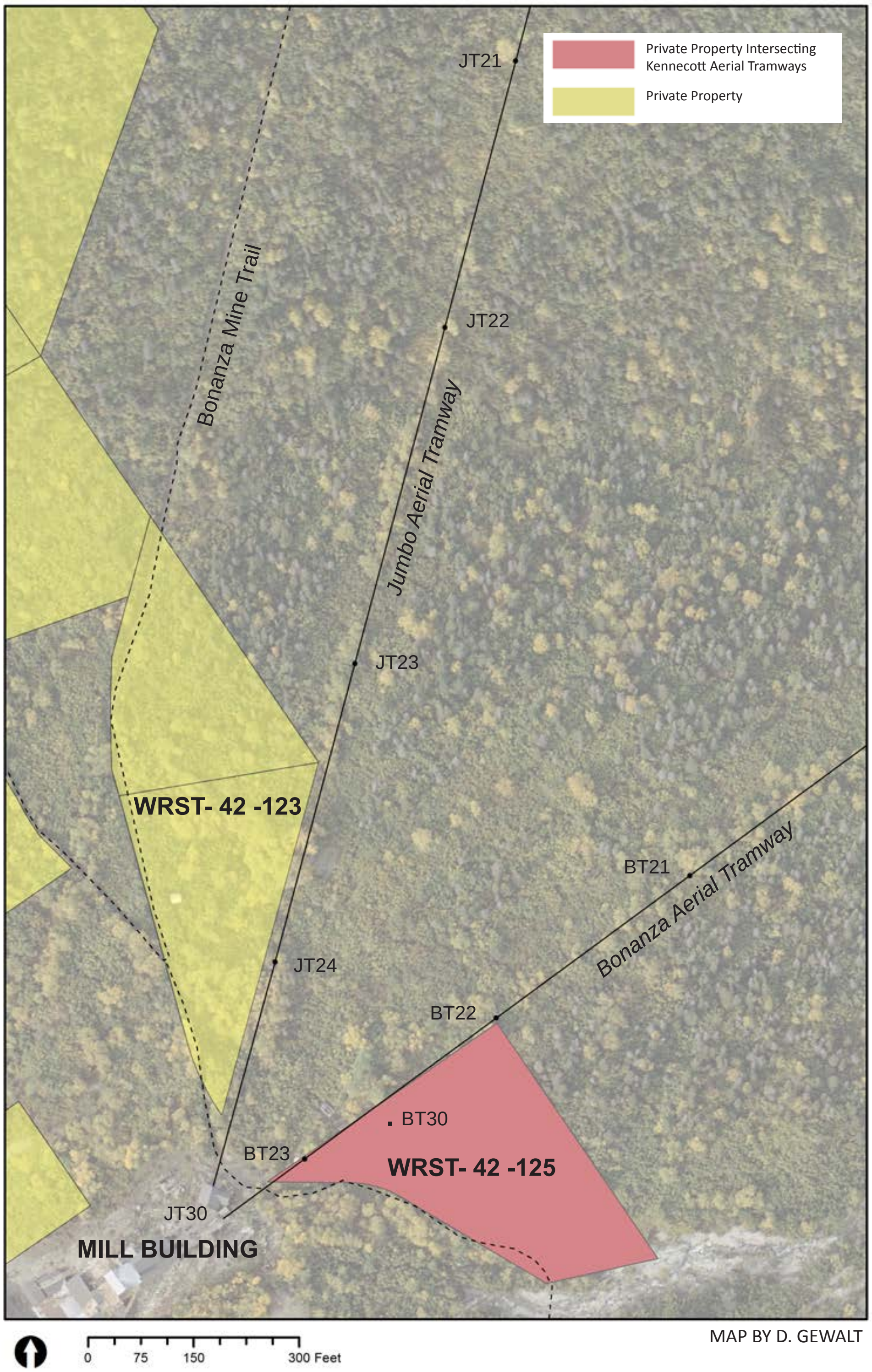


MAP BY D. GEWALT

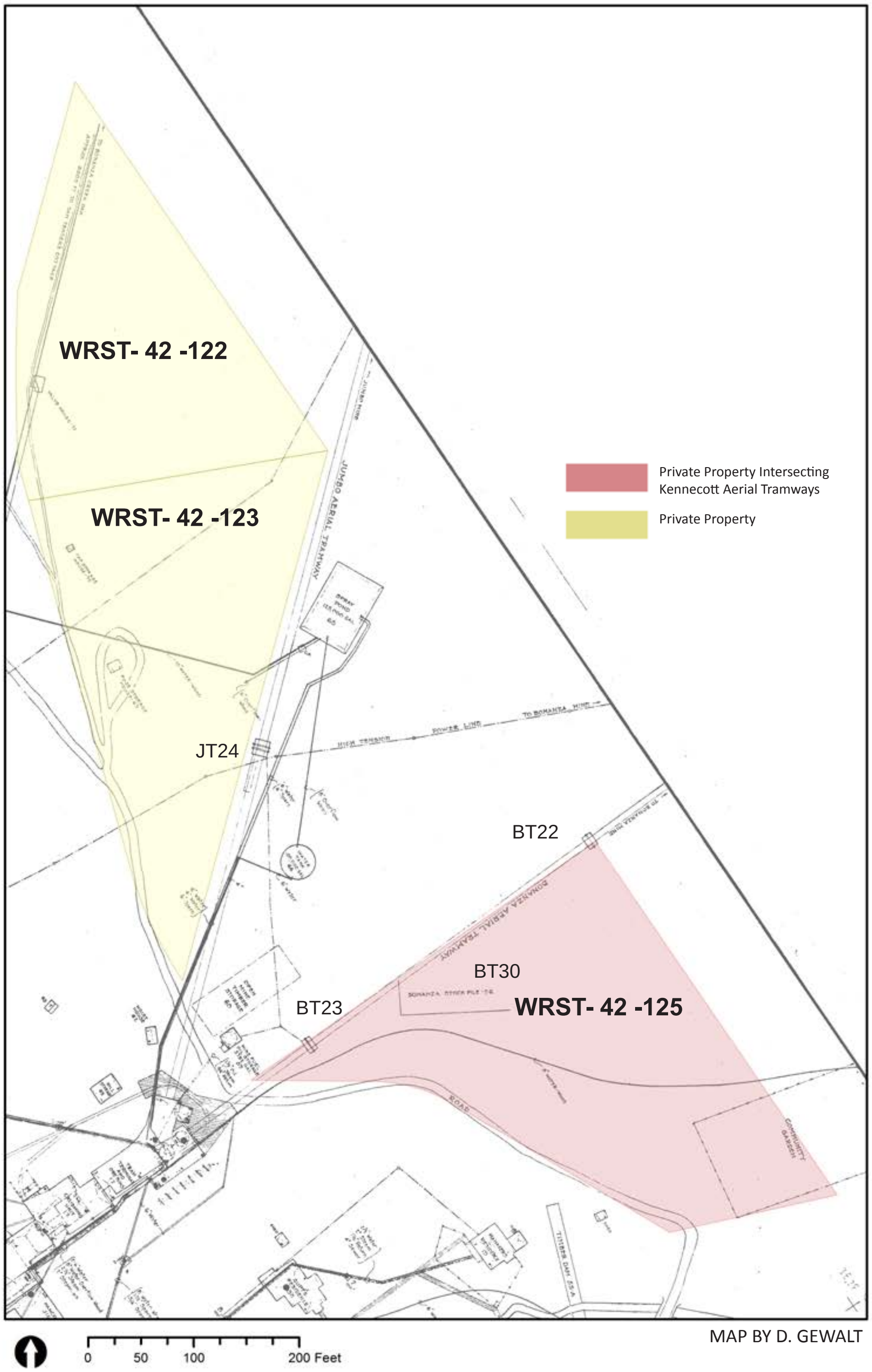
0 125 250 500 Feet

Geographic Information & Location Map (cont.)



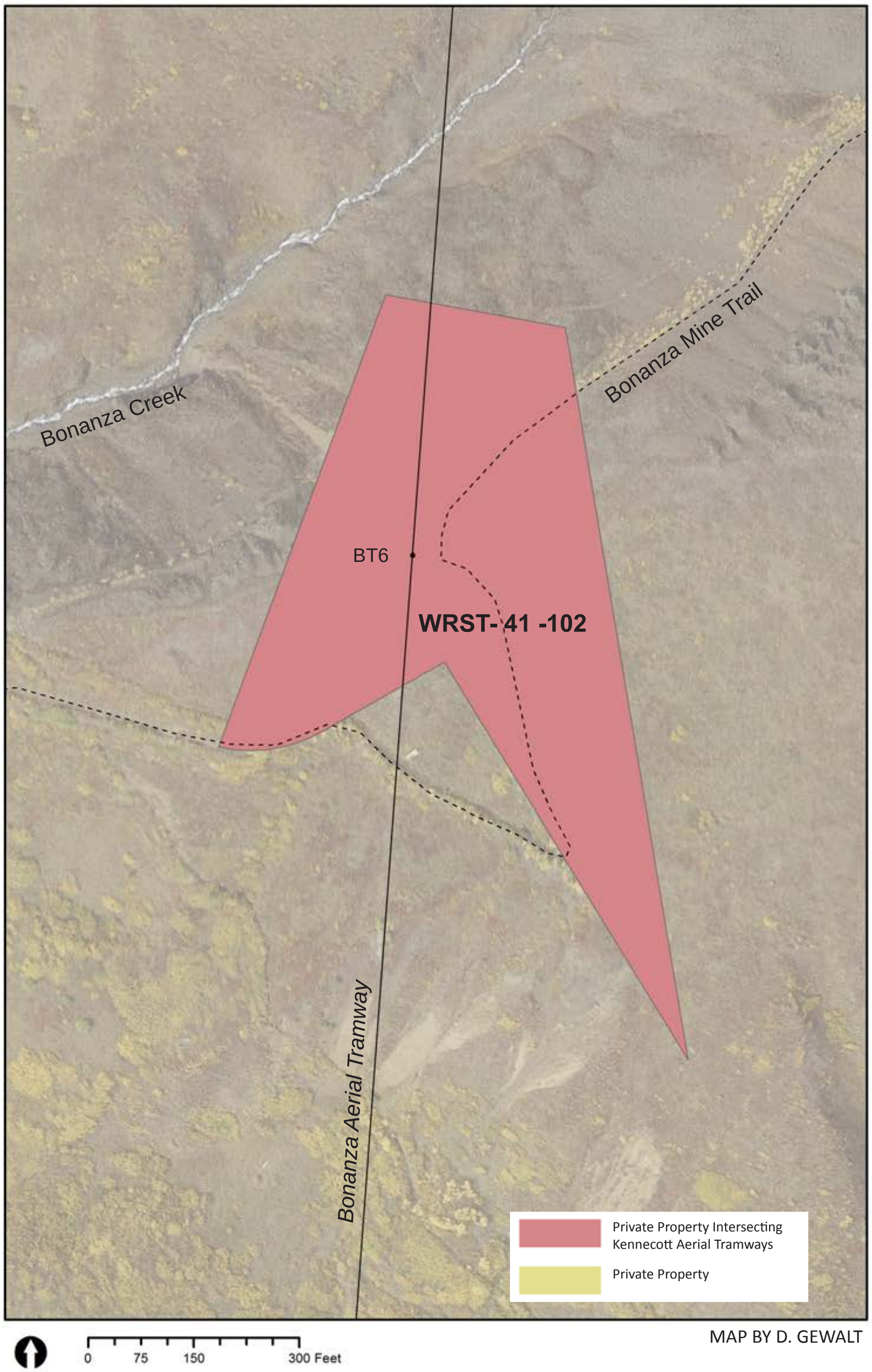
Geographic Information & Location Map (cont.)

1936 Insurance Map With Current Land Ownership



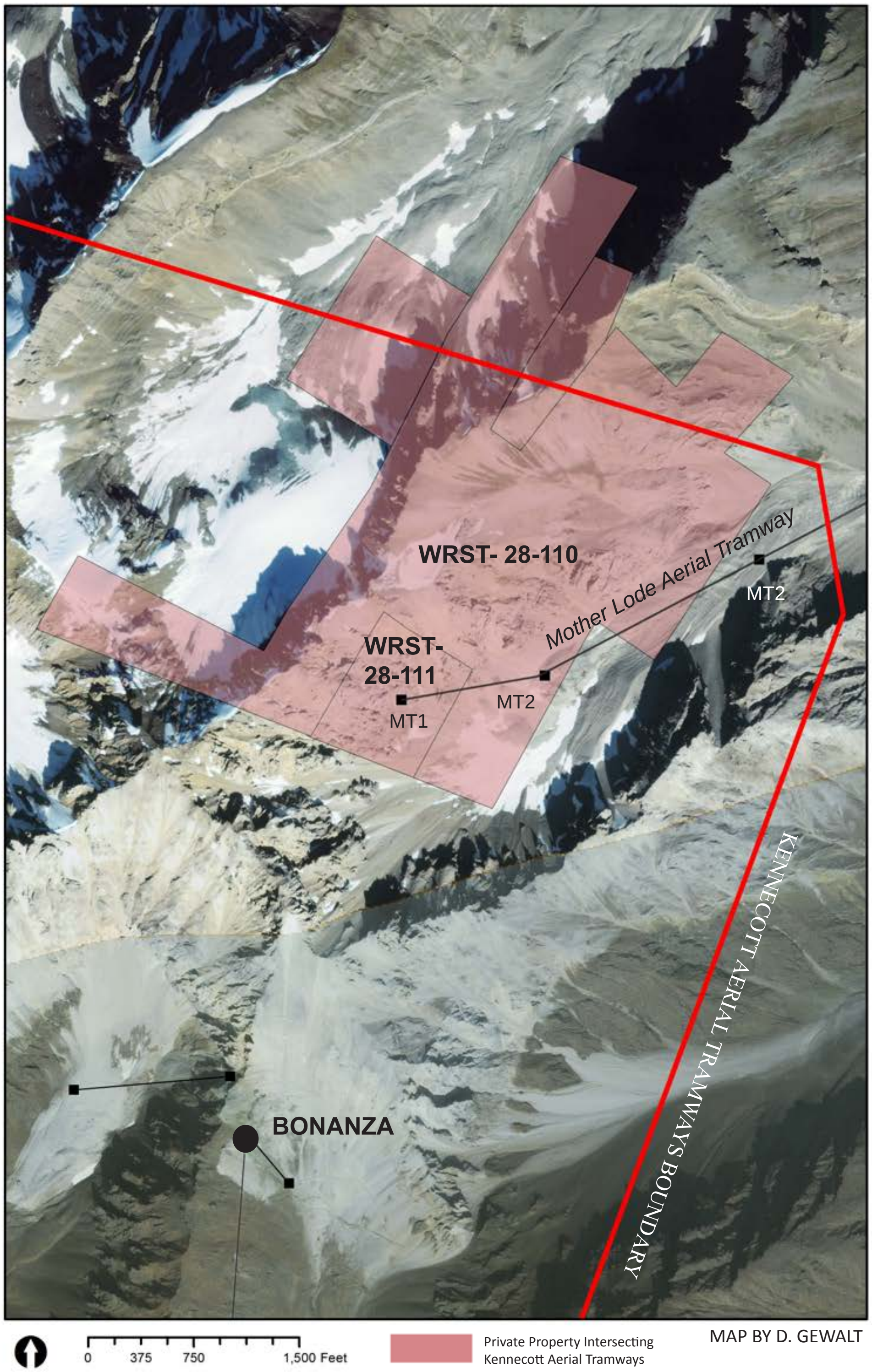
MAP BY D. GEWALT

Geographic Information & Location Map (cont.)



MAP BY D. GEWALT

Geographic Information & Location Map (cont.)



BONANZA ANGLE STATION (XMC-081) SITE MAP

MAP BY D. GEWALT

Management Information

General Management Information

Management Category:

May be Preserved and Maintained

Management Category Date:

06/17/2015

Management Category Explanatory Narrative:

The Kennecott Aerial Tramways meets the National Register criteria but due to the landscape's poor condition it "may be preserved and maintained."

Agreements, Legal Interest, and Access

NPS Legal Interest:

Type of Interest:

Fee Simple

Explanatory Narrative:

The Bonanza, Mother Lode, and Jumbo tramways intersect with private inholdings. Additional management entities such as subdivision easements and covenants may further influence land use within the Kennecott Aerial Tramways cultural landscape. All other property is owned by the National Park Service on a fee simple basis. For the purposes of this Cultural Landscape Inventory, the "Kennecott Aerial Tramways cultural landscape" refers specifically to the property the National Park Service has full legal interest and preservation documentation and management.

Public Access:

Type of Access:

Other Restrictions

Motorized vehicle access is restricted past the Jumbo Mine trailhead.

Adjacent Lands Information

Do Adjacent Lands Contribute?:

No

National Register Information

Existing National Register Status

National Register Landscape Documentation:

Entered - Documented

National Register Explanatory Narrative:

The Kennecott Mines were listed on the National Register of Historic Places on July 12, 1978 and later designated a National Historic Landmark (NHL) on June 23, 1986. The 1986 Landmark nomination indicates that the "tramway system with related structures" are contributing to the Kennecott Mines NHL (Spude and Pierce, 1986; Kennedy, 1978).

National Register Eligibility

Contributing/Individual:	Contributing
National Register Classification:	Site
Significance Level:	National
Significance Criteria:	A - Associated with events significant to broad patterns of our history

Period of Significance:

Start Year:	1908 AD
End Year:	1938 AD
Historic Context Theme:	Developing the American Economy
Subtheme:	The Mining Frontier
Facet:	Mining

Area of Significance:

Area of Significance Category:	Industry
Area of Significance Category:	Transportation
Area of Significance Subcategory:	None

National Register Information (cont.)

National Historic Landmark Information

National Historic Landmark Status: Yes

National Historic Landmark Date: 06/23/1986

World Heritage Site Information

World Heritage Site Status: Listed

World Heritage Category: Natural

Landscape Described in the Nomination?: No

Statement of Significance:

The significance of the Kennecott Aerial Tramways has been established as a contributing feature of the Kennecott Mines National Historic Landmark. However further explanation is required to articulate its significance as a component landscape. The Kennecott Aerial Tramways landscape is individually eligible for the National Register of Historic Places under Criterion A at the National level and its areas of significance are industry and transportation. The historic significance of the Kennecott Aerial Tramways resides its association with the historic development, decline, and abandonment of the Kennecott Mines. The period of significance for the Kennecott Aerial Tramways begins in 1908 with the construction of the Bonanza Tramway and ends in 1938 with the closure of the Kennecott Mines and subsequent abandonment of the aerial tramways (Spude and Pierce, 1986).

The Kennecott Aerial Tramways are directly related to the development of the Kennecott Mines, one of the nation's largest producers of copper during the early twentieth century, as they were the primary transportation link between the mines and Mill Town from 1909 until 1938. The entire mining operation was dependent on the tramways to deliver large quantities of ore from the mines to the Concentration Mill to be processed and shipped to outside markets. Throughout the life of the Kennecott Mines over 4.6 million tons of ore valued at roughly $200 million was transported on the aerial tramways. The Kennecott Aerial Tramways contains an intricate system of towers, tension stations, breakovers, as well as a number of buildings and objects that collectively represent an industrial and transportation related landscape that spans three decades of historic activity (Gilbert, et al., 2001: 32, 43, Appendix H).

