Watana Transportation Access Analysis

Project No. 82002

DRAFT

Prepared for:

Alaska Department of Transportation
and Public Facilities
Northern Region
2301 Peger Road
Fairbanks, Alaska 99709

Prepared by:
HDR Alaska, Inc.
2525 C Street, Suite 305
Anchorage, Alaska 99503

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Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

AAC	Alaska Administrative Code
ABF	Alaska Board of Fisheries
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish & Game
ADT	Average Daily Traffic
AEA	Alaska Energy Authority
AHRS	Alaska Heritage Resources Survey
AKNHP	Alaska National Heritage Program
ANCSA	Alaska Native Claims Settlement Act
APA	Alaska Power Authority
APDES	Alaska Pollutant Discharge Elimination System
AREMA	American Railway Engineering and Maintenance-of-Way Association
ARRC	Alaska Railroad Corporation
AS	Alaska Statute
ATV	All-terrain vehicle
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
CFR	Code of Federal Regulations
cfs	Cubic feet per second
cm/yr	Centimeters per year
Corps	U.S. Army Corps of Engineers
DEM	Digital Elevation Model
DMLW	Division of Mining, Land and Water
DNR	Alaska Department of Natural Resources
DOT&PF	Department of Transportation & Public Facilities
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulations
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FHWA	Federal Highway Administration
ft	Feet/Foot
GIS	Geographic Information System

GWh	Gigawatt Hour
H	Horizontal
HEA	Healy quadrangle
ICAP	Indirect Cost Allocation Program
m	Meter
MOA	Memorandum of Agreement
MON	Museum of the North
MOU	Memorandum of Understanding
MP	Milepost
mph	Miles per hour
MSB	Matanuska-Susitna Borough
MW	Megawatt
NED	National Elevation Dataset
NEPA	National Environmental Policy Act
NHCCI	National Highway Construction Cost Index
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
OHW	Ordinary High Water
PL	Public Law
RM	River Mile
ROM	Rough Order of Magnitude
ROW	Right of Way
SHP	Susitna Hydroelectric Project
SHPO	State Historic Preservation Officer
SWPPP	Storm Water Pollution Prevention Plan
TBD	To be determined
TLM	Talkeetna Mountains quadrangle
UCI	Upper Cook Inlet
USAF	United States Air Force
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
V	Vertical

1 Introduction

The purpose of the Watana Transportation Access Study is to identify a transportation corridor to be used to provide access to the Watana dam during its construction and operation. The objectives of this report are to:

- Identify the primary ground transportation mode to be used during construction and for the operational life of the dam.
- Identify and evaluate potential access corridors
- Identify suitable access corridors for further study
- Confirm the reasonableness of the proposed airport locations

This report is intended to be a reconnaissance-level study based on engineering, scientific, and environmental information. The information contained in this report is based largely on existing information that was supplemented by limited field investigations performed in October 2011. No public or agency consultation was conducted in the development of this report.

Section 1 of this report provides background information about the proposed project. Section 2 summarizes previous studies that have been done. Section 3 describes the identified corridors and those recommended to be dismissed from future study. Section 4 provides information about the criteria used to evaluate the corridors and summarizes the impacts. Section 5 identifies the suitable access corridors. Section 6 presents a summary of the airport evaluation process.

1.1 Project Background

The Susitna River was identified as a potential large hydropower site in the 1940s by the Bureau of Reclamation. In a 1976 report to Congress, the U.S. Army Corps of Engineers (Corps) proposed a two-dam project capable of producing 7,300 Gigawatt hours (GWh) of hydropower (Harza-Ebasco 1987). This concept was adopted by the Alaska Power Authority (APA), which began managing the project in 1980, and contracted with Acres America to review economic and environmental feasibility and file a Federal Energy Regulatory Commission (FERC) license application. Later, Harza-Ebasco was contracted to update the license application and perform final design.

The 1980s APA Project consisted of two dams: the first located in Watana Canyon at approximately river mile (RM) 184 and a second located at Devils Canyon (referred to as the Devil Canyon site in most earlier studies; RM 152). The 1980s APA Project effort culminated in the development of a license application filed with FERC in 1983, and an amended license application prepared in 1985. The project was cancelled in early 1986.