The Kennecott Aerial Tramways maintains integrity of location, feeling, association, design, materials, and workmanship. The location of tram towers, tension stations, and breakovers towering up the hillside from the Concentration Mill to the mining camps illustrates its function as an intricate aerial tramway system crossing creeks, gulches, and ravines and natural obstacles such as snow and steep grades that significantly limited ground transportation networks. The aerial tramways maintain a strong association with the development of Kennecott and allows contemporary observers to discern the spatial relationships and circulation patterns that were shaped by the natural landscape and the industrial activities that took place there during the period of significance. The aerial tramways also maintain integrity of design, materials, and workmanship, as articulated through its extant buildings and structures. The quality and placement of the original construction materials found in the buildings and structures is moderately intact although much is in a deteriorated state. The quality of workmanship and design is exhibited primarily in the Jumbo Operator's House, Jumbo Junction Station, Turnhouse, and in a number of the intact towers, tension stations, and breakovers on Bonanza Ridge. Even though some of the individual line-bearing structures could be characterized as being in poor condition, collectively the Kennecott Aerial Tramways convey a clear sense of its historic function and purpose.

National Register Information (cont.)

Cultural Landscape Type and Use

Cultural Landscape Type: Historic Vernacular Landscape

Current and Historic Use/Function:

Primary Historic Function:	Transportation
Primary Historic Use:	Transportation - Other
Primary Current Function:	Recreation
Primary Current Use:	Outdoor Recreation - Interpretation

Current and Historic Names:

Name:	Bonanza Tram Angle Station (XMC-081)
Type of Name:	Current
Name:	Jumbo Mine Aerial Tramway (XMC-086)
Type of Name:	Current
Name:	Jumbo Tram Junction Station (XMC-087)
Type of Name:	Current

Ethnographic Study Conducted: No

Chronology

YEAR	EVENT	DESCRIPTION
1906-1908 CE	Developed	Construction materials for the Bonanza Tramway are transported from Valdez to Kennecott on sleds (Gilbert, et al., 2001: 19).
1907-1911 CE	Designed	The Trenton Iron Company of New Jersey in collaboration with the Kennecott Mines Company prepared drawings for the Bonanza Tramway (Trenton Iron Company, 1907-1911).
1907-1911 CE	Developed	The Copper River and Northwestern Railroad (CRNW) is constructed from Cordova to Kennecott, a distance of 196 miles.
1908-1909 CE	Developed	The Bonanza Tramway is built (Gilbert, et al., 2001: 20, 68).
1910-1924 CE	Built	In 1910, a hydroelectric plant was constructed in the Mill Town to produce electricity for mining operations. A power line paralleled the Bonanza Tramway from the Mill Town to Bonanza Mine before continuing over the ridge to Jumbo Mine. Erie Mine was supplied with electricity by a power line that extended from the Mill Town (Gilbert, et al., 2001: 24-25).
1913 CE	Planned	Land is surveyed for the Jumbo Tramway (Brooks, USGS 592: 60).
1913 CE	Built	An avalanche damaged the Bonanza Tramway suspending the shipment of ore for several months (Gilbert, et al., 2001: 29).
1913-1914 CE	Developed	The Jumbo Tramway is built (Gilbert, et al., 2001: 20, 68).
1914-1924 CE	Built	An aerial tramway is constructed between Erie Mine and a staging area 2,000 feet below (Gilbert, et al., 2001: Appendix H).
1917 CE	Built	A stub tramway is built to transport ore from the East Slide ore body to the Bonanza Loading Station (East Slide Tram Terminal drawing T-7, dated July 16, 1917; Gilbert, et al., 2001: Appendix H).

Chronology (cont.)

YEAR	EVENT	DESCRIPTION
1918-1919 CE	Damaged	Avalanches damage the Jumbo and Bonanza tramways and power lines. Portions of the aerial tramways are repaired, improved, or rebuilt (Gilbert, et al., 2001: 38).
1918 -1920 CE	Built	Construction begins on an aerial tramway extending from Glacier Mine to the Jumbo Junction Station. The Glacier Tramway is operational by 1920 (Gilbert, et al., 2001: Appendix H).
1919 CE	Altered	The Jumbo Loading Station is moved underground (Gilbert, et al., 2001: Appendix H).
1931- 1937 CE	Altered	Erie Mine is temporarily closed as the cost of mining operations rise and profits decline (Gilbert, et al., 2001: Appendix H).
1937 CE	Built	The Erie Tramway is reconditioned and put into service (Gilbert, et al., 2001: Appendix H).
1938 CE	Abandon	The Kennecott Copper Corporation abandons all mining operations at Kennecott.
1976 CE	Land Transfer	The Great Kennecott Land Company subdivides the Kennecott property and sells parcels to the public. Several lots encompassing tramway related buildings and structures are sold to private individuals (Gilbert, et al., 2001: 47).
1978 CE	Established	The Kennecott Mines are listed on the National Register of Historic Places (Kennedy, 1978).
1980 CE	Established	Wrangell-St. Elias National Park and Preserve is established.
1986 CE	Established	The Kennecott Mines are designated a National Historic Landmark (NHL) on June 23, 1986 (Spude and Pierce, 1986).
1998 CE	Preserved	The Jumbo, Glacier, and Bonanza tramways are documented in *Inspection and Safety Assessment of Kennecott Mine Tram System, Wrangell-St. Elias National Park and Preserve* (Shields, 1998).

Chronology (cont.)

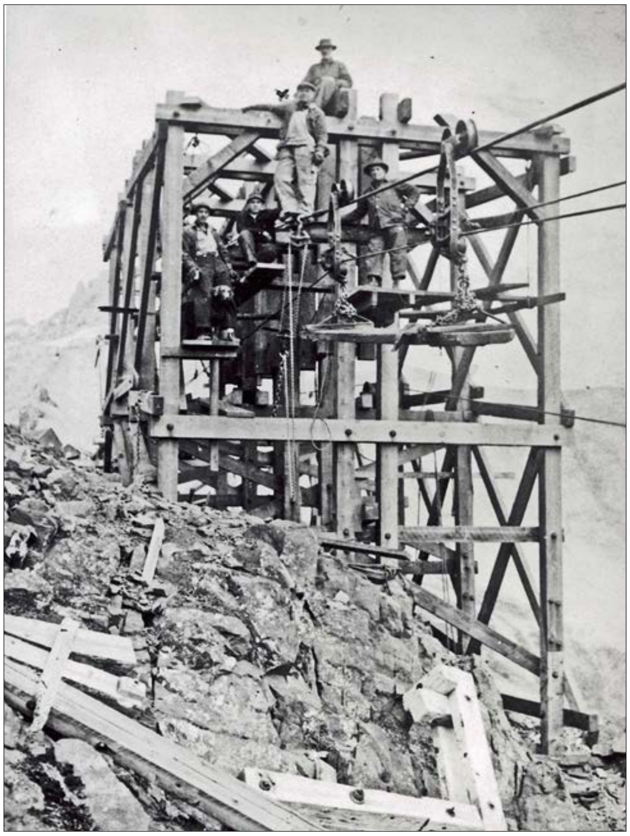
YEAR	EVENT	DESCRIPTION
2003 CE	Preserved	HAER documentation is conducted on the Kennecott Aerial Tramways. The Jumbo Tramway is documented with GPS (Bell, 2003)
2015 CE	Documented	Bonanza Tramway Engineer Survey is conducted by the National Park Service.
2015 CE	Documented	The NPS performs a condition reassessment of the Bonanza, Jumbo, and Glacier tramways.

Physical History

Construction of the Kennecott Aerial Tramways, c. 1908-1914 (Courtesy of the Cordova Historical Museum, 77-58-6).

Construction of the Kennecott Aerial Tramways, c. 1908-1914 (Courtesy of the Cordova Historical Museum, 77-58-7).

Physical History (cont.)



A breakover near Bonanza Mine (Courtesy of the Cordova Historical Museum, 77-58-5).

A man riding the Bonanza Tramway over Bonanza Canyon (Candy Waugaman Collection).

Physical History (cont.)

Miners on the Kennecott Tramway (Courtesy of the Cordova Historical Museum, 77-44-22).

View of the Bonanza Tramway from the upper level of Concentration Mill, c. 1953 (University of Alaska Anchorage, Archives and Special Collections, Consortium Library, UAA-HMC-0461).

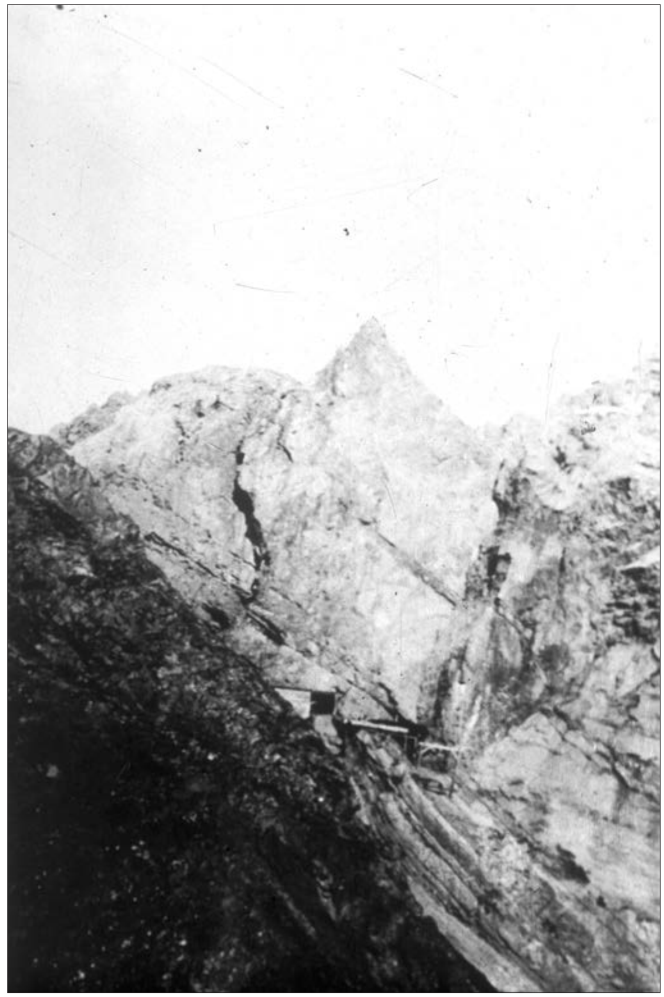
Physical History (cont.)

Jumbo Mine with breakover to left, c. 1976
(Courtesy of Moody Johnson, USDA).

View of Jumbo Tramway from Jumbo Mine, c. 1976
(Courtesy of Moody Johnson, USDA).

Physical History (cont.)

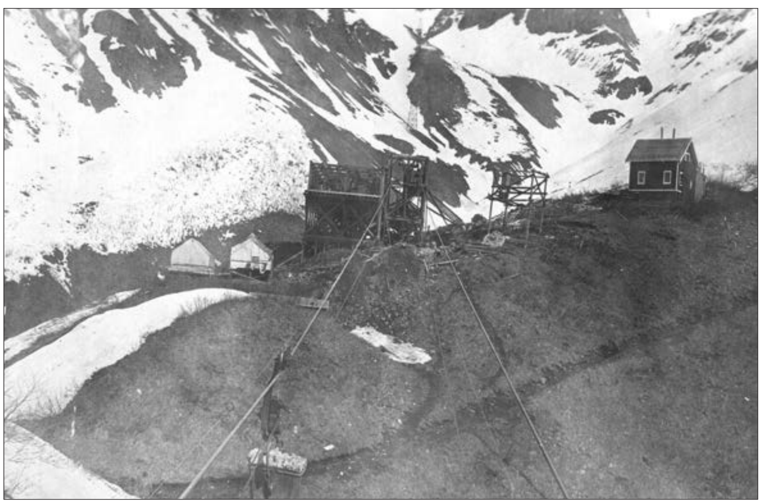
Bonanza Angle Station, c. 1922 (Courtesy of Geoffrey Bleakley).



Erie Mine Loading Terminal, c. 1916-1929 (University of Alaska Fairbanks, William C. Douglass Collection, UAF-2006-0086-00014).

Physical History (cont.)

Jumbo Junction Station, c. 1913-1918 (Courtesy of Geoffrey Bleakley).



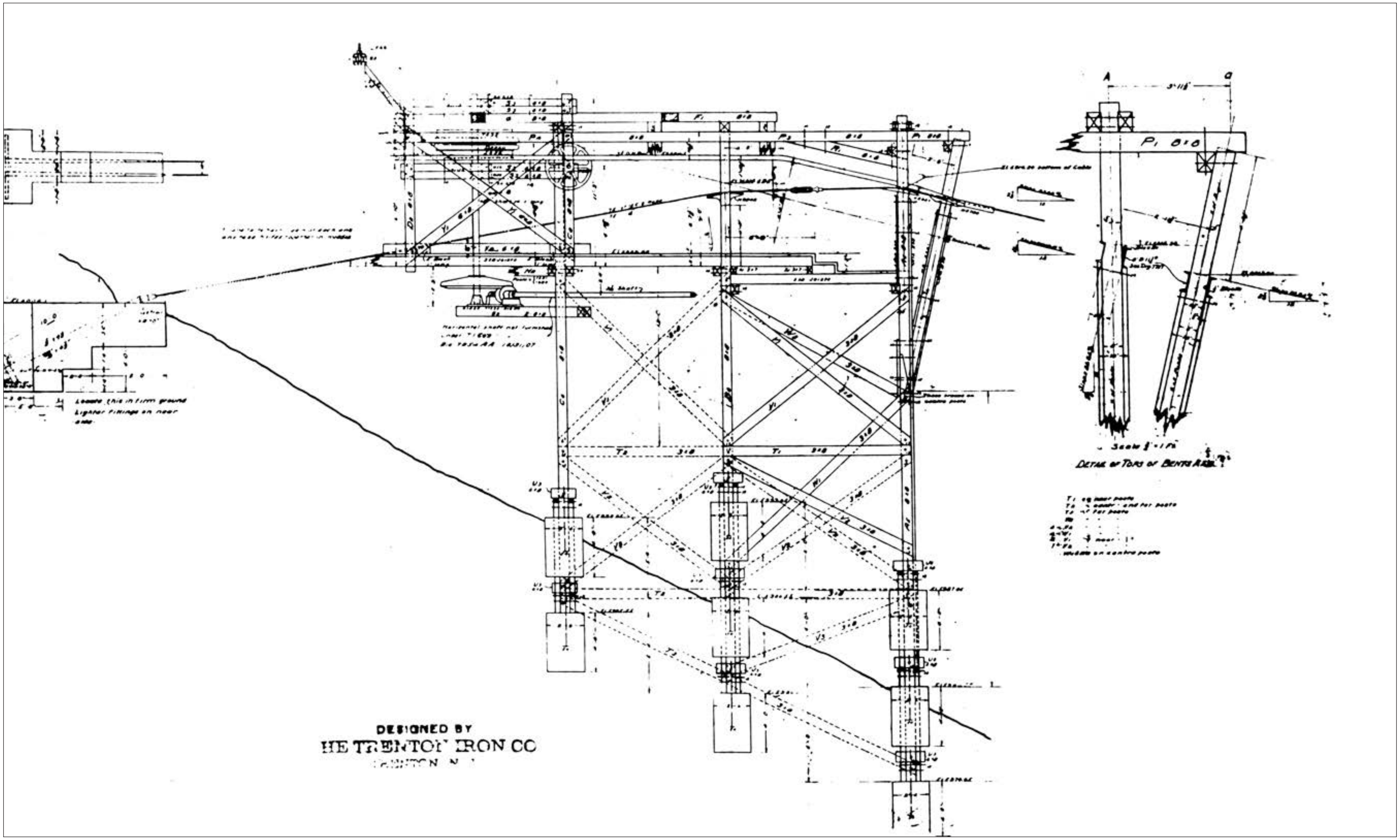
Jumbo Junction Station, c. 1913-1918 (Courtesy of Geoffrey Bleakley).

Jumbo Junction Station, c. 1918-1938 (Courtesy of Geoffrey Bleakley).

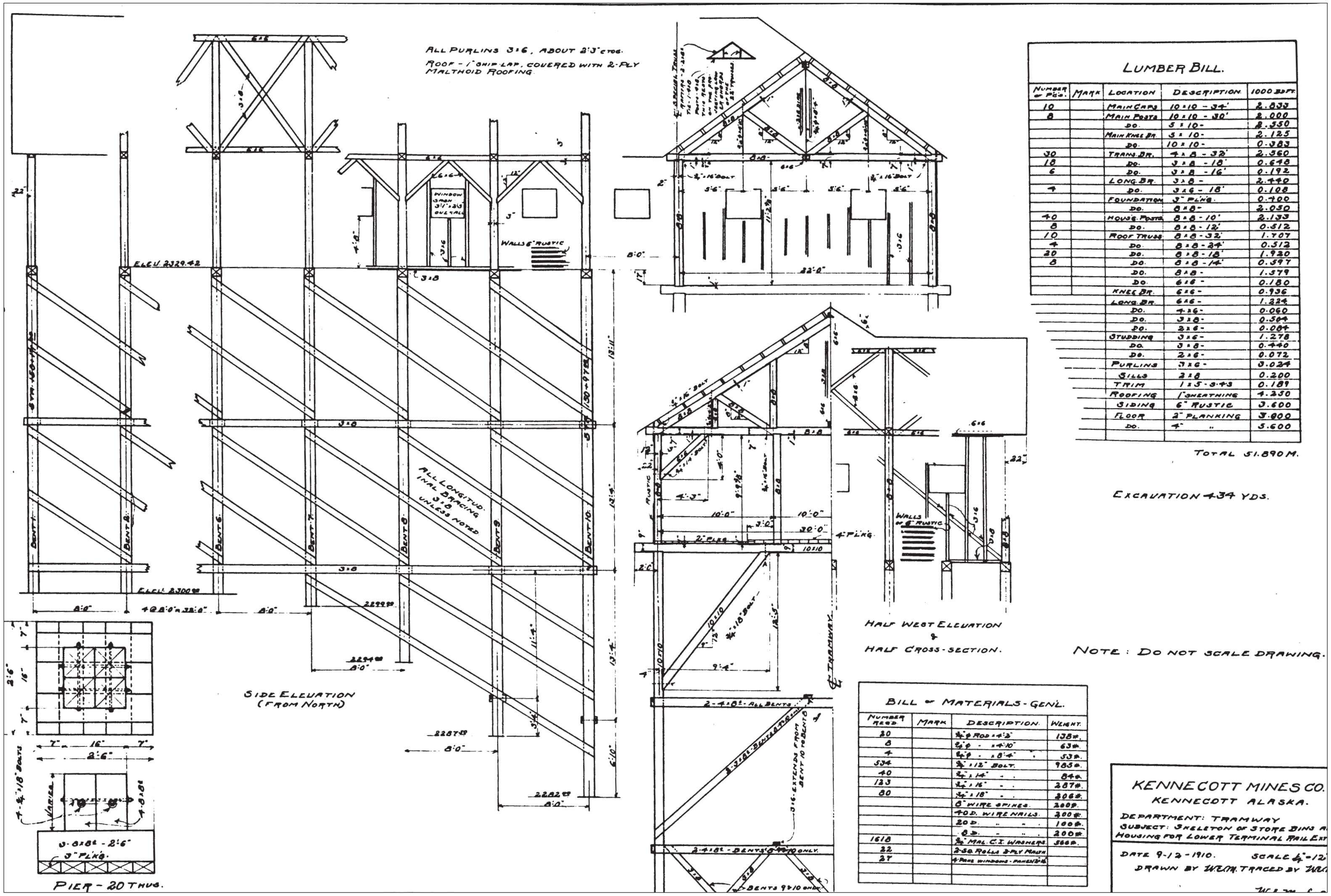
Physical History (cont.)