The current Watana Hydroelectric Project being evaluated by the Alaska Energy Authority (AEA) is located approximately halfway between Anchorage and Fairbanks in the upper Susitna basin (see Figure 1-1). It would create a single dam on the Susitna River at RM 184 in the vicinity of Watana Canyon. The proposed dam site itself is currently not accessible from the existing transportation network. Construction projects of this magnitude typically involve the need to transport large volumes of construction material, equipment, and personnel to the project site, making access an important component of the project. Once construction is complete, access will be needed to support the ongoing operation and maintenance of the dam. The Alaska

Department of Transportation and Public Facilities (DOT&PF) has undertaken a reconnaissance study to identify potential modes and locations of access corridors connecting the existing transportation network to the proposed dam site. The proposed dam site area is bounded by the Parks Highway/Alaska Railroad to the west, the Denali Highway to the north, the Richardson Highway to the east, and the Glenn Highway to the south. This report will evaluate potential transportation (road and rail) access corridors for the Susitna-Watana Hydroelectric Project and confirm that the proposed airport location is reasonable.

Figure 1-1. Location and vicinity map

2 Previous Access Route Studies

As part of the 1980s licensing effort, access to the Watana and Devils Canyon dam sites was considered. The reconnaissance level August 1982 *Access Plan Recommendation Report* identified three general transportation corridors to access the Watana dam site. Those corridors were:

- A corridor running west to east from the Parks Highway to the dam sites on the north side of the Susitna River. This corridor is often referred to as the North corridor.
- A corridor running west to east from the Parks Highway to the dam sites on the south side of the Susitna River. This corridor is often referred to as the South corridor.
- A corridor running north to south from the Denali Highway to the Watana dam site. This corridor is often referred to as the Denali corridor.

Within these three corridors, 18 different alternatives were analyzed. After some refinement and screening, the options were narrowed down to one alignment with each corridor (Plan 13, Plan 16, and Plan 18). These three corridors were then studied in further detail. After additional refinement and analysis, it was concluded that the Plan 18 (also called Denali North) "represented the most favorable solution to both meeting project-related goals and minimizing impacts to the environment and surrounding communities" (Harza-Ebasco 1985). In 1985, a draft environmental impact statement was produced that included a railhead and storage facility at the Cantwell railway station and a new road from the Denali Highway to the Watana site.[2]

3 Access Corridor Identification

Construction projects similar to the proposed Watana Dam require large quantities of construction material. Currently, there is no access to the proposed site, so an access corridor needs to be developed. As there are existing highways and the Alaska Railroad (ARRC) in the vicinity of the dam, both road and rail are considered potential modes of transportation for construction materials. The first step in the corridor identification process was to identify the design criteria for each of these modes.

3.1 Design Criteria

Road. For road access, an assessment of projected traffic volumes (less than 400 average daily traffic [ADT]) and likely vehicles needed during construction (the design vehicle is a WB-120 Double Interstate Semitrailer), resulted in the access roads design criteria listed in Table 3-1. The road is designed for those vehicles needed during construction rather than anticipated future traffic because the design team felt that a road designed for future use (dam support vehicles, recreational traffic, etc) would be insufficient to support construction needs. Public use of the access road is not recommended during the construction of the road or the dam. Some public use

[2] The Draft EIS included additional transportation improvements because that project was also developing a dam at the Devil Canyon site.

of road segments that are already accessible by the public (such as the Denali Highway) will need to be maintained during the project.

Rail. The proposed rail line to the dam site is a single track designed to American Railway Engineering and Maintenance-of-Way Association (AREMA) standards. The maximum grade is 3 percent, which is a compromise between construction costs and train performance. Due to the need to contour around mountainous terrain, small radius curves are used where required. Table 3-1 lists additional rail design criteria.

Table 3-1. Analysis design criteria

Road[a]		Rail	
Surface	All-season gravel	Type	Single track
Width	22 feet	Top embankment width	28 feet
Shoulder	5 feet	Minimum radius curve	574 feet
Overall width	32 feet	Maximum grade	3%
Design speed[b]	20–40 mph[c]	Design speed	25 mph[c]

[a] New alignment. Speed limits on the Denali Highway are not expected to change.
[b] Depending on grade. Refers to speed on new road.
[c] mph = miles per hour

For additional information about the design criteria, please see Appendix A.