Bonanza-Glacier Stub Tramway, view SE, undated photo (Candy Waugaman Collection).

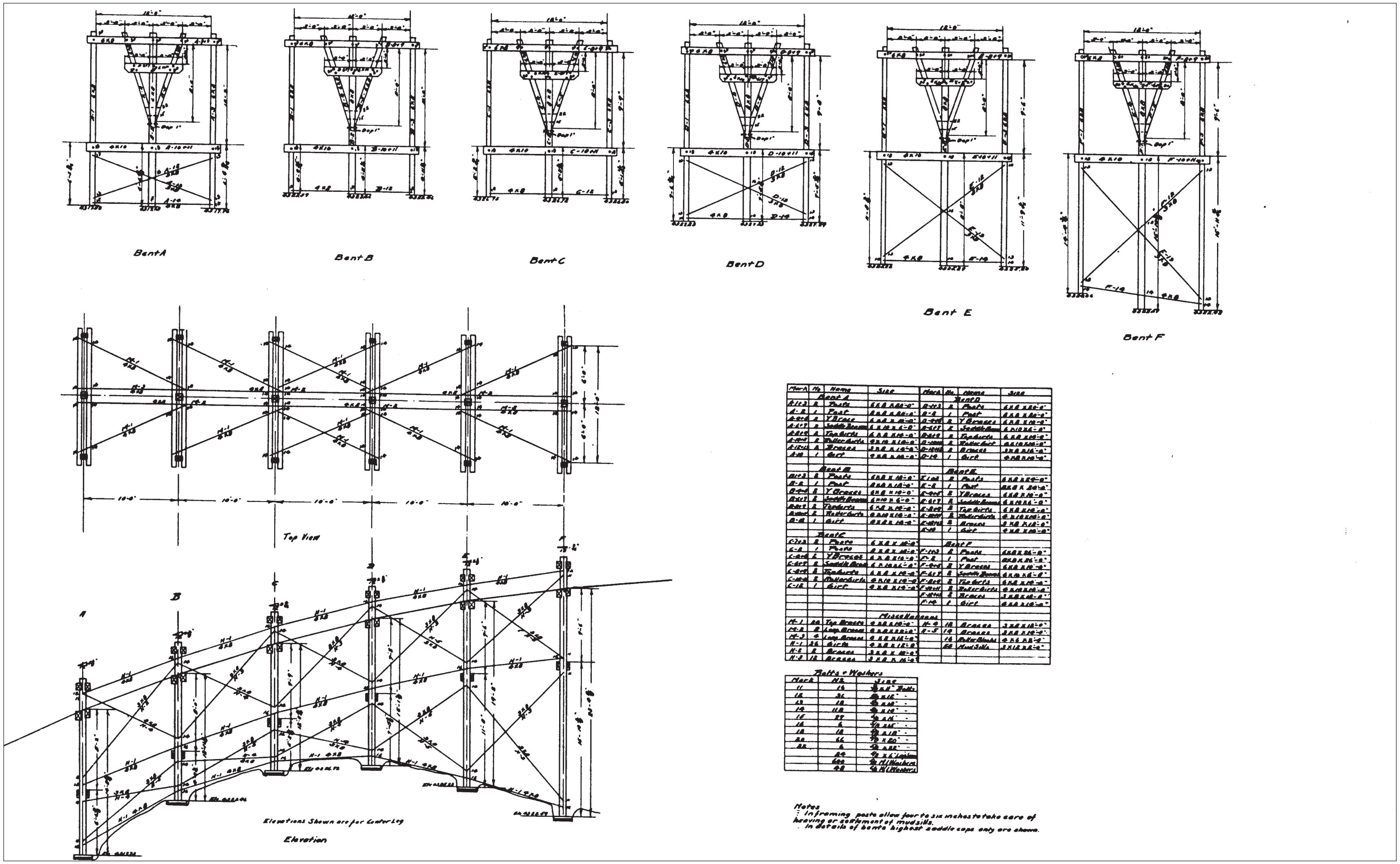
Glacier Loading Station, view E, undated photo (Candy Waugaman Collection).



Trenton Iron Works Company Drawing of Bonanza Loading Terminal, December 6, 1907 (NPS Alaska Regional Office).



Trenton Iron Works Company Drawing of Turnhouse, September 12, 1910 (NPS Alaska Regional Office).



Kennecott Copper Corporation Drawing of Glacier Tramway Breakover, November 22, 1918 (NPS Alaska Regional Office).

Analysis and Evaluation of Integrity

Summary:

The Kennecott Aerial Tramways maintains high integrity of location and association, and moderate integrity of feeling, design, materials, and workmanship as the primary physical features that convey the landscape's historic sense of time and place are present and recognizable in the contemporary landscape. This section provides an evaluation of the landscape's physical integrity by comparing landscape characteristics and features present during the period of significance (1908-1938) with current conditions. Physical features of the landscape are represented by and itemized under the following landscape characteristics: topography, circulation, spatial organization, and cluster arrangements. Other landscape characteristics that have been altered since the period of significance and no longer retain integrity are also discussed.

Location

The Kennecott Aerial Tramways maintain high integrity of location as its primary physical features have not been significantly altered or removed since the period of significance.

Design

The Operator's House at the Jumbo Junction Station and the Turnhouse on the upper level of the Concentration Mill maintain high integrity of design as the historic and current appearance of the buildings are similar when compared to the end of the period of significance (1938). Although the physical condition of individual line-bearing structures ranges from poor to good, the aerial tramway system conveys a strong sense of time and place as the spatial relationships and circulation patterns that were shaped by the natural landscape and the industrial activities that took place at Kennecott during the period of significance are clearly evident upon the landscape. As such, the Kennecott Aerial Tramways maintains moderate integrity of design.

Feeling

The Kennecott Aerial Tramways maintain a moderate integrity of feeling. Although, the aerial tramways are no longer in service, their prominence on Bonanza Ridge allow visitors to interpret the greater relationships between the mines and mill town as well as the topographic challenges that were overcome to transport ore to the mill during the historic period.

Setting

The Kennecott Aerial Tramways do not maintain integrity of setting as successional vegetation has intruded upon previously cleared areas east of the Mill Town making portions the aerial tramway corridors indiscernible and deterring access to much of the aerial tramway system.

Materials

The Kennecott Aerial Tramways maintain moderate integrity of materials as the quality and placement of the original construction materials (cables, insulators, timbers, bolts, nails, etc.) is intact although much is in a deteriorated state.

Workmanship

The Kennecott Aerial Tramways maintain moderate integrity of workmanship as the skill of Kennecott's workforce is exhibited in the lasting construction of the Operator's House at the Jumbo Junction Station, the Turnhouse on the upper level of the Concentration Mill, and in a number of intact towers, tension stations, and breakovers on Bonanza Ridge.

Association

The Kennecott Aerial Tramways maintain high integrity of association as the spatial relationships and circulation patterns that were shaped by the natural landscape and the industrial activities that took place at Kennecott during the period of significance are clearly evident upon the landscape.

Analysis and Evaluation (cont.)

CLUSTER ARRANGEMENTS

There is a wide variety of buildings, structures, archeological features and objects associated with the Kennecott Aerial Tramways. All of these features date between 1908 and 1938, a time period which represents the early development, decline and abandonment of mining operations at Kennecott. These features are organized under the following cluster arrangements based upon their location and spatial arrangement within the Kennecott Aerial Tramways landscape:

Bonanza Tramway
Erie Tramway
Glacier Tramway
Jumbo Tramway, and
Mother Lode Tramway

Although many of the buildings and structures are in advanced stages of deterioration, collectively they possess exceptional integrity and convey a strong sense of time and place. The aerial tramways and its associated features remain in their original locations and maintain a strong association with the industrial and transportation activities that took place Kennecott during the period of significance. The prominence of the aerial tramways on Bonanza Ridge allow visitors to interpret the greater relationships between the mines and mill town as well as the topographic challenges that were overcome to transport ore to the mill. While the physical condition of various line-bearing structures such as towers, breakovers, and tension stations ranges from good to poor, the Operator’s House at the Junction Station and Turnhouse maintain integrity of design. The quality of workmanship is evident in the construction of these buildings as well as in a number of line-bearing structures. In addition, much of the original construction materials remain intact although in a deteriorated state. Collectively, cluster arrangements maintain integrity of location, feeling, design, workmanship, materials, and association.

BONANZA TRAMWAY

The Bonanza Tramway is divided into 2 sections. The upper section of the aerial tramway is composed of 4 breakovers and a tower that extend 1.2 miles southwest from the loading station (BT1) at the 5,900’ elevation to the angle station (BT7) situated upon a ridge between National and Bonanza creeks at the 4,000’ elevation. As its name implies, the angle station is located at the angle or junction between the upper and lower sections of the aerial tramway between Bonanza Mine and the Concentration Mill. From the angle station, the lower section of the tramway is composed of 15 towers and 1 breakover that extend 1.5 miles before terminating at the Turnhouse at the 2,600’ elevation (BT8-23).

BUILDINGS AND STRUCTURES:

BT1: Bonanza Loading Station

The loading station is located at the 5,800’ elevation. It was built in 1909, enlarged in 1911 and moved underground in 1913 to connect the aerial tramway directly with the underground workings. The structure appears to be stable (Gilbert, et al., 2001: 27; Appendix H; Shields, 1998: 19).

BT2: Bonanza Breakover 2

The breakover is located at the 5,630’ elevation. The structure appears to be stable (Shields, 1998: 19).

BT3: Bonanza Breakover 3

The breakover is located at the 5,400’ elevation. The structure appears to be stable, however there are splices in the cable between BT2 and BT3 (Shields, 1998: 19).

Analysis and Evaluation (cont.)

BT5: Bonanza Breakover 5

Breakover 5 is located at the 5,100' elevation and appears stable. Weight boxes and cables are on the ground towards Breakover 6 (Shields, 1998: 19).

BT6: Bonanza Breakover 6 (Private - Non-contributing)

Breakover 6 is located at the 4,490' elevation and appears stable. There is rot in the foundation of the structure. The cables have been cut and are lying on the ground towards the angle station (BT7).

BT7: Bonanza Angle Station (Private - Non-contributing)

The angle station (XMC-081) is situated on a ridge between National and Bonanza creeks at the 3,800' elevation. As its name implies, the site is located at the angle or junction between the upper and lower sections of the Bonanza Tramway. The angle station allowed the Bonanza Tramway to make a steep horizontal jog up Bonanza Ridge and reduced slack in the cable lines.

The angle station is 4-stories tall. Although the roof is caved in, the work floor level is relatively intact and contains a variety of equipment from the 1920s including cable weights, ball wheels, tram cars, and cable tensioners. The breakover is connected to the angle station by a wooden walkway (Saleeby, 2000: 334; Gilbert, et al., 2001: 192).

BT8: Bonanza Tower 8

The tower is located at the 3,610' elevation and appears stable. The cables are on the ground and there is evidence of rot in the foundation of the structure (Shields, 1998: 19).

BT9: Bonanza Tower 9

The tower is located at the 3,470' elevation and appears stable. The cables are on the ground and there is evidence of rot in the foundation of the structure (Shields, 1998: 19).

BT10: Bonanza Tower 10

The tower is located at the 3,410' elevation and appears stable. The cables are on the ground and there is evidence of rot in the foundation of the structure (Shields, 1998: 19).

BT11: Bonanza Tower 11

The tower is located at the 3,240' elevation and appears stable. The cables are on the ground and there is evidence of rot in the foundation of the structure (Shields, 1998: 19).

BT12: Bonanza Tower 12

The tower is located at the 3,050' elevation. The tower is a square boxed framed structure perched upon the edge of a cliff. The cables touch the ground towards towers 11 and 13 (Shields, 1998: 19).

BT13: Bonanza Breakover 13

The breakover is located at the 2,940' elevation. It is a 2-story tall wood framed structure that is approximately 200' in length. The center frame is partially collapsed consequently filling the lower level with ore and debris. At the east end of the structure, there are two 10'x6' weight boxes filled with low grade ore. These boxes are in good condition although the box corners are deteriorated. The framing and planking of the upper level is rotten and unstable (Shields, 1998: 21; Reininghaus and Gewalt, 2015).

Analysis and Evaluation (cont.)

BT14: Bonanza Tower 14

The tower is located at the 2,850' elevation. The tower is between 30'- 40' tall. The cables are on the ground towards Tower 15. There is rot in the foundation of the structure (Shields, 1998: 21).

BT16: Bonanza Tower 16

Tower 16 is located at the 2,650' elevation. It stands approximately 30' tall and appears stable although a mature alder is growing through the middle of the structure. The tower was built upon an excavated bench that is cut into the steep hillside. Rot is present in the foundation and legs of the tower. A wooden ladder extends up the southeast corner of the tower from top to bottom. The rollers and cables are intact above the upper beam of the tower (Shields, 1998: 22; Reininghaus and Gewalt, 2015).

A circular concrete power pole footing is located 100' downslope from BT16. It is approximately 2' in diameter and 1' tall. The footing appears to be perched upon a 3' flat bench that was excavated into the hillside. A second footing is located about 30' upslope. Above the second footing, is what appears to be a remnant of a linear road structure or tower foundation. The flat area is approximately 25'x30' with trenches on the east and west sides. The cables between BT17 and BT16 are about 6' to the ground in this area. The cables are worn and the insulator cables are tangled in nearby trees. Large nuggets of ore are scattered across the tramline between BT17 and BT16.

BT17: Bonanza Tower 17

Tower 16 is located at the 2,540' elevation. Tower 17 is approximately 30' tall. Its foundation is situated upon 12'x12' cribbing that is terraced into the hillside to overcome steep topography. There are historic carvings on the horizontal beams of the tower (roman numerals: HII, HVIII) depicting the different prefabricated pieces that were used in its assembly. A wooden ladder extends up the southwest corner of the tower from top to bottom. The rollers and cables are intact although there is some slag in the cables downslope towards BT18. Overall, BT17 is in fair condition (Shields, 1998: 22; Reininghaus and Gewalt, 2015).

BT19: Bonanza Tower 19

Tower 16 is located at the 2,420' elevation. The tower is approximately 35' tall and leaning precariously to the north into a ravine. The deteriorated foundation of the tower is built upon a flat bench that was excavated into the hillside and the surrounding area looks as if it was once cleared as there are no mature trees within 50' of the tower in all directions. Several large nuggets of ore are scattered on the ground directly below the tower. A wooden ladder extends up the south side of the tower from top to bottom. The tower also has remnants of a power line system. A power line, wrapped in cloth, extends from the north to south side along the lower-center beam. The power line then goes upwards towards the top of the tower on either side making a U-shape. There are ceramic white insulators at both ends of the line. A 6"x5" wood sign is located on the west side of the tower. It is painted white with the number '39' painted in black 'Kennecott-style' lettering. Although the cables are intact towards BT20, the south roller has fallen to the ground and the remaining north roller looks as if it too is ready to fall. Overall, the tower is in poor condition and appears to be supported by the cables rather than its weak foundation.

BT20: Bonanza Tower 20

Tower 16 is located at the 2,370' elevation. The tower is approximately 25' tall. The structure does not appear stable as a mature alder tree is growing through the middle of the structure and the upper canopy of another large tree is putting pressure upon the tower from the east. The deteriorated foundation of the tower is built upon a flat bench that was excavated into the hillside and the surrounding area to the east looks as if it was once cleared as there are no mature trees within 50' of the tower. In addition, there is a very large stump directly north of the tower and several other large stumps between BT20 and BT21 which can be assumed to have been cut during the historic period. There are historic carvings on the horizontal beams of the tower (roman numeral: HX) depicting the different prefabricated pieces that were used in its assembly. A wooden ladder extends up the northeast corner of the tower from top to bottom. Although the cables are relatively intact, a telegraph-telephone

Analysis and Evaluation (cont.)

wire and insulators are dangling near the top of the tower. A flat foundation/ditch feature is located midway between BT20 and BT21. This feature may have served as a drainage feature for the tramway system or was the foundation of a tower that was perhaps removed and rebuilt elsewhere on the tramline (Shields, 1998: 22; Reininghaus and Gewalt, 2015).

BT21: Bonanza Tower 21

Tower 16 is located at the 2,310' elevation. The tower is approximately 35' tall. The structure does not appear stable as a mature alder tree is growing through the middle of the structure. The foundation of the tower is built upon a flat bench that was excavated into the hillside. There is rot in both the foundation and legs causing the tower to tilt toward the east thus compromising the structural stability of the tower. A wooden ladder extends up the northeast side of the tower from top to bottom. There are historic carvings on the horizontal beams of the tower (roman numeral: BVX) depicting the different prefabricated pieces that were used in its assembly. A 6"x5" wood sign is located on the west side of the tower. It is painted white with the number '41' painted in black 'Kennecott-style' lettering. The metal pullies are intact directly above the middle beam. A blue glass insulator cap is located near the top of the south side of the tower with telephone wire wrapped around it. The main cable, power lines and traction lines are intact although there is some slag between BT22 and BT21 (Shields, 1998: 22; Reininghaus and Gewalt, 2015).

BT22: Bonanza Tower 22 (archeology- add)

Tower 16 is located at the 2,240' elevation. The tower is completely collapsed with a mature alder growing through the remains of the structure. Two cables extend 9' above the ground with little slag. One cable slags toward ground between BT23 and BT22 (Shields, 1998: 22; Reininghaus and Gewalt, 2015).

BT23: Bonanza Tower 23 (Private - Non-contributing)

Tower 16 is located at the 2,160' elevation. The tower is located east of the Concentratrion Mill. It is accessible by a foot trail that extends from the road above the mill. There is rot in the foundation of the tower causing it to tilt toward the east. A wooden ladder extends up the northeast side of the tower from top to bottom. There are historic carvings on the horizontal beams of the tower (roman numerals: MIII, MII, MI, H, I) depicting the different prefabricated pieces that were used in its assembly. The main cables are on the ground approximately 50' west of the tower although four traction cables are intact. A telegraph-telephone wire runs along the north side of the tram tower. A wooden ladder extends up the northeast side of the tower from top to bottom (Shields, 1998: 22; Reininghaus and Gewalt, 2015).

BT24: Bonanza House (Private - Non-contributing)

The two-story operator's house (22'x18') is occupied and in good condition (Saleeby, 2000: 334).

BT25: Bonanza Cistern (Private - Non-contributing)

The footprint of the cistern is 4'x6'.

BT26: Bonanza Outhouse (Private - Non-contributing)

The footprint of the outhouse is 5'x5'.

BT27: Bonanza Stub Tower 1

The stub tramway was built in 1917 to transport ore from the East Slide ore body to the loading station at Bonanza Mine. The tower is located at the 5,450' elevation (East Slide Tram Terminal drawing T-7, dated July 16, 1917; Gilbert, et al., 2001: Appendix H).

Analysis and Evaluation (cont.)

BT29: Bonanza Stub Tower 3

The stub tower is rigged for a single fixed cable with a single reversible traction rope. Insulators attached to the top of the tower suggest power or phone lines were carried on the aerial tramway. The tower is located at the 5,850’ elevation (East Slide Tram Terminal drawing T-7, dated July 16, 1917; Gilbert, et al., 2001: Appendix H).