For the purposes of this study for routes utilizing road access, it is expected that bulk materials (cement, fuel, reinforcing steel, etc.) and manufactured materials (transformers, power parts, etc.) for the dam will arrive in-state at one of the Ports in Southcentral Alaska and be transported to the project site by rail. Depending on the corridor selected, improvements will be necessary at one of the sidings along the ARRC's mainline tracks. Currently, there are passing sidings at Gold Creek, Chulitna, Hurricane, and Cantwell stations that must remain unobstructed to support ARRC's current operations. Approximately 5,000 feet of new railroad siding is recommended to accommodate the unloading and holding of rail cars until ready for return. Additionally, an approximately 40-acre marshalling/lay down yard for the stockpile and storage of materials brought up on the railroad before transfer to large truck would be necessary.

For the purpose of this study, it is also assumed that establishment of a pioneer road to the dam site within the first construction season is important to the overall project schedule. A pioneer road would not be built to pre-established design criteria. The purpose of the pioneer road is to provide basic access to the dam site by personnel and equipment while the road is under construction.

3.2 Corridor Development Methodology

This section describes the methodology used to develop the corridors considered as part of this study. For the current Watana Transportation Access Study, the project team started with the three road alignments and one rail alignment identified in the Alaska Power Authority *Access Planning Study Supplement, September 1982*. The three road (Plans 13, 16, and 18) and one rail alternatives were digitized using GIS software then imported into AutoCad, where they were adjusted to meet the project's design criteria. The mapping used to lay out the corridors was based on the United States Geological Survey (USGS) 100-foot contour data[3].

Next, the project team reviewed USGS 1:63,360 series maps to identify other viable road corridors that should be studied as part of the current transportation access study. As a result of this review, the Butte Creek (East) corridor was identified.

The level of detail of the existing base data and mapping is generally adequate for a planning level study, but it should be recognized that the centerlines presented in this study are subject to change as additional information about the area is identified. To address this potential variation, the project team delineated a broad corridor around each centerline that reflects the anticipated limits of where the possible centerline alignments would be located as the design progresses. The corridor widths are typically 2 miles (approximately 1 mile each side of the centerline) but vary at certain locations along the routes to reflect areas where the project team determined additional data and study are warranted to more precisely identify the road centerline locations. The corridor boundaries varied due to factors including potential wetland areas, terrain, and proximity to potential transmission lines.

The corridors identified through this process (South Road, South Rail, Hurricane [West], Seattle Creek [North], and Butte Creek [East]) are shown in Figure 3-1 and are described in more detail below.

[3] The 100-foot contours were derived from the 90-meter National Elevation Dataset (NED) raster provided by the Alaska Department of Natural Resources.