BT30: Bonanza Stockpile Ore Bin (Private - Non-contributing)

The ore bin is located above the Concentration Mill. It is a wood framed structure that was used to store excess ore in the Mill Town during the period of significance.

ARCHEOLOGICAL FEATURES:

BT4: Bonanza Tower 4

The collapsed tower is located at the 5,150’ elevation. The top frame of the tower is hanging from a cable line (Shields, 1998: 19).

BT15: Bonanza Tower 15

The collapsed tower is located at the 2,760’ elevation. The tower was built upon an excavated bench that is cut into the steep hillside. There is a ceramic insulator cap directly above one of the cable rollers (Shields, 1998: 21; Reininghaus and Gewalt, 2015).

BT18: Bonanza Tower 18

The collapsed tower is located at the 2,470’ elevation. The top portion of the tower is hanging from the cables 50’ downslope from the collapsed lower portion of the tower. A 6”x5” wood sign is located on the west side of the lower portion of the tower. It is painted white with the number ‘38’ painted in black ‘Kennecott-style’ lettering. Two of the four cables are pinned to the ground by a fallen tree west of the tower remains (Shields, 1998: 22; Reininghaus and Gewalt, 2015).

BT28: Bonanza Stub Terminal 2

The collapsed terminal is located at the 5,900’ elevation near the 1518 E portal at Bonanza Mine.

ERIE TRAMWAY

The Erie Tramway is located 4 miles north of the Mill Town. The aerial tramway extends from the loading station at Erie Mine to a staging area situated alongside the Old Tractor Road 2,000 feet below the mine. Between 1916 and 1924, the aerial tramway was the primary connection between Erie Mine and the Mill Town. Once the Jumbo-Erie Crosscut was completed in 1924, the aerial tramway was reserved for transporting supplies thereafter. The loading terminal and a collapsed tower are all that remain of the aerial tramway. There is no evidence of the staging area below Erie Mine.

STRUCTURE:

E1: Erie Loading Terminal

The loading terminal is located at the 4,250’ elevation at the entrance of the 103 Level Portal.

ARCHEOLOGICAL FEATURE:

E2: Erie Collapsed Tower

Analysis and Evaluation (cont.)

The collapsed tower is hanging from the cables at the 3,650' elevation.

GLACIER TRAMWAY

The Glacier Tramway is composed of a collapsed loading station, 5 towers, and a breakover that extend 4,500' from the Jumbo Junction Station to Glacier Mine. The aerial tramway was built sometime between 1916 and 1920 to transport ore from Glacier Mine to the Concentration Mill for processing. The tramway also occasionally carried ore from Bonanza Mine when the Bonanza Tramway was undergoing repairs.

BUILDINGS AND STRUCTURES:

GT4: Glacier Tower 4

The tower is located at the 4,350' elevation and appears stable. The cables are on the ground (Shields, 1998: 19).

GT5: Glacier Breakover 5

The beakover is located at the 4,300' elevation. The structure appears sound and there is very little sag in the cables between GT5 and GT4 (Shields, 1998: 19).

GT6: Glacier Tower 6

The tower is located at the 4,130' elevation. The structure appears sound. Three cables touch the ground between towers 6 and 7 (Shields, 1998: 19).

GT7: Glacier Tower 7

The tower is located at the 3,950' elevation. The structure appears sound although foundation rot is present (Shields, 1998: 19).

ARCHEOLOGICAL FEATURES:

GT1: Glacier Loading Station

The remains of the Glacier Loading Station are located below the toe of an alpine glacier at the 5,020' elevation. The structure is partially buried by debris and is not safe to enter (Shields, 1998:18).

GT2: Glacier Tower 2

The collapsed tower is located at the 4,930' elevation (Shields, 1998: 19).

GT3: Glacier Tower 3

The collapsed tower is located at the 4,460' elevation (Shields, 1998: 19).

JUMBO TRAMWAY

Similar to the Bonanza Tramway, the Jumbo Tramway is divided into 2 sections. The upper section of the tramway (XMC-086) extends 1.5 miles between Jumbo Mine (XMC-085) and the Junction Station Complex (XMC-087) which intersects the terminus of the Glacier Tramway. This section is composed of a linear arrangement of features, including a loading station, breakover station, anchor-tension station, and 6 towers that cascade down Bonanza Ridge. The junction station is supported by a transformer tower, an operator's house, outhouse, and 2 tent structures that were likely used to house

Analysis and Evaluation (cont.)

workers and supplies during the period of significance. There is also a number of miscellaneous objects such as sleds and snow fences scattered upslope from the Junction Station Complex. The lower section of the Jumbo Tramway consists of 2 breakover stations, an anchor-tension station and 12 towers that extend approximately 1.5 miles from the junction station to the turnhouse on the upper level of the Concentration Mill (AHRS, XMC-086, 1987; AHRS, XMC-087, 1987).

Several engineering surveys have been performed on the Jumbo Tramway over the years. In parenthesis, all abbreviations that begin with "J" such as J1, J2, and J3 correspond to the structures identified in *Inspection and Safety Assessment of Kennecott Mine Tram System, Wrangell-St. Elias National Park and Preserve* (Shields, 1998). All other abbreviations such as T2 and STA 2 correspond to the structures identified in the Historic American Engineering Record (HAER) survey conducted by the National Park Service in 2003 (Bell, et al., 2003).

BUILDINGS AND STRUCTURES:

JT1: Jumbo Breakover Station 0 (J1; J2)

Loading Station 0 is located at Jumbo Mine at the 5,660' elevation. It is a breakover utilizing the "Y" bracing, which is more efficient at distributing loads and requires less timber than the "T" bracing. Similar to the towers, breakovers support pairs of idler wheels with guides that catch the slack in the traction cable and keep it from causing damage to the wood beams at the front and rear of the breakover as the cable moves the ore carts up or down slope. The upper tram deck of the breakover is buried by debris (Shields, 1998: 18; Bell, et al., 2003: Station 0).

JT2: Jumbo Breakover Station 1 (J3)

The collapsed "T" type breakover is situated at the 5,470' elevation (Bell, et al., 2003: Station 1).

JT4: Jumbo Tower 2 (J5; T2)

Tower 2 is located at the 4,830' elevation. This tower is in good condition although the southeast corner is undercut. The base of the structure is 25'x28' and the frames are constructed of upright 8"x8" timbers. The wood frames of the tower are of the pass through type. They are approximately 65' to 70' high with a 12' high pass through from the top. Boards nailed up the center uprights at the east and west end to serve as a ladder to reach the top of the structure (Shields, 1998:18; Bell, et al., 2003: T2).

JT6: Jumbo Breakover A/T Station 2 (J7; STA 2)

The breakover is located at the 4,590' elevation. This structure served as an anchor/tension situated station midway on the upper section of the Jumbo Tramway. It appears to have been damaged by an avalanche. The station is in poor condition with only 3 of the 5 pass through frames intact. A weight box and a considerable portion of the station have fallen downhill. A sign on this structure designates it as "Station No. 2". The traction rope passes through this station as a continuous length (MCSIF XMC-086, 1986; Shields, 1998: 18; Bell, et al., 2003: Site Plan).

JT7: Jumbo Tower 4 (J8; T4)

Tower 4 is located at the 4,440' elevation. This tower is 20' tall and without a kicker. It appears to have been modified at least once with the addition of a second set of cable hangers and idler wheels. Pieces of another tower are located downslope from Tower 4. Overall, this structure appears to be stable (MCSIF XMC-086, 1986; Shields, 1998: 18; Bell, et al., 2003: Site Plan).

JT8: Jumbo Tower 5 (J9; T5)

Tower 5 is situated at the 4,070' elevation. This tower appears to be essentially intact and supports the cables prior to crossing Jumbo Creek to the west. Boards are nailed up the center uprights to serve as a ladder to reach the top of the structure. Overall, this structure appears to be stable (MCSIF XMC-086, 1986; Shields, 1998: 18; Bell, et al., 2003: Site Plan).

Analysis and Evaluation (cont.)

JT9: Jumbo Tower 6 and Station 3 (J10; STA 3; T6; Jumbo Junction Station)

Tower 6 and Station 3 are located at the 3,650' elevation. Station 3 was built between 1913-1914 and modified into a junction station sometime between 1918-1920 to supplement the transportation of ore from Glacier Mine. Tower 6 and Station 3 appear stable although some foundation rot is present. The upper level of the Jumbo Tramway intake to the north is partially collapsed. All electrical control units and major heavy equipment including a toothed saw, brake drum, holiday grip wheel, brake drums, link belt, and a GE induction motor are inside the junction station (MCSIF XMC-087, 1986; Bell, et al., 2003: Site Plan).

JT10: Jumbo Breakover Station 4 (J11)

The breakover station is located at the 3,550' elevation. It is a "T" type breakover. The structure is stable although rot is present in the foundation (Shields, 1998: 21; Bell, et al., 2003: Site Plan).

JT12: Jumbo Breakover A/T Station 5 (J13; STA 5)

Station 5 is a breakover anchor/tension station located at the 3,050' elevation. A portion of the central structure is collapsed. Weight boxes are on the ground nearby (Shields, 1998: 21; Bell, et al., 2003: Site Plan).

JT13: Jumbo Tower 8 (J14; T8)

Tower 8 is a small tower without a kicker at the 2,950' elevation. There is some rot in the foundation. The lateral bracing has been sawed out and the tower leans towards the east. Vegetation is both supporting the structure and wedging it apart. The traction cables are on the ground (Shields, 1998: 21; Bell, et al., 2003: Site Plan).

JT14: Jumbo Tower 9 (J15; T9)

Tower 9 is a collapsed tower without a kicker at the 2,850' elevation. The structure is fairly stable although the center frame is broken. The lateral bracing has been sawed out and the tower leans towards the east. Vegetation is both supporting the structure and wedging it apart (Shields, 1998: 21; Bell, et al., 2003: Site Plan).

JT15: Jumbo Breakover Station 6 (J16; STA 6)

Station 6 is a "Y" type breakover at the 2,830 elevation. The structure is fairly stable although some foundation rot is present. The longitudinal bracing has been sawed out and there is some compression breakage in the top frame. The cables are slacking (Shields, 1998: 21; Bell, et al., 2003: Site Plan).

JT18: Jumbo Tower 12 (J19; T12)

Tower 12 is a small tower without a kicker at the 2,510' elevation. It is located on the west side of the trail leading to the mines. The tower is stable although foundation rot is present. There is an ore car hanging from a cable. Vegetation is both supporting the structure and wedging it apart (Shields, 1998: 20; Bell, et al., 2003: Site Plan).

JT19: Jumbo Tower 13 (J20; T13)

Tower 13 is a small tower without a kicker at the 2,460' elevation. Vegetation is both supporting the structure and wedging it apart (Shields, 1998: 21; Bell, et al., 2003: Site Plan).

JT20: Jumbo Tower 14 (J21; T14)

Tower 14 is a small tower without a kicker at the 2,400' elevation. There is some rot in the foundation (Shields, 1998: 20;

Analysis and Evaluation (cont.)

Bell, et al., 2003: Site Plan).

JT21: Jumbo Tower 15 (J22; T15)

Tower 15 is a small tower without a kicker at the 2,350’ elevation. There is some rot in the foundation. The main cable is up and the traction lines are down (Shields, 1998: 20; Bell, et al., 2003: Site Plan).

JT22: Jumbo Tower 16 (T16)

Tower 16 is a small tower without a kicker at the 2,330’ elevation (Shields, 1998: 21; Bell, et al., 2003: Site Plan).

JT23: Jumbo Tower 17 (J23; T17)

Tower 17 is a small tower without a kicker located at the 2,290’ elevation. There is rot in the foundation (Shields, 1998: 20; Bell, et al., 2003: Site Plan).

JT24: Jumbo Tower 18 (J24; T18)

Tower 18 is a small double “Y” type tower without a kicker located at the 2,200’ elevation. The tower is unstable and the foundation is failing due to rot and settlement. The power cable collapsed onto the main line which is still up. The traction cables are on the ground (Shields, 1998: 20; Bell, et al., 2003: Site Plan).

JT25: Jumbo Operator’s House (Jumbo Bunkhouse; Mid-Station Bunkhouse)

LCS: 561747
FMSS: 108977

The operator’s house was built to house workers who performed maintenance on the Jumbo Tramway. This wood-framed building is a small 1-1/2 story bunkhouse. Its main component is rectangular, measuring approximately 22’-6”x18’-6” with its primary axis running north-south. Five panel doors provide access to the entries on both the north and south elevations. A metal-clad gabled roof that was installed in the 1950s covers the main building; the entry roofs are cedar-shingled and the building’s original cedar shingle roof is visible below the corrugated metal roof. There are 7 windows on the main building first level, plus 4 cut openings, 3 in the south entry and 1 in the north entry. There are 3 windows on the second level.

The interior of the building has 3 rooms on the first floor. A living/dining area fills the north half and connects to the kitchen which is in the southeast corner of the main building. Adjacent to the kitchen is a bedroom with a closet under the stairs. The upper level houses a small closet opposite the stairs, and 3 bedrooms, the largest of which takes up the south half of the floor, the other two dividing the north.

In 2003, the Jumbo Aerial Tramway was documented to the standards of the Historic American Engineering Record (HAER) as defined in the Kennecott NHL General Management Plan (GMP). The HAER team briefly inspected the building and concluded it was in fair condition but noted its failing foundation. In addition to the foundation, the building was damaged by rodent infestation (primarily porcupine) and visitor trespass. The building’s doors and windows were covered with plywood in August 2004 to prevent trespass.

Field drawings and a preliminary condition assessment were performed as part of a volunteer effort in 2004. The drawings and notes were used to stabilize the foundation of the building in 2008. This stabilization effort, performed by NPS staff and Teacher’s Restoration Corps (TRC), included repairing the foundation by replacing failing material with new, cataloguing all period pieces of furniture, and providing additional closure of the building to visitors and pests (Crosby, 2006; MCSIF XMC-087, 1986; PMIS 131291, 2008; PMIS 131291A, 2008).

Analysis and Evaluation (cont.)

JT27: Jumbo Transformer Tower

The transformer tower is an upright pole structure with a transformer attached to it (MCSIF XMC-087, 1986; Bell, et al., 2003: Site Plan).

JT30: Tramway Turnhouse

The turnhouse served as the terminus of the Jumbo and Bonanza tramways. It is a large wooden deck on the upper level of the Concentration Mill sheltered by a 26’x31’ post and beam framed building with a 13’x14’ addition. The turnhouse is in fair condition (Gilbert, et al., 2001: 77; LCS 038168, 2008; Bell, et al., 2003: Site Plan).

ARCHEOLOGICAL FEATURES:

JT3: Jumbo Tower 1 (J4; T1)

Tower 1 is a collapsed tower without a kicker located at the 5,110’ elevation (MCSIF XMC-086, 1986; Bell, et al., 2003: Site Plan).

JT5: Jumbo Tower 3 (J6; T3)

Tower 3 is collapsed and hanging on the main cable line at the 4,630’ elevation (MCSIF XMC-086, 1986; Shields, 1998:18; Bell, et al., 2003: Site Plan).

JT11: Jumbo Tower 7 (J12; T7)

Tower 7 is a collapsed tower with a kicker located at the 3,140’ elevation (Bell, et al., 2003: Site Plan).

JT16: Jumbo Tower 10 (J17; T10)

Tower 10 is a collapsed tower without a kicker at the 2,680’ elevation. Splice joints and intrusive vegetation are pulling apart the structure. The lateral bracing is sawed out and the southwest corner is rotted out (Bell, et al., 2003: Site Plan; Shields, 1998: 21).

JT17: Jumbo Tower 11 (J18, T11)

Tower 11 is a very unstable tower without a kicker located at the 2,590’ elevation. The lateral bracing is sawed out. The cable is cut 100 feet downslope. A portion of the cable is buried under a roadbed (Bell, et al., 2003: Site Plan; Shields, 1998: 21).

JT26: Jumbo Collapsed Bunkhouse 1

During the period of significance, there were 2 similar tent frame structures (JT26 and JT28) to house workers and supplies at the Junction Station Complex. In 1986, only the east wall of one of the tent frame structures remained standing roughly 20’ tall. The roof was covered with tarpaper. The interior included 2 bed frames and a barrel stove. In 2015, the remains of the collapsed bunkhouses were completely covered in vegetation and only recognizable by what was once and elevated foundation platform cut into the hillside (MCSIF XMC-087, 1986).

JT28: Jumbo Collapsed Bunkhouse 2

This structure has collapsed completely. It may have once served as a shed. It’s footprint roughly measures 23’x30’ (MCSIF XMC-087, 1986).

Analysis and Evaluation (cont.)

JT29: Jumbo Outhouse

The collapsed outhouse is the remains of a 5’3”x6’6” wood frame structure with a shed roof (MCSIF XMC-087, 1986; Bell, et al., 2003: Site Plan).

JT40: Jumbo Underground Loading Station (J1)

The loading station is located at the 5,690’ elevation at the entrance to Jumbo Mine (Gilbert, et al., 2001: Appendix H; Bell, et al., 2003: Site Plan).

SMALL SCALE FEATURES:

JT31: Cut

An area approximately 60’ wide and 30’ deep was excavated from the hillside to allow clearance for the tram cars at the 4,800’ elevation.

JT32: Cans

A scatter of cans is located at the 5,280’ elevation.

JT33: Ladder

The ladder is located at the 5,090’ elevation.

JT34: Fuel Drums

A collection of fuel drums are located at the 5,020’ elevation.

JT35: TD-24

TD-24 is located at the 4,680’ elevation.

JT36: Tent Frame

The remains of a tent frame are located at the 4,680’ elevation.

JT37: Heavy Equipment Sled

A sled is located at the 3,900’ elevation.

JT38: Sled

A second sled is located at the 3,700’ elevation.

JT 39: Slide Fence

The slide fence was built to protect the tramway from rock and snow slides. The fence is anchored to the hillside by a “deadmen” and steel wire ropes.

Analysis and Evaluation (cont.)

MOTHER LODE TRAMWAY

The Kennecott Copper Corporation established a small camp in Mother Lode Gulch to support the exploration of the ore body in 1919; however, this camp was abandon after reoccurring snow slides damaged the campsite. Although little is known about the Mother Lode Tramway, the following features are likely associated with the 1919 campsite:

ARCHEOLOGICAL FEATURES:

MT1: Mother Lode Terminal (Private - Non-contributing)

The terminal is located at the 5,800' elevation on the east side of Bonanza Ridge.

MT2: Mother Lode Tower 1 (Private - Non-contributing)

Tower 1 is located at the 5,200' elevation on the east side of Bonanza Ridge.

MT3: Mother Lode Tower 2

Tower 2 is located at the 4,600' elevation on the east side of Bonanza Ridge.