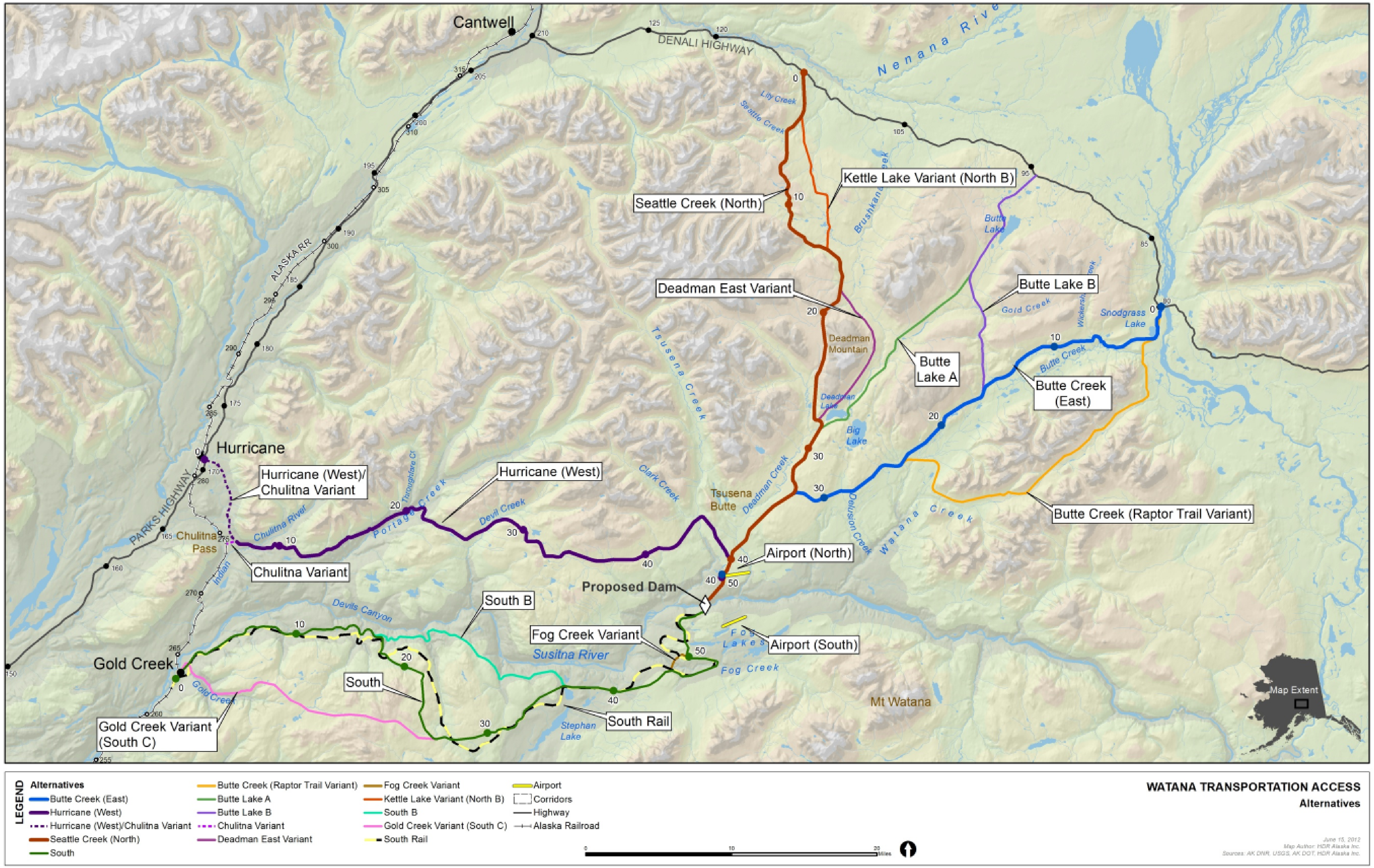

Figure 3-1. Corridors

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3.3 Alternatives[4]

3.3.1 South Road

The South Road corridor is based on Plan 16 from the September 1982 *Access Planning Study Supplement*. The corridor starts at the ARRC Gold Creek Station[5] (ARRC MP 263), adjacent to the Susitna River. This alternative assumes resources (e.g., construction material, workers) are transported to the Gold Creek Station via rail and then transferred onto vehicles. Heading east, the first 16 miles traverses along a moderately steep, north-facing side slope and crosses multiple deeply incised ravines. Near MP 16.5, the alignment heads south to ascend to higher ground to bypass a large, deep ravine located just east of MP 21. When the alignment gets to the headwaters of the ravines at MP 25, the alignment turns northeast toward the dam site.

At 750 feet, the alternative's starting point at the ARRC Gold Creek Station is its lowest elevation. As the corridor travels east, it increases in elevation until it reaches approximately 3,450 feet near the corridor mid-point (between MP 21 and MP 22). From there, the corridor gradually descends to approximately 2,000 feet (the elevation of the south bank of the Susitna River at the dam site). The total length of this alignment is approximately 54.8 miles.

Three variant routings off of this corridor were examined, including the Fog Creek variant, South B variant, and Gold Creek variant (also known as South C).

3.3.1.1 South Road Fog Creek Variant

The South Road Fog Creek variant was developed to shorten the road required to cross Fog Creek. The variant would deviate from the South Road Alignment near MP 44.5, cross Fog Creek, and rejoin the South Road Alignment approximately 5.5 miles later (near MP 50). This variant would be approximately 4.4 miles shorter than the South Road alignment but it would require a bridge approximately 700 feet long. This required construction would substantially increase the cost of this variant by approximately $27 million. A bridge of this size in an area without existing road access would also be very time consuming to construct, and would lengthen the construction schedule. Based on this information, it was decided that the Fog Creek variant was unsuitable and dismissed from further analysis from the South Road corridor.

3.3.1.2 South Road B Variant

The South Road B corridor is a variant of the South Road corridor. The variant was developed in an attempt to shorten the overall corridor length between Gold Creek and the Watana dam site by continuing along the north-facing slope of the Susitna River to a point just north of Stephan Lake. This variant would deviate from the South Road Alignment at MP 15.5, ascend to its maximum elevation of 2,400 feet near MP 25, and rejoin the South Road Alignment 11 miles later at MP 36 just north of Stephan Lake.

The South Road B variant is approximately 4 miles shorter than the South Road alternative. However, the route would require three additional bridges, each with a clear span of 200 to 300 feet. These bridges would increase the cost to build the access route by approximately $32.8 million. For additional information about these bridges, please see Appendix B. The need

[4] Alternative descriptions are based on the proposed centerlines.
[5] A road connection between this location and the Parks Highway was not studied as part of this analysis.

for these two bridges would make it difficult to establish a pioneer road to the Watana dam site in the first construction season and also has the potential to increase the construction schedule. Based on this information, it was decided that the South Road B variant was not suitable and the variant was dismissed from further analysis from the South Road corridor.

3.3.1.3 South Road Corridor—Gold Creek Variant (South C)

Figure 3-2. Example of a steep ravine to be crossed in the Gold Creek variant

This variant was identified because an office review of the terrain in the area indicated that an alignment that ascends the Gold Creek drainage may be possible and would avoid the deeply incised ravines and side-hilling that would be required in the South Road corridor. After ascending Gold Creek valley to its maximum elevation of 3,650 feet (at MP 16), this variant would have fairly level or gently rolling terrain for a substantial portion of the corridor. In the office, using the 100-foot contour topographic map, constructing a road up the Gold Creek drainage appeared to be feasible; however, aerial reconnaissance of this area indicated that a long-span bridge would be required to cross the first major tributary of Gold Creek and rounding the side of the hill where the creek turns east would likely require major rock excavation.

In the upper reaches of Gold Creek, between MP 4 and MP 6, the side slope is scree-covered bedrock, which would make bridge construction extremely challenging. There are several deeply incised gullies with exposed bedrock that would need to be crossed. Additional bridges and major rock excavation would be anticipated to be necessary to traverse the deep gullies (see Figure 3-2). Because the variant would have steeper side slopes, a high probability of extensive rock excavation, the potential for mining claims in the area, and additional costs associated with the extensive and difficult bridges, the South Road alignment was considered a more suitable option and the Gold Creek variant was dismissed from further evaluation as a possible alignment within the corridor.

3.3.2 South Rail

Figure 3-3. West slope above Portage Creek Valley

The South Rail corridor is based on the rail corridor shown in Figures B6, B7, and B8 of the 1982 *Access Planning Study Supplement*. It would leave the ARRC Gold Creek Station (ARRC MP 263) proceeding northeast to start the 17-mile traverse along the north-facing slope of the southern bank of the Susitna River. Twenty miles from Gold Creek Station, the alignment would turn south to ascend the side of a narrow deep ravine. After passing the headwaters of this ravine (near MP 27), the alignment turns east to descend to the lower terrain near Stephan Lake. The terrain between Stephan Lake and the dam site is characterized by rocky hills with lakes, ponds, and wetlands between the hills. The alignment would need to twist and curve around to avoid these lakes, rocky hills, and wetlands.

At the east end of the alignment, where it turns north toward the dam site, the rail line would be routed around to the upper reaches of Fog Creek in order to shorten the length of the bridge needed to span the Fog Creek. North of Fog Creek the alignment snakes around two higher upland areas to reach the dam site.

The rail line was routed using a maximum grade of 3 percent, which is the maximum grade on the ARRC mainline between Seward and Fairbanks. To keep the volume of embankment and excavation, and the length of bridges to a minimum, the shallow 3 percent grade forces the alignment to follow closely the terrain contours. Since it traverses hilly terrain, the alignment curves and twists more than the road alignments, which greatly increases its length. The length of the rail alignment could be shortened by using a 4 percent maximum grade and allowing for higher embankments, deeper excavations, and longer bridges, but that steepness would reduce the potential haul weight and increase operating cost.

At 750 feet, the alternative's starting point at Gold Creek is its lowest elevation. As the alternative travels east, it ascends to a maximum elevation of approximately 3,000 feet between MP 23 and MP 25. From that point, the alternative gradually descends as it continues to travel towards the Watana dam site which has an elevation of 2,000 feet. The total length of this alignment is approximately 60.9 miles.