BONANZA TRAMWAY CLUSTER ARRANGEMENT

FEATURE #	FEATURE	OWNERSHIP	FEATURE TYPE	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
BT1	Bonanza Loading Station		Historic Structure	Yes	61.51265558	-142.83426124
BT2	Bonanza Breakover 2		Historic Structure	Yes	61.51051170	-142.83539235
BT3	Bonanza Breakover 3		Historic Structure	Yes	61.50845905	-142.83644916
BT4	Bonanza Tower 4		Archeological Site	Yes	61.50726356	-142.83707819
BT5	Bonanza Breakover 5		Historic Structure	Yes	61.50675046	-142.83733766
BT6	Bonanza Breakover 6	Private	Historic Structure	No	61.50134611	-142.84013291
BT7	Bonanza Angle Station (XMC-081)	Private	Historic Building	No	61.49621007	-142.84280629
BT8	Bonanza Tower 8		Historic Structure	Yes	61.49530942	-142.84657168
BT9	Bonanza Tower 9		Historic Structure	Yes	61.49455428	-142.84972116
BT10	Bonanza Tower 10		Historic Structure	Yes	61.49358039	-142.85380436
BT11	Bonanza Tower 11		Historic Structure	Yes	61.49295287	-142.85641702
BT12	Bonanza Tower 12		Historic Structure	Yes	61.49153615	-142.86233894
BT13	Bonanza Breakover 13		Historic Structure	Yes	61.48996513	-142.86892128
BT14	Bonanza Tower 14		Historic Structure	Yes	61.48961964	-142.87034748
BT15	Bonanza Tower 15		Archeological Site	Yes	61.48919057	-142.87214006
BT16	Bonanza Tower 16		Historic Structure	Yes	61.48883070	-142.87365517
BT17	Bonanza Tower 17		Historic Structure	Yes	61.48845696	-142.87520460
BT18	Bonanza Tower 18		Archeological Site	Yes	61.48799538	-142.87713257
BT19	Bonanza Tower 19		Historic Structure	Yes	61.48754425	-142.87901672
BT20	Bonanza Tower 20		Historic Structure	Yes	61.48710508	-142.88085077
BT21	Bonanza Tower 21		Historic Structure	Yes	61.48661297	-142.88290574
BT22	Bonanza Tower 22		Archeological Site	Yes	61.48619467	-142.88465630
BT23	Bonanza Tower 23	Private	Historic Structure	No	61.48577792	-142.88639169
BT24	Bonanza House (XMC-081)	Private	Historic Building	No	61.49619434	-142.84368794
BT25	Bonanza Cistern (XMC-081)	Private	Historic Structure	No	61.49598219	-142.84246796
BT26	Bonanza Outhouse (XMC-081)	Private	Historic Structure	No	61.49628024	-142.84393537
BT27	Bonanza Stub Tower 1		Historic Structure	Yes	61.51289968	-142.83394848

BONANZA TRAMWAY CLUSTER ARRANGEMENT (CONT.)

FEATURE #	FEATURE	OWNERSHIP	FEATURE TYPE	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
BT28	Bonanza Stub Terminal 2		Archeological Site	Yes	61.51419273	-142.83429531
BT29	Bonanza Stub Tower 3		Historic Structure	Yes	61.51444275	-142.84068238
BT30	Bonanza Stockpile Ore Bin	Private	Historic Structure	No	61.48585991	-142.88575913

ERIE TRAMWAY CLUSTER ARRANGEMENT

FEATURE #	FEATURE	OWNERSHIP	FEATURE TYPE	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
ET1	Erie Tram Terminal		Historic Building	Yes	61.54208774	-142.89391830
ET2	Erie Collapsed Tower		Archeological Site	Yes	61.54284374	-142.89734202

GLACIER TRAMWAY CLUSTER ARRANGEMENT

FEATURE #	FEATURE	OWNERSHIP	FEATURE TYPE	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
GT1	Glacier Loading Terminal		Archeological Site	Yes	61.51185465	-142.84598258
GT2	Glacier Tower 2		Archeological Site	Yes	61.51168857	-142.84653145
GT3	Glacier Tower 3		Archeological Site	Yes	61.50973798	-142.85297671
GT4	Glacier Tower 4		Historic Structure	Yes	61.50781632	-142.85933182
GT5	Glacier Breakover		Historic Structure	Yes	61.50757837	-142.86010412
GT6	Glacier Tower 5		Historic Structure	Yes	61.50701907	-142.86195775
GT7	Glacier Tower 6		Historic Structure	Yes	61.50639739	-142.86399078

JUMBO TRAMWAY CLUSTER ARRANGEMENT

FEATURE #	FEATURE	OWNERSHIP	FEATURE TYPE	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
JT1	Jumbo Loading Station 0		Historic Structure	Yes	61.52234963	-142.85179882
JT2	Jumbo Breakover Station 1		Historic Structure	Yes	61.52030009	-142.85378206
JT3	Jumbo Tower 1		Archeological Site	Yes	61.51863194	-142.85540020
JT4	Jumbo Tower 2		Historic Structure	Yes	61.51679708	-142.85717958
JT5	Jumbo Tower 3		Archeological Site	Yes	61.51494762	-142.85896980
JT6	Jumbo Anchor/Tension Station 2		Historic Structure	Yes	61.51380327	-142.86007453
JT7	Jumbo Tower 4		Historic Structure	Yes	61.51290200	-142.86095097
JT8	Jumbo Tower 5		Historic Structure	Yes	61.51115958	-142.86263517
JT9	Jumbo Tower 6 and Station 3		Historic Structure	Yes	61.50528137	-142.86832352
JT10	Jumbo Station 4		Historic Structure	Yes	61.50387071	-142.86967383
JT11	Jumbo Tower 7		Archeological Site	Yes	61.50168091	-142.87178230
JT12	Jumbo Station 5		Historic Structure	Yes	61.49851643	-142.87478635
JT13	Jumbo Tower 8		Historic Structure	Yes	61.49776192	-142.87550440
JT14	Jumbo Tower 9		Historic Structure	Yes	61.49588899	-142.87732922
JT15	Jumbo Station 6		Historic Structure	Yes	61.49545313	-142.87775670
JT16	Jumbo Tower 10		Archeological Site	Yes	61.49417460	-142.87900671
JT17	Jumbo Tower 11		Archeological Site	Yes	61.49302679	-142.88011163
JT18	Jumbo Tower 12		Historic Structure	Yes	61.49182697	-142.88127680
JT19	Jumbo Tower 13		Historic Structure	Yes	61.49104502	-142.88204162
JT20	Jumbo Tower 14		Historic Structure	Yes	61.48984142	-142.88319801
JT21	Jumbo Tower 15		Historic Structure	Yes	61.48886638	-142.88413249
JT22	Jumbo Tower 16		Historic Structure	Yes	61.48840163	-142.88464939
JT23	Jumbo Tower 17		Historic Structure	Yes	61.48764025	-142.88531276
JT24	Jumbo Tower 18		Historic Structure	Yes	61.48655206	-142.88636071
JT25	Jumbo Bunkhouse		Historic Building	Yes	61.50498324	-142.86798694
JT26	Jumbo Collapsed Bunkhouse 1		Archeological Site	Yes	61.50490298	-142.86869223
JT27	Jumbo Transformer Tower		Historic Structure	Yes	61.50490251	-142.86834771

JUMBO TRAMWAY CLUSTER ARRANGEMENT (CONT.)

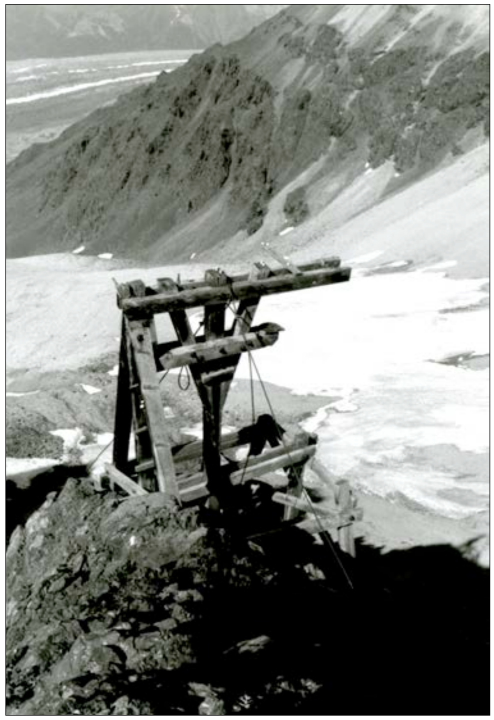
FEATURE #	FEATURE	OWNERSHIP	FEATURE TYPE	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
JT28	Jumbo Collapsed Bunkhouse 2		Archeological Site	Yes	61.50490298	-142.86869223
JT29	Jumbo Outhouse		Archeological Site	Yes	61.50494228	-142.86897374
JT30	Tramway Turnhouse		Historic Building	Yes	61.50496984	-142.86862904
JT31	Cut		Small Scale Feature	Yes	61.52080789	-142.85329304
JT32	Can Scatter		Small Scale Feature	Yes	61.52051173	-142.85541379
JT33	Ladder		Small Scale Feature	Yes	61.51940899	-142.85666631
JT34	Fuel Drums		Small Scale Feature	Yes	61.51866222	-142.85841628
JT35	TD-24		Small Scale Feature	Yes	61.51539981	-142.85944456
JT36	Tent Frame		Small Scale Feature	Yes	61.51405938	-142.85681830
JT37	Heavy Equipment Sled		Small Scale Feature	Yes	61.50588661	-142.86653946
JT38	Sled		Small Scale Feature	Yes	61.51162828	-142.85732528
JT39	Slide Fence		Small Scale Feature	Yes	61.52031093	-142.85386928
JT40	Jumbo Underground Loading Station		Archeological Site	Yes	61.52254864	-142.85160232

MOTHER LODE TRAMWAY CLUSTER ARRANGEMENT

FEATURE #	FEATURE	OWNERSHIP	FEATURE TYPE	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
MT1	Mother Lode Terminal	Private	Archeological Site	No	61.52083484	-142.82483317
MT2	Mother Lode Tower 1	Private	Archeological Site	No	61.52083174	-142.81887790
MT3	Mother Lode Tower 2		Archeological Site	Yes	61.52209525	-142.80980041

Analysis and Evaluation (cont.)

Bonanza Tramway



Left:
Bonanza Angle Station c. 1922 (Courtesy of Geoff Bleakley).

Right:
Bonanza Tower 18, view west to Glacier Mine (NPS, 1993).

Left:
Bonanza Tower 9 and 10 (BT9, left/ BT10, right) c. 1920s.

Analysis and Evaluation (cont.)

Bonanza Tramway

Bonanza Tower 17, view SE (NPS, 1993).

Breakover near Bonanza Mine, view SW (NPS, 1998).

Analysis and Evaluation (cont.)

Bonanza Tramway

Breakover near Bonanza Mine, view W (NPS, 2006).

Bonanza Loading Station, view E (NPS, 2006).

Analysis and Evaluation (cont.)

Bonanza Tramway


Foundation between BT15-16 (NPS, 2015)


BT13: Bonanza Breakover 13, view W (NPS, 2015)


BT13: Bonanza Breakover 13, view E (NPS, 2015)

Analysis and Evaluation (cont.)

Bonanza Tramway


BT16: Bonanza Tower 16, view E (NPS, 2015).

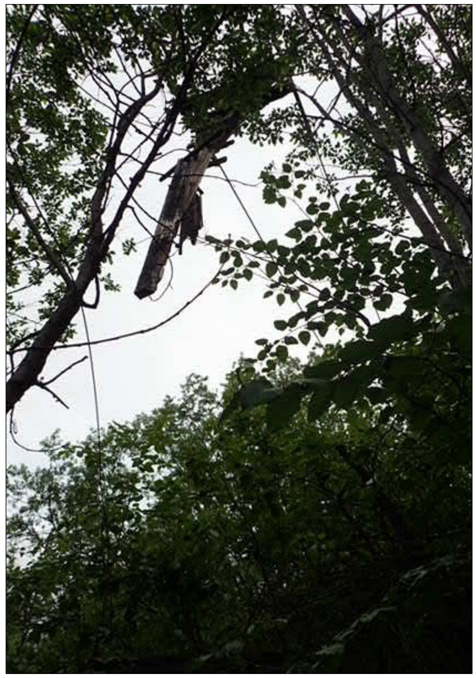

BT14: Bonanza Tower 14, view E (NPS, 2015)


BT15: Bonanza Tower 15, view NE(NPS, 2015)

Analysis and Evaluation (cont.)

Bonanza Tramway


BT17: Bonanza Tower 17, view E (NPS, 2015)


BT18: Bonanza Tower 18, view NE (NPS, 2015)


BT19: Bonanza Tower 19, view N (NPS, 2015)


BT20: Bonanza Tower 20, view N (NPS, 2015)

Analysis and Evaluation (cont.)

Bonanza Tramway

BT21: Bonanza Tower 21, view E (NPS, 2015)

BT22: Bonanza Tower 23 view E (NPS, 2015)

BT22: Bonanza Tower 22, view E (NPS, 2015)

Analysis and Evaluation (cont.)

Erie Tramway

Erie Mine. Collapsed tower in bottom left corner (NPS, 2003).

Erie Loading Station, view E (NPS, 2003).

Analysis and Evaluation (cont.)

Erie Tramway


E2: Collapsed tower, view N (NPS, 1993).


E2: Collapsed tower, view W (NPS, 1993).

Analysis and Evaluation (cont.)

Glacier Tramway

Glacier Loading Terminal, view W (NPS, 1993).

Looking from Glacier Tower 6 to Jumbo Junction Station Complex, view W (NPS, 1998).

Analysis and Evaluation (cont.)

Glacier Tramway

Glacier Breakover, view W (NPS, 1998).

Glacier Mine, view NW from Bonanza Mine (NPS, 2006).

Analysis and Evaluation (cont.)

Glacier Tramway

GT2: Glacier Tower 2, view W (NPS, 2015)

GT1: Sorting and Loading Station, view NE (NPS, 2015)

Analysis and Evaluation (cont.)

Glacier Tramway

GT3: Glacier Tower 3, view E (NPS, 2015)

GT4: Glacier Tower 4, view E (NPS, 2015)

Analysis and Evaluation (cont.)

Glacier Tramway

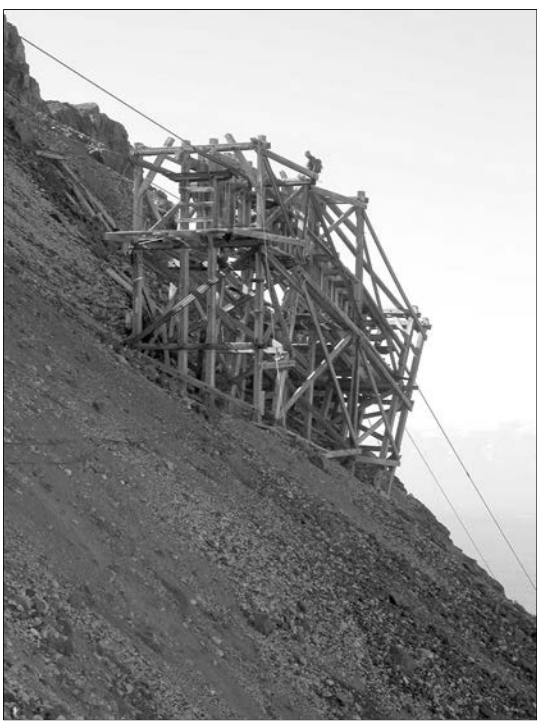
GT6-5: Glacier Breakover 5 and Tower 6, view E (NPS, 2015)


GT7: Glacier Tower 7, view W (NPS, 2015)

Analysis and Evaluation (cont.)

Jumbo Tramway

JT1: Jumbo Breakover Station 0, view E (NPS, 2003).

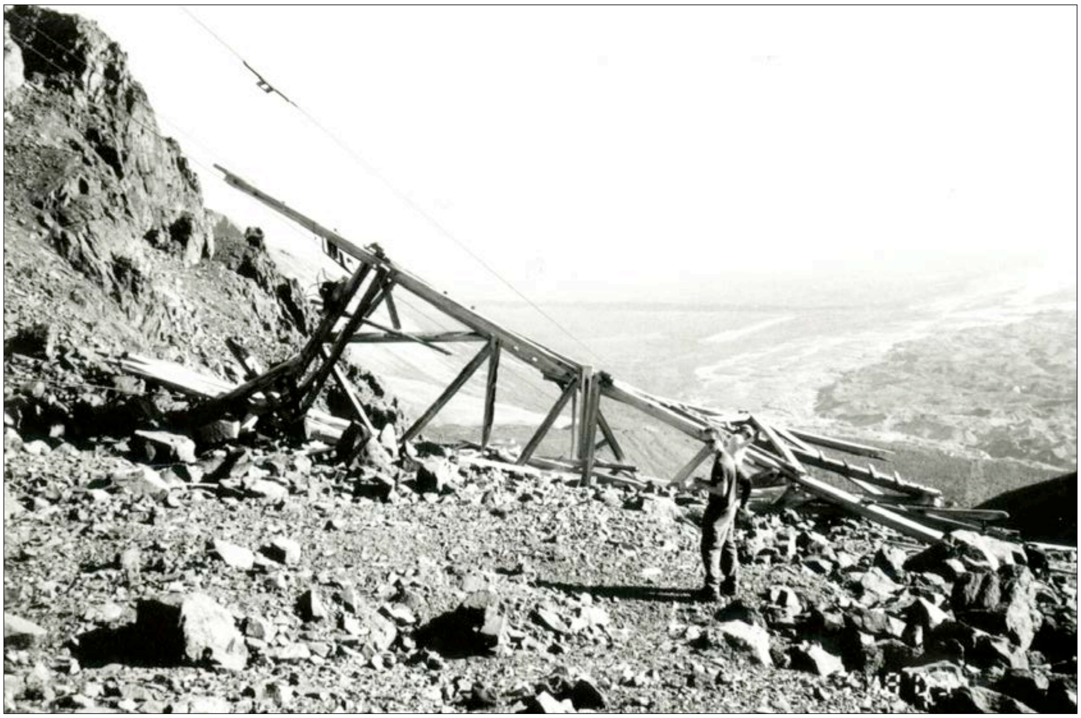


JT2: Jumbo Breakover Station 1, view S (NPS, 2003).

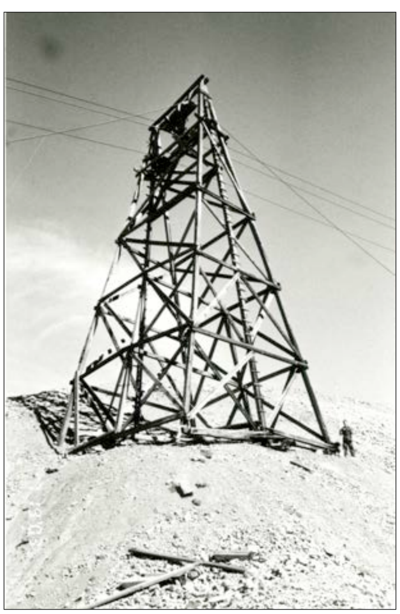
JT2: Jumbo Breakover Station 1, view S (NPS, 2003).

Analysis and Evaluation (cont.)

Jumbo Tramway



JT3: Jumbo Tower 1 (J4; T1), view SE (NPS, 2003).



JT4: Jumbo Tower 2 (J5; T2), view W (NPS, 2003).

Analysis and Evaluation (cont.)