3.3.3 Hurricane (West)

The Hurricane (West) alternative is based on the North-Access Plan 13 alternative from the September 1982 *Access Planning Study Supplement*. The alternative is approximately 51.7 miles long and is all new construction. The proposed alternative starts on the Parks Highway near Milepost 171, which is across from the ARRC Hurricane station (ARRC MP 282). At 1,750 feet, this is also the lowest point on the alignment. Leaving the Parks Highway, the alternative heads east toward the Talkeetna mountains for 1.3 miles.

Figure 3-4. Steep ravine crossing over to Devil Creek

After reaching the lower slopes of the mountains, it turns southward toward Chulitna Pass where it side-hills around the lower slope of an unnamed mountain to cross Indian Creek at MP 7.8. After crossing Indian Creek, the alternative heads east to enter Portage Creek valley. Here, the alternative cuts along the steep slope on the west side of Portage Creek to Thoroughfare Creek (MP 20.3). After crossing Thoroughfare Creek, the alternative turns to cross Portage Creek (MP 20.5) then ascends a steep gully toward Devil Creek (MP 26.7). After crossing Devil Creek, the alternative ascends to reach higher rolling terrain where it will traverse Tsusena Creek. After crossing Tsusena Creek (MP 44.7), the alternative ascends the bench located just south of Tsusena Butte then proceeds to the dam site.

Of the alignments on the north side of the Susitna River, Hurricane (West) will be the most difficult to construct due to the need to traverse the steep side slopes in Portage Creek valley and to ascend the steep gully located opposite Thoroughfare Creek while leaving the Portage Creek valley. In addition, the contouring around the base of the mountain at Chulitna Pass will be challenging because of this area's steep side slopes and swampy areas. In addition, the railbelt intertie power line is located in this area.

At 1,750 feet, the alternative's starting point at the Parks Highway is its lowest elevation. As the alternative travels east, it ascends to a maximum elevation of approximately 3,250 feet at MP 32.8. From that point, the alternative gradually descends as it continues to travel towards the Watana dam site, which has an elevation of 2,000 feet.

3.3.3.1 Chulitna Variant (Road and Rail)

The two Chulitna variants were developed to use the Chulitna railroad siding because this siding is closer to Anchorage and the proposed dam site. The Chulitna Variant—Rail would start at the Chulitna railroad siding (ARRC MP 274) and would join the Hurricane Alignment near MP 7. An approximately 1-mile access road would connect Chulitna to the Hurricane alignment. This would eliminate the need to build approximately 6 miles of road and would not require any improvements to the Parks Highway. A rail-only access option would restrict the general public's access along the corridor but would provide roadless flexibility for construction and operation of the dam. It would also require more extensive improvements to the siding than an alignment with road access. Based on this information, it was decided that the Chulitna Variant—Rail was less desirable as an access corridor than the Hurricane (West) alignment, and Chulitna Variant—Rail was dismissed as a variant from the corridor.

The Chulitna Variant—Road would use the road from the Hurricane (West) alignment but would use railroad siding at Chulitna (ARRC MP 274) instead of Hurricane (ARRC MP 282). The Chulitna railroad siding would require a similar improvements as the Hurricane siding. However, the increased activity at Chulitna could be considered more disruptive to those living near Chulitna because the area has less existing development than the area around Hurricane. Additional information about the construction logistics would be needed to identify definitively the more suitable location for the rail siding. Consequently, it was decided to keep the Chulitna Variant—Road in the Hurricane (West) corridor for future study if the Hurricane (West) is selected as the preferred access route.

3.3.4 Seattle Creek (North)

The Seattle Creek (North) corridor is based on the Denali-Access Plan 18 alignment identified in the September 1982 *Access Planning Study Supplement*. The corridor starts on the Denali Highway near MP 113.7 (approximately 20 miles east of Cantwell). The corridor heads south for approximately 3 miles. At this point (between the Lily and Seattle Creeks) the corridor splits into western and eastern segments.

The western segment proceeds southward on the western side of Brushkana Creek drainage, crossing Seattle Creek (MP 5.0) and Brushkana Creek (MP 10.9). Then the alignment continues southeast until MP 14.8, where it merges with the eastern segment.