Jumbo Tramway

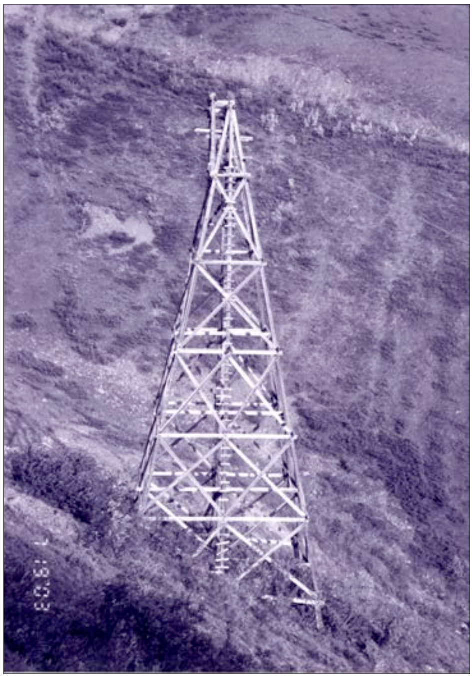
JT5: Jumbo Tower 3 (J6; T3), view E (NPS, 2003).

Left JT6: Jumbo Breakover A/T Station 2 (J7; STA 2), view S (NPS, 2003).

Analysis and Evaluation (cont.)

Jumbo Tramway

JT7: Jumbo Tower 4 (J8; T4), view SE (NPS, 1998).



JT8: Jumbo Tower 5 (J9; T5) view SE (NPS, 2003).

JT9: Jumbo Breakover Station 3 (J10; STA 3), view NE (NPS, 2003).

JT9: Jumbo Tower 6 (J10; T6), view NE (NPS, 2003).

Analysis and Evaluation (cont.)

Jumbo Tramway

JT9: Jumbo Breakover Station 3 (J10; STA 3), view W (NPS, 2003).

JT10: Jumbo Breakover Station 4 (J11; STA 4), view E (NPS, 2003).

Analysis and Evaluation (cont.)

Jumbo Tramway

JT11: Jumbo Tower 7 (J12; T7), (NPS, 2003).

JT13: Jumbo Tower 8 (J14; T8), view W (NPS, 2003).

JT12: Jumbo Breakover A/T Station 5 (J13; STA 5), view E (NPS, 2003).

Analysis and Evaluation (cont.)

Jumbo Tramway

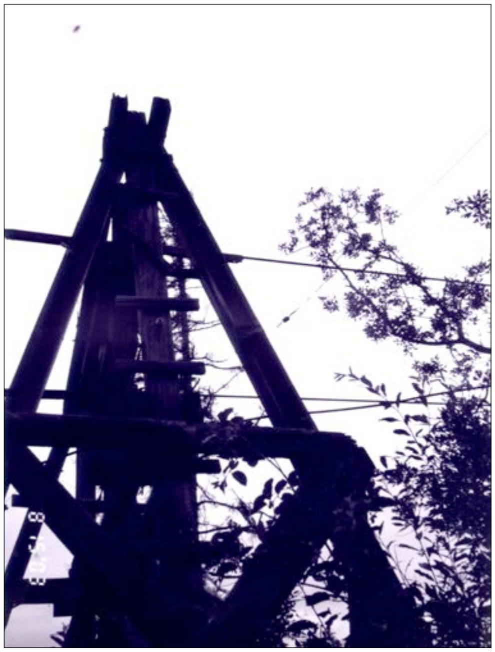
Left:
JT14: Jumbo Tower 9 (J15; T9) (NPS, 2003).

Right:
JT16: Jumbo Tower 10 (J17; T10), view W (NPS, 2003).

JT15: Jumbo Breakover Station 6 (J16; STA 6), view W (NPS, 2003).

Analysis and Evaluation (cont.)

Jumbo Tramway



JT17: Jumbo Tower 11 (J18; T11), view SE (NPS, 2003).

JT18: Jumbo Tower 12 (J19; T12), view SE (NPS, 2003).

JT19: Jumbo Tower 13 (J20; T13), view W (NPS, 2003).

JT20: Jumbo Tower 14 (J21; T14), view E (NPS, 2003).

Analysis and Evaluation (cont.)

Jumbo Tramway

JT21: Jumbo Tower 15 (J22; T15), view W (NPS, 2003).

JT22: Jumbo Tower 17, view W (NPS, 2003).

JT23: Jumbo Tower 17 (J23; T17), view W (NPS, 2003).

Analysis and Evaluation (cont.)

Jumbo Tramway

JT24: Jumbo Tower 18 (J24; T18), view E (NPS, 2003).

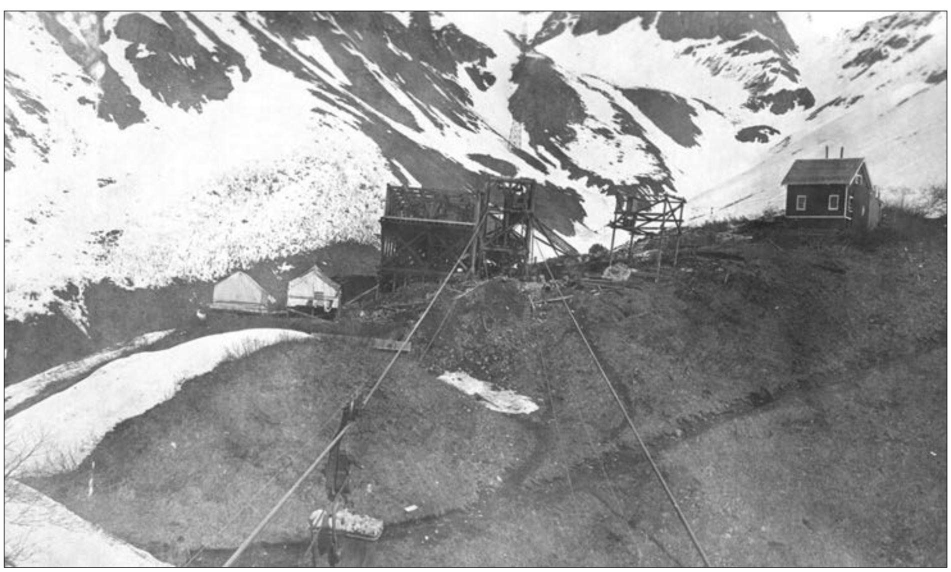
JT24: Jumbo Tower 18 SW corner (J24; T18), view E (NPS, 2003).

Jumbo Junction Station Complex, Operator's House (right), view E (NPS, 2006).

Analysis and Evaluation (cont.)

Jumbo Tramway

Jumbo Junction Station Complex, view E, c. 1910s (Courtesy of Geoffrey Bleakley).



JT26 and JT28 far left, view E, c. 1920s (Courtesy of Geoffrey Bleakley).

Analysis and Evaluation (cont.)

Jumbo Tramway

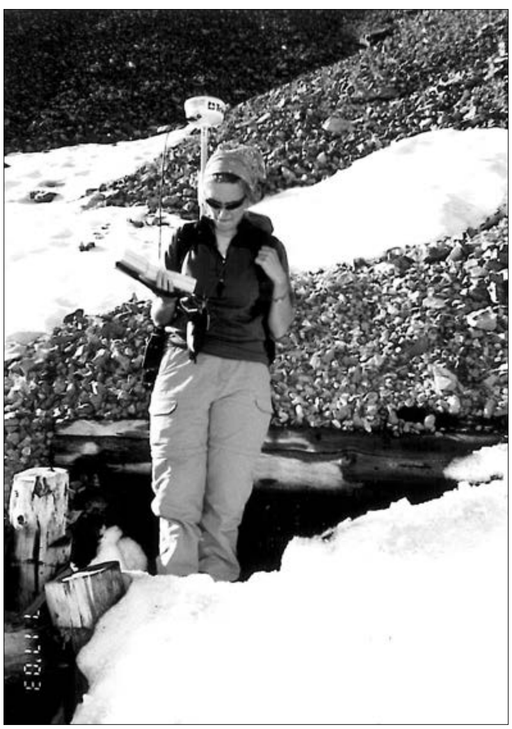
JT27: Transformer Tower (center), view E (NPS, 2008).

JT29: Turnhouse, view W (NPS, 2008).

Analysis and Evaluation (cont.)

Jumbo Tramway

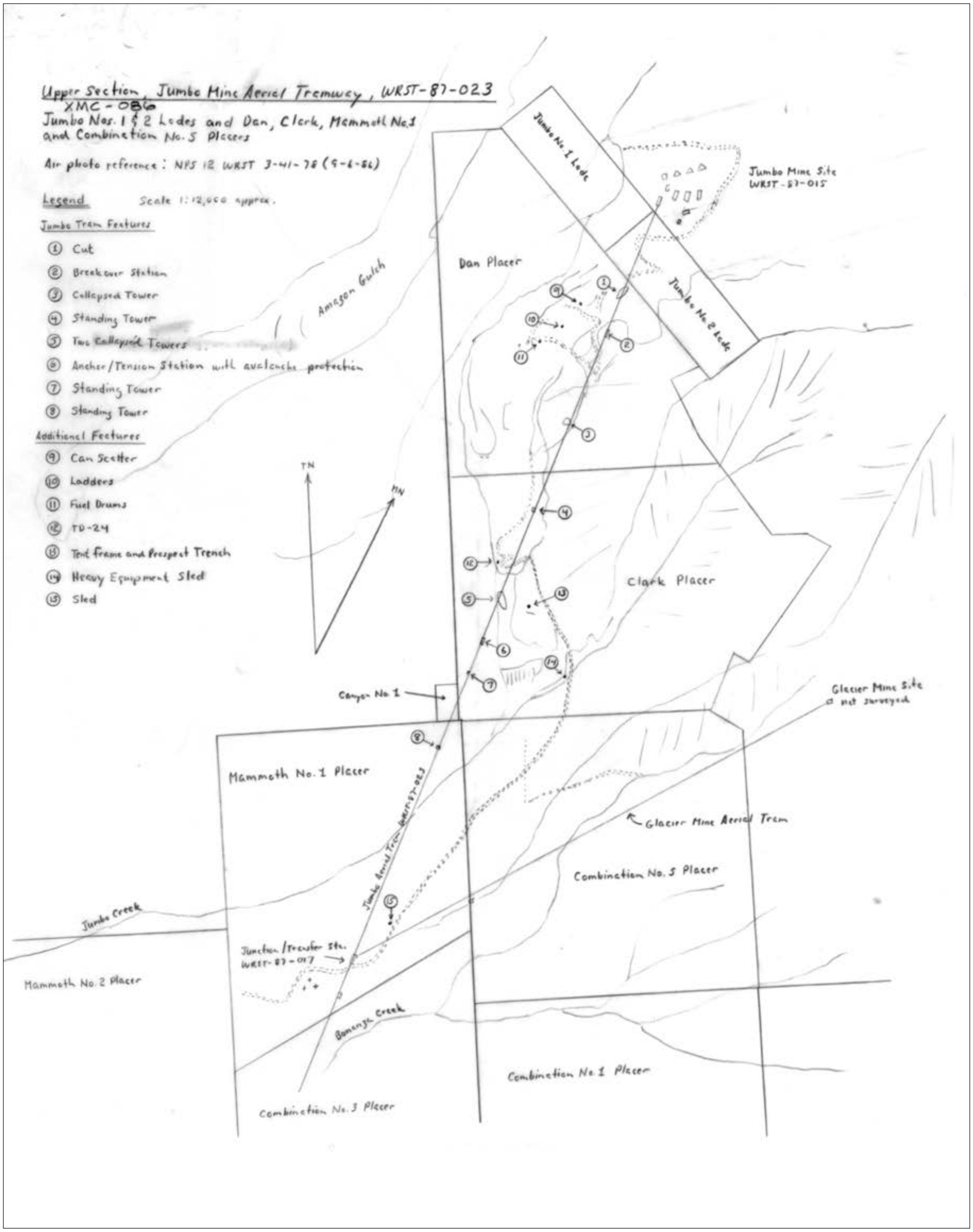
JT30: Outhouse, view E (NPS, 2008).



JT39: Snow Fence, view W (NPS, 2003).

JT40: Entrance to Jumbo Underground Loading Station, view E (NPS, 2003).

Analysis and Evaluation (cont.)



Source: Records of the Alaska Regional Office. ARCC-00400, VIII-F, Box 70, Folder 21: WRST - Site No. XMC-086.

Analysis and Evaluation (cont.)

CIRCULATION

The aerial tramways played a significant role in the development of Kennecott as they were essential in preparing the mines for production, enabled the mines to produce large quantities of ore and provided a dependable transportation network between the mines and Concentration Mill between 1908 to 1938. Prior to the construction of the aerial tramways, the mines were connected to the Mill Town by wagon roads and foot trails that were only accessible four months out of the year. This in turn, significantly limited mining operations to the summer months and the high cost of haulage from Kennecott precluded the ability to ship out low-grade ores. Moving wagon teams up and down the steep slope of Bonanza Ridge was also time consuming, dangerous, and costly. On a downhill trek, the driver had to take care that heavy ore wagon did not break away, run over the horses leading the wagon, or slide off the road. The return journey uphill was just as difficult being almost impossible to move wagons up steep slopes. It was clear from the beginning of mining operations, that the success of the Kennecott Mines depended on aerial tramways to transport ore across over natural obstacles with ease.

Bonanza Mine was established sometime around 1900 but little development occurred until 1906 when a rude wagon road was cleared between the Mill Town and mine. Drawings for an aerial tramway were prepared in 1907 by the Trenton Iron Company of New Jersey, and construction began the following year. Workers cleared a 50 foot wide corridor of vegetation from either side of the aerial tramway to ensure access to the towers for repairs and reduce the risk of damage from avalanches and fallen trees. Over the course of two summers, the loading station, angle station, and an intricate system of towers, breakovers, and tension stations were built up the hillside of Bonanza Ridge. Although the aerial tramway was complete in 1909, construction was still underway on the Concentration Mill. Consequently, the aerial tramway was initially used to transport materials and supplies needed to build a support camp at Bonanza Mine while stockpiles of ore continued to grow. Nevertheless, by 1911 the Concentration Mill was at an operational capacity and the aerial tramway was transporting up to 100 tons of ore from the mines each day to be processed (Gilbert, et al., 2001: 20, 24-25, 28, Appendix H).

Once the Bonanza Tramway was transporting ore, attention was given to Jumbo Mine where promising discoveries had been made. An aerial tramway was purchased and shipped to Kennecott in 1911 and built between 1913 and 1914. The Jumbo and Bonanza tramways ultimately superseded the use of wagon roads and trails and allowed the mines to increase production. The Jumbo Tramway had the capacity to transport 20 tons of ore per hour at a speed of 528’ per minute and the Bonanza Tramway’s rated capacity was 18 tons per hour at a speed of 452’ per minute. Remarkably, in 1915 750 tons of ore was extracted from Bonanza and Jumbo mines daily, a 300 percent increase from the previous year’s production (Gilbert, et al., 2001: 29, Appendix H; Smith, 1917: 30-32).

With a steady supply of ore from Bonanza and Jumbo mines to support operations, efforts were made to develop Glacier and Erie mines. By 1916, a third aerial tramway was built extending from Erie Mine to a staging area situated 2,000’ below the camp. The Jumbo junction station was improved sometime between 1918 and 1920 to support a 4,500’ long aerial tramway extending to a loading station at Glacier Mine. This tramway was used to transport ore from Glacier Mine as well as service Bonanza Mine when the Bonanza Tramway was undergoing repairs. It is likely that a stub tramway extending from upper Glacier Mine to Bonanza Mine was built during this time to support the occasional movement of Bonanza’s ore on the Glacier Tramway (Gilbert, et al., 2001: 29, 68, Appendix H; Glacier Tramway drawing T-159, 1918).

By the late 1920s, the Kennecott Mines were connected underground making it possible to transport ore from Erie Mine, pass through Jumbo tunnels, and exit at Bonanza. This eased the transportation of ore within the mines and secured access to all of the loading stations as it was not uncommon for avalanches to prohibit the shipment of ore for months on end. The aerial tramways continued to be actively used and serviced until the last of the great Kennecott ore bodies were in sight. A portion of the Glacier Tramway was disassembled after the mine closed in 1928 and the Kennecott Copper Corporation conducted limited repairs on the remaining aerial tramways after mining operations declined in the 1930s. Subsequently, the Kennecott Copper Corporation closed all mining and aerial tramway operations on Bonanza Ridge in 1938 (Gilbert, et al., 2001: 42-43; Appendix H; Saleeby, 2000: 332).

While the aerial tramways are no longer actively used, the primary features of the aerial tramways are intact and the spatial relationships and circulation patterns that were shaped by the natural landscape and the industrial activities that took place at Kennecott during the period of significance are clearly evident upon the landscape. As such, circulation contributes to the historic significance of the Kennecott Aerial Tramways landscape and maintains integrity of location and association.

Analysis and Evaluation (cont.)

TOPOGRAPHY

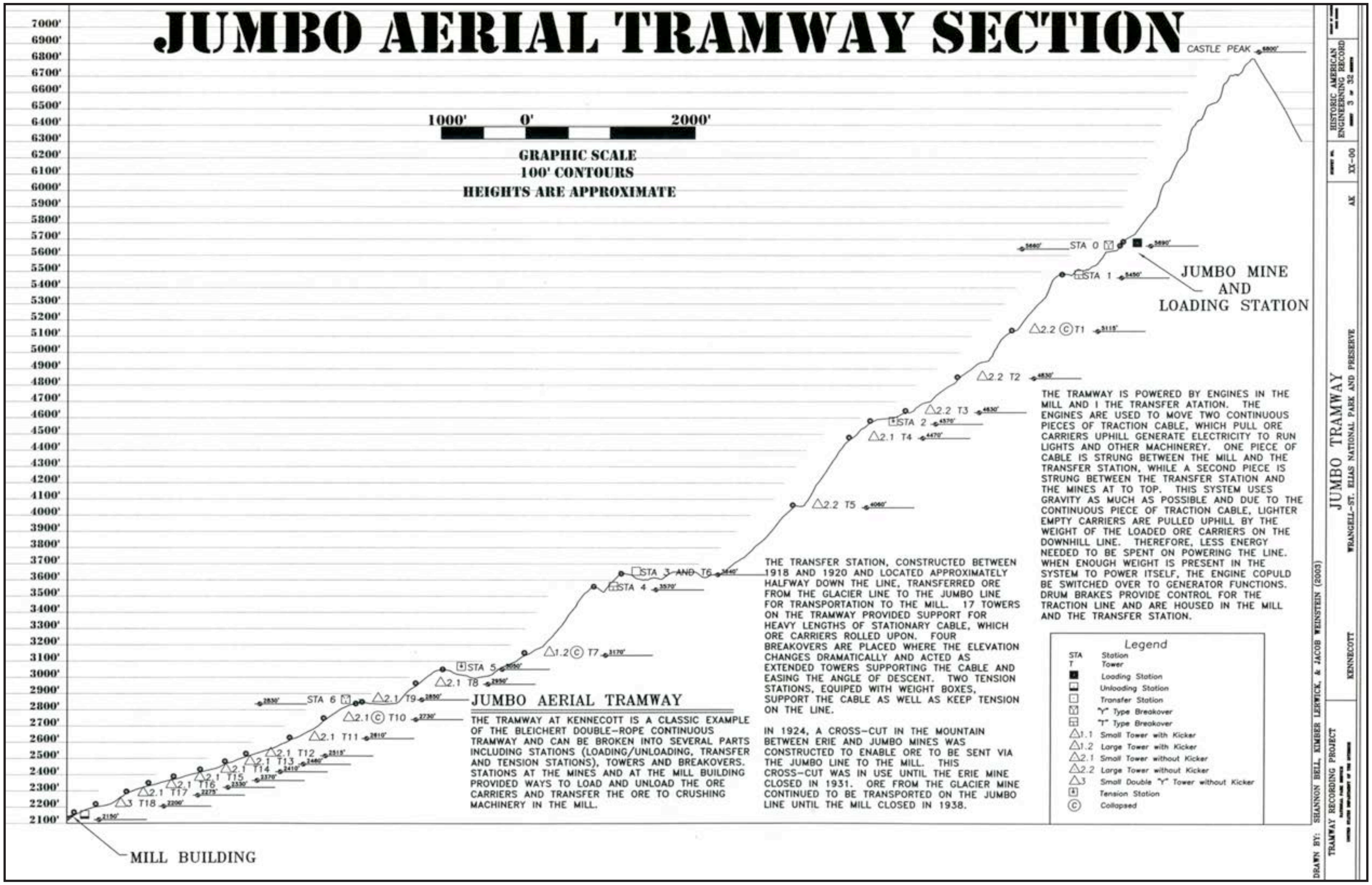
Kennecott is situated on the west face of Bonanza Ridge in the Wrangell Mountains of southeast Alaska. The landscape is characterized by pronounced steep mountain slopes rising from the Kennicott Valley at about 2,000’ to nearly 7,000’ in elevation before jutting downward into McCarthy Creek to the east and the Kennicott Glacier to the west. The valley is predominately occupied by the Kennicott Glacier which has a width of about 3 miles and extends northwestward approximately 24 miles to Mount Blackburn and Mount Regal. The top of Bonanza Ridge hosts a Chisitone-limestone contact that is serrated by perpendicular pinnacles and hoodoo formations. This contact defined the location of ore and influenced the siting of the mining camps high on the ridgeline. Below the mining camps are numerous gulches, talus slopes, and alpine glaciers that feed into several drainages before emptying into the Kennicott Glacier below (Bateman, 1920: 1-5).

The natural topography of this dramatic landscape provided a number of challenges that affected the layout of circulation systems at Kennecott. The narrow north-south alignment of Bonanza Ridge coupled with the Kennicott Glacier abutting its western edge, forced wagon roads, and later the Copper River and Northwestern Railroad, to follow the east perimeter of the glacier. At higher elevations, narrow cirques, gulches, and steep slopes influenced the placement of the aerial tramways to connect the mines to the Concentration Mill a they could economically negate rugged topography. As such, the Kennecott Tramways provided a dependable mode of transportation at Kennecott ultimately superseding the use of the wagon roads and trails leading to the mines.

In sum, topography influenced the design and layout of the aerial tramway system in many ways. Notably, by influencing the line width and load bearing capacity of the cables between towers as well as the siting of anchor-tension stations and breakovers on the upper and lower extensions of the tramways to ease stress on the line. The Bonanza Tramway even incorporated and angle station to overcome the challenges of topography at higher elevations on Bonanza Ridge midway allowing the Bonanza Tramway to make a steep horizontal jog up Bonanza Ridge to the loading station. Topography also played a key role in the avoidance of avalanche paths as snow fences were placed alongside the aerial tramways to protect them from damage. In some instances land was either cut or blasted away to provide sufficient foundations for tram towers or to allow enough clearance for tram buckets to pass through. This is evident in a cut of land between JT1 and JT2 (Gilbert, et al., 2001: 18; 191).

To date, the topography of Bonanza Ridge remains the same to as it was during the historic period and the spatial relationships between the natural topography and built features is evident upon the contemporary landscape. For this reason, topography contributes to the historic character of the Kennecott Aerial Tramways landscape and maintains integrity of location and association.

Analysis and Evaluation (cont.)



Topographic section cut of Jumbo Tramway (Bell, et al., 2003).

Analysis and Evaluation (cont.)

SPATIAL ORGANIZATION

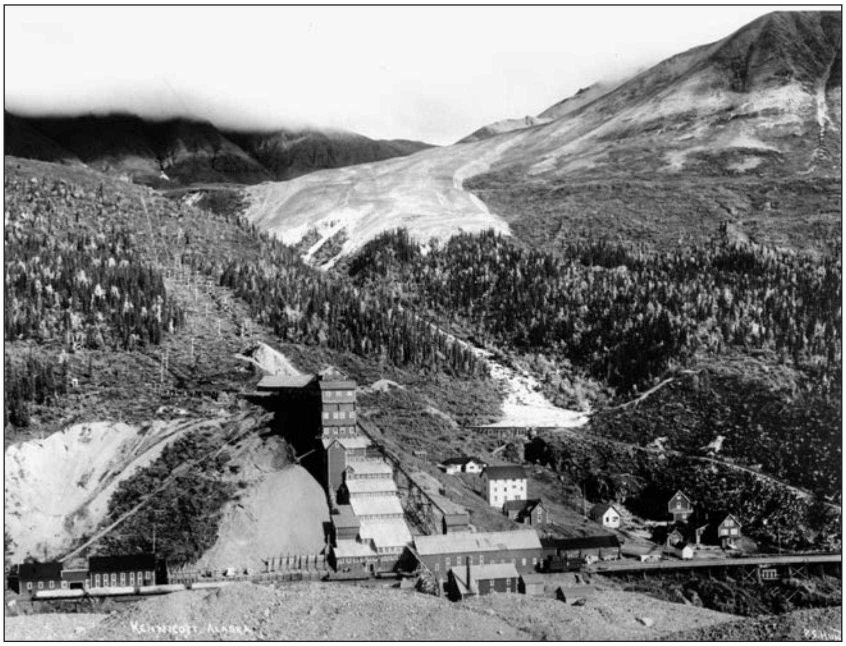
The construction of the aerial tramways was influenced by the development, decline and abandonment of the Kennecott Mines. The development of the mines stimulated the construction of aerial tramways between 1908 and 1924 when the Kennecott Mines were in full production. As ore bodies were worked out and new discoveries became less frequent between 1925 and 1932, mining operations declined and the aerial tramway were eventually decommissioned leading to the subsequent closure of the mines and abandonment of the aerial tramways in 1938. As such, the developmental stages of aerial tramway system reflect periods of growth and decline throughout three decades of mining operations at Kennecott.

Upon the abandonment of the Kennecott Mines, the aerial tramways were essentially left in place allowing contemporary observers to discern the spatial relationships and circulation patterns that were shaped by the natural landscape and the industrial activities that took place at Kennecott. As such, spatial organization is an important analysis tool for understanding the historical development of the Kennecott Aerial Tramways as well as the Kennecott Mines. For this reason spatial organization is considered a contributing landscape characteristic to the Kennecott Aerial Tramways and maintains integrity of location and association.

VEGETATION

During the period of significance, vegetation was systematically cleared from the tramway corridors to reduce fire and tree fall. Since the initial abandonment of the aerial tramways in 1938, successional vegetation has reestablished itself within previous cleared areas. Comparisons between historic and contemporary photos clearly show the great changes that have occurred as a result of succession (refer to views 1 and 2). Notably, vegetation has obscured visual evidence of the Bonanza and Jumbo tramway corridors and deterred visitor access to much of the area east of the mill town. Successional vegetation has also accelerated the deterioration of wood structures by trapping excess moisture in the understory. Consequently, this promotes rot in wooden bases and foundations causing structures to collapse. For these reasons, vegetation is a detriment to historical integrity of the Kennecott Aerial Tramways landscape. Future recommendations may include selectively clearing vegetation in the tramway corridor and routinely brushing vegetation from the base of tramway towers and breakover stations to prevent further deterioration of the structures.

Analysis and Evaluation (cont.)



View 1: Tramway from Kennicott Glacier, c. 1910s (Courtesy of Geoffrey Bleakley).

View 1: Tramway from Kennicott Glacier, c. 1990s (Courtesy of CityProfile.com).

Analysis and Evaluation (cont.)

View 2: Jumbo Junction Station Complex from Jumbo Trail, c. 1913 (Courtesy of Geoffrey Bleakley).

View 2: Jumbo Junction Station Complex from Jumbo Trail (NPS Photo, 2003).

Condition

Condition Assessment and Impacts

Conditions Assessment: Poor

Assessment Date: 6/17/2015

Condition Assessment Narrative:

The Kennecott Aerial Tramways cultural landscape maintains its historic integrity due to the historic character its landscape features and characteristics convey. Collectively these features convey a strong sense of time and place, and contribute to the landscape's integrity of location, association, materials, workmanship, and design. Nevertheless, the majority of built features associated with the Kennecott Aerial Tramways show clear evidence of major disturbances and rapid deterioration by natural forces and are at a critical point where preservation and stabilization efforts are greatly needed. For these reasons the condition of the Kennecott Aerial Tramways is considered 'Poor'.

Impacts

Type of Impact: Structural Deterioration

External or Internal: Internal

Impact Description: Contributing buildings and structures are in advanced stages of deterioration. Cable lines have moderate external and internal corrosion, and all traction lines have severe core rot.

Type of Impact: Other-Avalanche/Snowload

External or Internal: Internal

Impact Description: Several structures have been damaged by avalanches, rock slides, and heavy snow loads.

Type of Impact: Vegetation/Invasive Plants

External or Internal: Internal

Impact Description: The aggressive succession of weedy and woody plants impacts historic resources. Vegetation should be removed from supporting structures to slow deterioration.

Type of Impact: Neglect

External or Internal: External

Impact Description: Neglect impacts the longivity of the remaining historic resources.

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Supplemental Information

GLOSSARY

Angle Station: A tramway structure that accomplishes a turn in the line.

Back Traffic: Supplies and materials returning to a mine by tramway in the opposite direction of the ore.

Bull Wheel: End pulley on a tramway.

Carrier (Ore Bucket): Container attached to a tram line to hold ores or other materials.

Clip: Device attached to a single-rope tramway to hold the carrier to the cable.

Discharge Terminal (Turnhouse): End terminal of the tramway where the ore is unloaded.

Double-Rope: A tramway of the Bleichert design where the carrier rides on a track cable and is pulled by a second, smaller cable.

Friction Grip: A device for attaching the traction cable to the carrier on a double-rope tramway.

Jig-back: Simple form of a balanced tramway that utilizes two carriers, one going up while the other goes down, and vice versa.

Junction Station: Also known as a transfer station. A structure on longer tramways that transfers carriers from one section to another by means of a rail connection.

Ropeway: Another term for an aerial tramway. Popular in the nineteenth century.

Single Rope: Also known as the Endless Wire Ropeway. Definition of a tramway that uses a traveling cable with carriers attached.

Tension Station: Structures placed along longer tramway to apply tension to the track cables, usually at intervals of a mile or more.

Traction Cable: A small moving cable that pulls the carriers on a double-rope tramway.

Wire Rope: Steel or iron cable used on all tramways to support and move loads. Available in many sizes and surfaces.

Supplemental Information (cont.)

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Kain: June 12, 1994. Kennicott Glacier Lodge. Interview with Nels Konnerup and William Douglass. Interviewers are Logan Hovis and Anne Kain of the NPS. Logan do you want to take the lead?

Hovis: Certainly. I know both of you have a lot of memories of the place that pertain to how you grew up here and the friendships you formed here…And a lot of information that is harder to get at is how the place worked. How the people that worked in the mill or in the mines worked. What they did. We have a good idea of what they did in the bunkhouses, but I'm very curious what they did when they were around the machinery. You worked in the mill a little bit at certain times.

Konnerup: Very little in the mill but…

Hovis: And on the tramway?

Konnerup: On the tramways. And also underground at the Jumbo [and] Erie.

Hovis: I would really like to hear what you did there. In all of the places.

Konnerup: Bill Douglass, of course, knows very well [the] administrative operations that went on here, and his father was the preeminent manager of this whole operation from 1915 onward until 1929. This was the most efficient mining company and administrative offices that I've ever encountered. And I've been fortunate to have seen mining operations in Montana, Utah, and Nevada and other places. They never worked quite as smoothly as they did here.

Hovis: You worked there as a miner as well as in the other operations?

Konnerup: Either that or I had friends some who were and a geologist I traveled with a little bit with, John Mercy. So I do have a comparative of ideas about what goes on in a mining town operation. I don't like to call this a mining camp because it was a mining town. It was a friendly sort of place. Very unusual in my opinion. And I think the good deal of it leads to Bill Douglass's father and the men he hired in the administrative positions. And that goes all the way from foreman [who] worked in the mines and camps [and] people who worked in administrative levels in the lower camps or town.

Hovis: I've read Mr. Douglass's history about the operations. It's very useful. When you worked up at the Jumbo mines, what was your position?

Konnerup: Well, I happened to be able to muck, as they say, from both sides. And there was a contract operation between going from Jumbo to Erie and the crew was two miners and two muckers. And they all happened to be Finns except me. And they didn't [have] another Finn who could muck on both sides. I got a temporary position and that was 1934. And the price of copper was going up probably because of the imminent war situation. And I think they were thinking of making more out of there and bringing it to the Jumbo tram area, rather than over the side of the hill down along the glacier. Which was a very practical solution.

Hovis: Did you help with the drill setup.

Konnerup: No. Just mucking.

Hovis: Just Mucking.

Konnerup: They were traditional liners-the [type of] pneumatic hammers [that] were set up. And the miners put 14 feet of steel into the face. As soon [as] they drew that out we went in and mucked it in the cars.

Hovis: Then you drill, fire and muck around each shift.

Supplemental Information (cont.)

Konnerup: Yes, fire, wait for the dust to settle and then we start mucking. That was my only experience underground except for going down the stopes and looking around. Bonanza was, I think, about 3,200 feet deep. The deepest shaft in the mining operation. There was communication between the Mother Lode and the Bonanza and communication between the Jumbo and Erie being developed. Then I had the good fortune to take a job riding the line on the aerial tramways [I was too young, but Jack Morris] decided that if I wanted it bad enough I could handle it.

Hovis: What would you do in that job?

Konnerup: Well, that was riding up and down the line watching for problems that developed in the towers and the saddles and cables. And keeping all of the gear on the line greased. It was a mean job in the winter and [a] beautiful job in the summer.

Hovis: You get quite intimately involved with the latches that hold the top cars onto the cables.

Konnerup: Oh, yes. Occasionally, there would be an accident in that area and some buckets got away and crashed. And generally, you have a splicing job to do on the cables. And then we did the splicing in the place with a platform across the main lines and pulled the cables together and spliced them. And it was generally a hurry-up job because that mill depended on the tramways and it cost a lot of money to shut that mill down. The objective was to keep as much ore on the top side as you could in case of an interruption in the tramway.

Hovis: When you would do maintenance on the towers, would you walk up to them or would you ride the buckets and jump off.

Konnerup: Ride the buckets and jump off.

Hovis: How old were you?

Konnerup: Seventeen, when I started.

Hovis: How old were you when you finished?

Konnerup: I worked two years before I left. But it was considered a little more dangerous than some jobs. There were a few people over the years in the tramway operations. I thought it was perfectly safe.

Hovis: Would you ever work in the transfer stations or the angle stations?

Konnerup: Yes, I worked at the angle station on the Bonanza side. Steve Brachanan and I, we worked two shifts and that again was designed to keep the mill running.

Konnerup's Daughter: Tell them about the bear up at the angle station.

Konnerup: It was an increasing episode. Steve liked to feed the bears and porcupines. They do get to be nuisances. I didn't much like the idea, but Steve thought it was fine. He was on the day shift and I was on the night shift. I went on at 6:00. I was supposed to be having dinner ready for him when he came off shift and I'd go on. And one day a little old black bear was sitting up there in the walkway between the tramway and the house. Steve called over and said, "Get that bear off the walkway so I can get in here." I said, "No that's your problem." I left him there and he had to run my shift for about an hour and a half. The bear finally left.

Hovis: You pay him for that?

Konnerup: So Steve never more fed the bear.

Hovis: I don't know if the snow is gone enough or not, but that house is still up there.

Supplemental Information (cont.)

Konnerup: Yeah.

Hovis: In pretty good shape. I think there's a gentleman who lives in it.

Konnerup: That's right. I'm not sure about Station 3 on the Jumbo side.

Hovis: It's in good shape, too.

Konnerup: At one time, one winter I stayed riding line. I stayed very often at stations.

Hovis: You'd ride line on both tram systems.

Konnerup: Yeah. And it was a full time job with seven days a week and eight hours a day and sometimes more. I spent quite a lot of time on that line because there were several towers. It was very low and they had to shovel out from under the towers so the buckets didn't lift off the line. I remember one night we went to bed and there was a bowling blizzard up there and in the morning, when we got up, the house was completely covered [with snow], except for that window that's up about four feet. We had to crawl out through there to get to the tram lines. The Jumbo line, when I was there, the Jumbo tram only worked eight hours a day.

Hovis: Did you have a lot of problems – I think it is [station] number six or seven. It's a breakover about half way up from the angle/transfer station to the top. There's a lot of snow slides or snow guards up there now.

Konnerup: On the Jumbo?

Hovis: Yes, the Jumbo.

Konnerup: Just above the station 3, it was a breakover tower and that was a menace. We had to keep that clear and then there was a long span below it and tower on lower side was another place. The worst snow slides in that came all in [one] time. And the same on the Bonanza side, just outside the Bonanza breakover there was a deep canyon in there.

Hovis: The loading station at the top of the Jumbo, that's actually in the ground, isn't it? You go in the mountain?

Konnerup: Yeah, there's part of the timbered tunnel. On the Bonanza side, it was even right out in the open. The wind was howling and was mighty cold in there.

Hovis: I was in that station last summer. I was two places where there was heat. I assume it was a little rescue station or the foreman shack and a little place where you had a hot plate in it you used to keep the grease warm.

Konnerup: Yeah, that was about all the heat. Now, I remember very well Jack Morris, when I was riding line behind him and when the weather got real cold he would send me up to help on the Bonanza side because those chutes would freeze up. And for some reason or another Jack thought that I could keep the tram running or something. He'd send me up there to help him open the shoot. I remember having big Scandinavian and Norwegian fellow. They called him big John Wilson…he was so darn strong that he'd take one of those handles on the chute and it was solid steel and he'd bend it. But that would keep the muck coming down. And one of the tricks to doing that would [be to] cut a short stick of dynamite and put a fuse on it and shove a stick up the chute and jar it loose. That would, of course, would break the caked ore away from the chute. And we kept it running.

(Break)

Kain: What was the ethnic makeup of the miners themselves? Here you had a lot of Scandinavians in administrative…down here in the lower camp.

Supplemental Information (cont.)

Konnerup: Most of the miners were Scandinavians, Finns, or Norwegians.

Douglass: People who'd come from mining backgrounds in the so called "Old Country." A lot of them with heavy accents.

Konnerup: A lot of them couldn't sign their paychecks, just make their marks.

Kain: So a lot of them were Welsh and Scandinavian, very similar to the makeup of the people down here?

Douglass: I think the composition was the same at the mine pretty much as it was down here except that the people at the mines probably were less educated. They would start up there and they ended up down here.

Kain: When I was talking to the Moore sisters yesterday, their father left here and went to Chile and married a woman from Chile. Did you have people from the mines like that? Kennecott had mines in Chile; did any of those people ever come up here?

Douglass: No, I never heard of any.

Konnerup: No, we had very few Latin people here. I think probably the weather conditions were not attractive, for one thing.

Douglass: I think the Chile operation was later in the 20s, too. Most of the mine labor force was people who came here between 1915 and 1920.

Kain: Yes. They said their father was here first, and then went down there, and then came back here.

Konnerup: Well, Jim Davis, who built the aerial tramways here, built aerial tramways all over the world and he built those tramways for Kennecott Copper and probably some of the other companies in Latin America too. And in those days and up through the 1920s the aerial tramway was a much more common system of transporting, more than it is now, where they use rails and drill tunnels and things like that.

Hovis: Did you ever have any of the cables break under your load?

Konnerup: There have been breaks in the running lines, when buckets bang together. But mostly it wasn't a complete break, it was a frayed cable. We'd salvage the buckets from the ground by pulling them up to the towers and loading them on. We'd set up a platform right on the wire between the towers and pull the cable together and splice it right back in place. Jack Morris and the fellow that I replaced was a steeplejack, forgot to duck one day and they were task masters of high wire acts.

Douglass: As Nels says, those were considered a little more dangerous, those trips down to those towers and not only the danger from the buckets and the cables that were running all the time but the snow slide danger. One man, I can't remember his name, was working on one of those towers and a snow slide swept him away, I can't remember his name, 1927, I think.

Konnerup: Yeah, I can't remember his name either.

Douglass: He was not normally supposed to be there, he was sort of a sub-foreman or something and he'd gone up to check something and he'd got too…and swept him away.

Konnerup: That was probably on the breakover from the Jumbo station.

Hovis: What did you use the telephones for that are on those breakovers?

Konnerup: To call in to stop the tram when we were working on a tower or working on a cable. We could string a line from that telephone that was on the tower down to where we wanted to stop the bucket. Some of those couplings on the main lines, sometimes we would drop ropes over the side and slide down the ropes and pull those buckets up to the towers and then

Supplemental Information (cont.)

we'd load them on a platform and take them down for repairs. All of those buckets went into the machine shop for periodic repairs and – remember that little track that runs up to the tram house – all that equipment went up and down on that rail car. Douglass: Have you ever seen the buckets? I didn't see any of them around here anywhere.

Konnerup: There some in the dump over there.

Hovis: Yes, and some of the old buckets I don't think were worth salvaging are in the scrap heap behind the machine shop. I haven't seen too many of the hangers and bells in there, though.

Konnerup: There's some over here, but they had a hook, like a bail on a bucket, and a latch that went onto the bucket and onto the frame. Those things ran right over the top of the crusher and you just flip the latch and turn the bucket over. When we were riding line, we, of course, didn't stop the tram except when we were working on the line, but if we were cutting off the tightening bolts on the towers or anything we would just jump on the tower the same way we would jump on while it was going.

Kain: I'm surprised more people didn't get killed doing that.

Douglass: It wasn't that slow either.

Konnerup: No, it moved fairly fast. It moved fast enough so that when you jumped off at the lower end and hit the ground you had to run a few steps before you stopped.

Hovis: And you had your tools in your hand when you did it.

Konnerup: Either you had them over your shoulder in a sack or something.

Douglass: I can remember me father twice a week would go into the mine for an inspection and so on and so forth and he would sit at the bottom of that bucket and ride up there. On some days it was so cold…it took half an hour to get up there.

Konnerup: About 45 minutes.

Kain: If it's fifty below, that's cold.

Supplemental Information (cont.)

1998 Kennecott Aerial Tramways Site Visit Findings

Excerpt from Michael Shields. "Inspection and Safety Assessment of Kennecott Mine Tram System, Wrangell-St. Elias National Park and Preserve," (Contract Report for Wrangell-St. Elias National Park and Preserve, 1998). Pp. 2-5.

The Kennecott system is a classic example of a double-rope continuous mine tram (2 main carriers or track lines, and a continuous-loop traction line), with three distinct tram runs:

(1) Jumbo Mine line
(2) Glacier Mine line, which meets the Jumbo line at a transfer station; and
(3) Bonanza Mine line, which incorporates an angle station to overcome topography.

1. Wire-rope Lines

The main track lines are lock-coil type internal-wire-rope core (iwrc) wire-rope, having a tight smooth outer surface. Exterior wires are nested flat-S shapes to prevent a broken strand from popping loose, and interior round wires are reverse-laid to give the rope anti-rotation properties under load. In diameters over one inch there is an interior lay of wedge-lock wires between the surface lock-coil wires and interior round wires. As was standard practice, the downslope mains (called "mains") which carried loaded ore cars are slightly larger than their corresponding upslope mains (called "returns"), which carried empty or only supplies-loaded cars; this saved both weight and money.

The traction line is lang-lay 6"x7" fiber-core wire-rope, providing both good flexibility and surface friction (gripping) characteristics. This rope configuration is more prone to surface wear and internal corrosion than the lockcoil type. When in service, all wire-rope lines were to be regularly oiled at least monthly. The lack of severe surface corrosion after 60+ years indicates the Kennecott lines were regularly oiled, though frequency is unknown. The rope core of the traction lines appears to be extensively rotted.

Lock-coil rope splices were made with forged threaded, pinlock, mechanical-wedge sockets having a long taper to facilitate the passage of ore car sheave wheels. I could not find any traction-line splices, but presume they were woven to facilitate passage over the traction-line terminal sheaves. All splicing sockets and other line fittings appear to provide at least 90% and perhaps 100% efficiency relative to line breaking strength.

The lock-coil track lines on Kennecott are:

Jumbo line: 1-1/4" main, 1-1/8" return, with light to moderate surface corrosion and little evident wear; minor tension sprung at one point in 1-1/4"; one moderate smooth bend where breakover structure rests on line; splices every 2 to 3 spans indicate periodic replacement of line sections. Total line span to Mill 15,600 ft. (2.95 miles); 99.2% of main and 93.6% of return are still aerial.

Glacier line: 1" main, 7/8" return, with light to moderate surface corrosion and little evident wear; minor tension sprung in 1" at loading station; splices in main every 3 to 4 spans. Total line span to Transfer Station 4,850 ft. (0.92 miles); 56.7~ of main and return still aerial.

Bonanza line: 1-1/411 main, 1-1/8" return, with moderate surface and internal corrosion, notable wear evidence (est. 5% to 10%); upper sections of 1-1/4" have several tension-broken wires and some tension distortion; numerous splices indicate more frequent section replacement than on Jumbo or Glacier, lines apparently overloaded with some frequency. Total line span to Mill 15,550 ft. (2.95 miles); 47.8% of main and return still aerial.

The 6"x7" traction lines are in worse shape:

Jumbo traction: 7/8" worn to 13/16", with moderate surface and internal corrosion. 75% still aerial.

Supplemental Information (cont.)

Glacier traction: 11/16” worn to 5/8”, with moderate surface and internal corrosion, notable core rot. Total traction line 9,700 ft. (1 .84 miles), 56% still aerial.

Bonanza traction: 3/4” worn to 11/16-”, with moderate surface and internal corrosion, notable core rot; one section with 7 broken wires in lay (may have been an attempt to cut line); obviously heavily used, near replacement cycle. Total traction line 31,050 ft. (5.88 miles), 36.9% still aerial.

2. Anchors and Weight Boxes

These trams are rigged in sections of up to 0.46 miles, with the upper ends of the main and return lines attached to a fixed anchor and the lower ends attached to weight boxes which “float” within a structural framework to keep tension on the lines. This arrangement (as opposed to a high-tension system with fixed anchors at both ends) allows the in-line tension generated by a travelling load to be distributed throughout the section rather than concentrating on any one end or intermediate supporting structure. The “anchor” for the traction line loop is a large horizontal power sheave at section bottom and a similarly large carrier sheave at section top; ore-car control- is achieved by the sheave power unit and large drum-and-band brakes on sheave axles.

The loading station anchor points are now all buried. Kennecott design drawings show the fixed anchors to be heavy steel plate frames set into massive concrete deadmen. The main track lines are attached to the anchor plates by large cast and forged fittings and a length of lock-coil wire-rope sized for a breaking strength roughly two times that of the track lines. There was no evidence of any anchor shifting, distortion, fatigue or severe corrosion, and though there may be some deadman movement due to ground thawing, the anchors are assumed to be stable and sound. There is some minor misalignment in a couple of the traction line sheaves, but this appears to be from structure settlement rather than any line loading.

Weight boxes are of 2”x12” plank and 4”x6” to 6”x8” frame construction, rocks filled, and are attached to main track lines via very heavy chain, forged wedge-eyes and sling hooks, and bridle rods to the boxes. All weight boxes are resting on the ground or frame members which indicate unloaded main lines throughout the system. Dimensions were taken of the Mill weight boxes, and loads calculated at:

Jumbo 36,900 lbs. main, 25,100 lbs. return.
Bonanza 45,000 lbs. main, 26,300 lbs. return.

The 22% difference in main loads between Jumbo and Bonanza helps account for the evidence of overloading seen in the Bonanza line. There is no evidence that any weight boxes or their attaching rigging have been distorted or damaged by on-line tension.

3. Line Carriers

Main and return track lines are carried through major structural stations and breakovers by grooved cleats underlying rails on which the ore cars ran. The cars transitioned from track line to rail to track line via a hinged top-cleat. In the case of towers there is no rail, and track lines are carried by offset cleats which allow car wheel transition. Traction lines are passed through structures on wide-flange sheaves (“guide wheels”) resting in open oil-bath frames, with wing-rod fittings to reposition the cable as it pulled off the sheave under load. Traction line “wheels” were not lubricated in their throats, but track line cleats were heavily greased to facilitate line flexion. Greasing and oiling appears to have been excellent, with no evidence of excessive line wear due to lack of lubrication. However, lines have jumped out of their carriers in several locations due to slide or avalanche impacts or adjacent tower failure, and there is considerable evidence of wing-rod wear by traction lines from minor (and perhaps episodic) line misalignment.

4. Supporting Structures

The largest problem on all Kennecott tram lines is the presence and stability or lack thereof, of line-supporting structures. Such structures can be broken into categories:

Supplemental Information (cont.)

(1) Loading stations
(2) Towers and breakovers
(3) Angle and transfer stations
(4) Mill building

All three loading stations are in varying stages of structural distortion and collapse, with the Bonanza station being perhaps the most stable and the Jumbo station the least. These structures will continue their collapse at an ever increasing rate, but short of the abrupt total failure of a traction rope sheave such collapse should have little effect on tram lines and no effect on the anchors.

5. Towers and Breakovers

Towers and Breakovers are heavy timber-frame structures with strong lateral and longitudinal cross-bracing, all bolt together construction, and have excellent joinery. As built, these structures were very strong and stable. They are not “fastened to” the ground; they are essentially freestanding structures set onto excavated ground or rock platforms and are held in position by their own mass and weight and by the near-balanced compressive component of tram line loading. The condition of towers and breakovers on each line varies from sound and apparently stable to fully collapse. The primary causes of deterioration and failure in structures above 4000 feet elevation are avalanche impacts, snowpack loading and sill rot, while in lower elevation structures they are foundation and frame member rot, vegetation wedging of frame members and joints, snowpack loading, and the past intentional removal of bracing members.

The Transfer Station and Angle Station appear to be fairly stable and structurally sound, though both have some rot in sills and foundation framing. The Mill building is obviously a different story, with rot and progressive structural failure in the tramway terminal level. While the Mill weight boxes are “to ground”, there is still sufficient tension on the track lines to contribute to further structural distortion as rot progresses in frame members. Continued vandalism in this structure can only hasten the process.

Supplemental Information (cont.)

Kennecott Aerial Tramways - Kennecott Mines NHL
Wrangell-St. Elias National Park and Preserve
Period of Significance: 1908 AD-1938 AD
Property Type: Historic Vernacular Landscape
Significance Level: National
Significance Criterion: A
Areas of Significance: Transportation and Industry

Contributing Landscape Characteristics

LANDSCAPE CHARACTERISTIC	ASPECTS OF INTEGRITY
Cluster Arrangements	Location, Feeling, Design, Workmanship, Materials, and Association
Circulation	Location and Association
Spatial Organization	Location and Association
Topography	Location and Association

Supplemental Information (cont.)

Kennecott Aerial Tramways Non/Contributing Landscape Features and Characteristics

FEATURE #	FEATURE	OWNERSHIP	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
	Bonanza Tramway Cluster Arrangement				
BT1	Bonanza Loading Station		Yes	61.51265558	-142.83426124
BT2	Bonanza Breakover 2		Yes	61.51051170	-142.83539235
BT3	Bonanza Breakover 3		Yes	61.50845905	-142.83644916
BT4	Bonanza Tower 4		Yes	61.50726356	-142.83707819
BT5	Bonanza Breakover 5		Yes	61.50675046	-142.83733766
BT6	Bonanza Breakover 6	Private	No	61.50134611	-142.84013291
BT7	Bonanza Angle Station (XMC-081)	Private	No	61.49621007	-142.84280629
BT8	Bonanza Tower 8		Yes	61.49530942	-142.84657168
BT9	Bonanza Tower 9		Yes	61.49455428	-142.84972116
BT10	Bonanza Tower 10		Yes	61.49358039	-142.85380436
BT11	Bonanza Tower 11		Yes	61.49295287	-142.85641702
BT12	Bonanza Tower 12		Yes	61.49153615	-142.86233894
BT13	Bonanza Breakover 13		Yes	61.48996513	-142.86892128
BT14	Bonanza Tower 14		Yes	61.48961964	-142.87034748
BT15	Bonanza Tower 15		Yes	61.48919057	-142.87214006
BT16	Bonanza Tower 16		Yes	61.48883070	-142.87365517
BT17	Bonanza Tower 17		Yes	61.48845696	-142.87520460
BT18	Bonanza Tower 18		Yes	61.48799538	-142.87713257
BT19	Bonanza Tower 19		Yes	61.48754425	-142.87901672
BT20	Bonanza Tower 20		Yes	61.48710508	-142.88085077
BT21	Bonanza Tower 21		Yes	61.48661297	-142.88290574
BT22	Bonanza Tower 22		Yes	61.48619467	-142.88465630
BT23	Bonanza Tower 23	Private	No	61.48577792	-142.88639169
BT24	Bonanza House (XMC-081)	Private	No	61.49619434	-142.84368794
BT25	Bonanza Cistern (XMC-081)	Private	No	61.49598219	-142.84246796
BT26	Bonanza Outhouse (XMC-081)	Private	No	61.49628024	-142.84393537
BT27	Bonanza Stub Tower 1		No	61.51289968	-142.83394848
BT28	Bonanza Stub Terminal 2		No	61.51419273	-142.83429531
BT29	Bonanza Stub Tower 3		Yes	61.51444275	-142.84068238
BT30	Bonanza Stockpile Ore Bin	Private	No	61.48585991	-142.88575913
	Erie Tramway Cluster Arrangement				
ET1	Erie Loading Terminal		Yes	61.54208774	-142.89391830
ET2	Erie Collapsed Tower		Yes	61.54284374	-142.89734202
	Glacier Tramway Cluster Arrangement				
GT1	Glacier Loading Terminal		Yes	61.51185465	-142.84598258
GT2	Glacier Tower 2		Yes	61.51168857	-142.84653145

Supplemental Information (cont.)

Kennecott Aerial Tramways Non/Contributing Landscape Features and Characteristics (cont.)

#	FEATURE	OWNERSHIP	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
GT3	Glacier Tower 3		Yes	61.50973798	-142.85297671
GT4	Glacier Tower 4		Yes	61.50781632	-142.85933182
GT5	Glacier Breakover		Yes	61.50757837	-142.86010412
GT6	Glacier Tower 6		Yes	61.50701907	-142.86195775
GT7	Glacier Tower 7		Yes	61.50639739	-142.86399078
	Jumbo Tramway Cluster Arrangement				
JT1	Jumbo Breakover Station 0		Yes	61.52234963	-142.85179882
JT2	Jumbo Breakover Station 1		Yes	61.52030009	-142.85378206
JT3	Jumbo Tower 1		Yes	61.51863194	-142.85540020
JT4	Jumbo Tower 2		Yes	61.51679708	-142.85717958
JT5	Jumbo Tower 3		Yes	61.51494762	-142.85896980
JT6	Jumbo Breakover A/T Station 2		Yes	61.51380327	-142.86007453
JT7	Jumbo Tower 4		Yes	61.51290200	-142.86095097
JT8	Jumbo Tower 5		Yes	61.51115958	-142.86263517
JT9	Jumbo Tower 6 and Station 3		Yes	61.50528137	-142.86832352
JT10	Jumbo Breakover Station 4		Yes	61.50387071	-142.86967383
JT11	Jumbo Tower 7		Yes	61.50168091	-142.87178230
JT12	Jumbo Breakover A/T Station 5		Yes	61.49851643	-142.87478635
JT13	Jumbo Tower 8		Yes	61.49776192	-142.87550440
JT14	Jumbo Tower 9		Yes	61.49588899	-142.87732922
JT15	Jumbo Breakover Station 6		Yes	61.49545313	-142.87775670
JT16	Jumbo Tower 10		Yes	61.49417460	-142.87900671
JT17	Jumbo Tower 11		Yes	61.49302679	-142.88011163
JT18	Jumbo Tower 12		Yes	61.49182697	-142.88127680
JT19	Jumbo Tower 13		Yes	61.49104502	-142.88204162
JT20	Jumbo Tower 14		Yes	61.48984142	-142.88319801
JT21	Jumbo Tower 15		Yes	61.48886638	-142.88413249
JT22	Jumbo Tower 16		Yes	61.48840163	-142.88464939
JT23	Jumbo Tower 17		Yes	61.48764025	-142.88531276
JT24	Jumbo Tower 18		Yes	61.48655206	-142.88636071
JT25	Jumbo Operator’s House		Yes	61.50498324	-142.86798694
JT26	Jumbo Collapsed Bunkhouse 1		Yes	61.50490298	-142.86869223
JT27	Jumbo Transformer Tower		Yes	61.50490251	-142.86834771
JT28	Jumbo Collapsed Bunkhouse 2		Yes	61.50490298	-142.86869223

Supplemental Information (cont.)

Kennecott Aerial Tramways Non/Contributing Landscape Features and Characteristics (cont.)

#	FEATURE	OWNERSHIP	CONTRIBUTING FEATURE	LATITUDE (D/D)	LONGITUDE (D/D)
JT29	Jumbo Outhouse		Yes	61.50494228	-142.86897374
JT30	Tramway Turnhouse		Yes	61.50496984	-142.86862904
JT31	Cut		Yes	61.52080789	-142.85329304
JT32	Can Scatter		Yes	61.52051173	-142.85541379
JT33	Ladder		Yes	61.51940899	-142.85666631
JT34	Fuel Drums		Yes	61.51866222	-142.85841628
JT35	TD-24		Yes	61.51539981	-142.85944456
JT36	Tent Frame		Yes	61.51405938	-142.85681830
JT37	Heavy Equipment Sled		Yes	61.50588661	-142.86653946
JT38	Sled		Yes	61.51162828	-142.85732528
JT39	Slide Fence		Yes	61.52031093	-142.85386928
JT40	Jumbo Underground Loading Terminal		Yes	61.52254864	-142.85160232
	Mother Lode Tramway Cluster Arrangement				
MT1	Mother Lode Terminal	Private	No	61.52083484	-142.82483317
MT2	Mother Lode Tower 1	Private	No	61.52083174	-142.81887790
MT3	Mother Lode Tower 2		Yes	61.52209525	-142.80980041
	Additional Landscape Characteristics				
	Topography		Yes		
	Circulation		Yes		
	Spatial Organization		Yes		
	Vegetation		No		