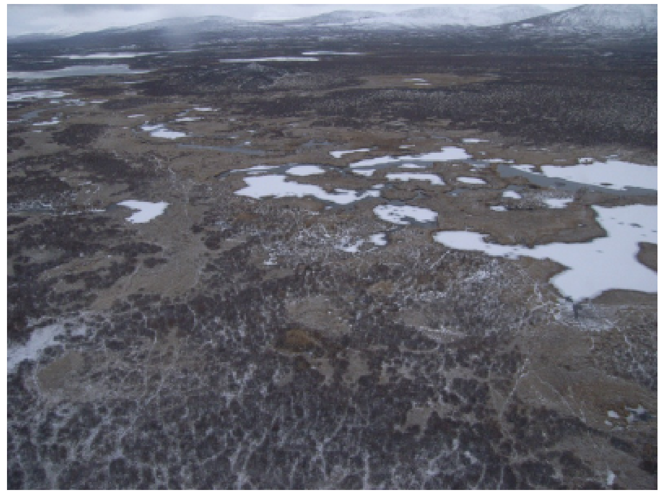

Figure 3-5. Kettle Lake variant

The eastern portion (called the Kettle Lake variant) goes through a group of kettle lakes[6] located in the center of the Brushkana Creek drainage. There is shallow ground water among the kettle lakes, but the ground under this area appears to be thaw stable. Based on the geotechnical reconnaissance of this area, there appears to be a lot of rock rubble in the streams, and water depth in the lakes does not seem to be more than several feet deep at most.

While the Kettle Lake variant is 1.8 miles shorter and is better exposed to the sun, it also appears to be wetter and would likely require additional stream crossings. Additional field work and research would be required to definitively identify the more suitable location for the alignment. Consequently, it was decided to have the alignment use the western segment but keep the Kettle Lake variant in the Seattle Creek (North) corridor for future study if the Seattle Creek (North) corridor is recommended for further study.

At MP 14.8, the corridor runs parallel to Brushkana Creek for a short distance before turning south to ascend up to a higher valley along the western edge of Deadman Mountain. The alignment runs along the lower west flank of Deadman Mountain to stay above the wet soils of the valley floor. Near MP 18.5, the corridor splits into western and eastern segments because the Deadman Mountain area has the highest elevation along the alignment. This elevation may cause snow loading and icing issues for a potential transmission line[7]. The east side of Deadman Mountain, while not as suitable for an access road as the west, would be a viable location if it made economic sense to do so. Additional information is needed before a decision to locate the road on the eastern side of the mountain or to separate the road and

Figure 3-6. Deadman Mountain

[6] Kettle lakes are water-filled depressions left behind after partially buried ice blocks melt.

[7] In an October 25, 2011, meeting with the AEA project team, they indicated they would prefer to locate the transmission line in the same corridor as the road but would prefer to remain under an elevation of 3,000 feet.

transmission line can be made. As a result, the Deadman East variant is included in the Seattle Creek corridor.

Just south of Deadman Mountain (MP 28), the corridor drops down into the Deadman Creek drainage to run along the east side of Deadman Creek, crossing back to the west side of the creek approximately 4.5 miles north of the dam site.

The starting elevation of the corridor at the Denali Highway is approximately 2,700 feet. As the corridor moves south, it ascends to a maximum elevation of approximately 4,100 feet along the west side of Deadman Mountain at MP 20.9. The corridor then descends until it reaches 2,000 feet at the Watana dam site.

The Seattle Creek alignment will require approximately 43.3 miles of new roadway. In addition, 24 miles of the Denali Highway will need to be upgraded. Likely improvements to the Denali Highway appear to be:

- Widening the highway by 8 feet (from 24 feet to 32 feet)
- Approximately 56 culvert replacements
- New bridge structure to replace existing multiple pipe culvert structure
- Additional signage
- Improvement of the Parks Highway/Denali Highway intersection to include a traffic signal and turning lanes[8]

For more information about improvements to the Denali Highway, please see the *Denali Highway Trip Reconnaissance Report* (Appendix C).

3.3.5 Butte Creek (East)

The Butte Creek (East) alignment starts on the Denali Highway in the area near MP 79 (approximately 53 miles east of Cantwell). The alignment travels south for approximately 2.5 miles, following an existing dirt road[9]. Just south of Snodgrass Lake, the alignment heads west to follow the dirt road for approximately 7 miles. From this point, the alignment travels southwest, following the northern side of the Butte Creek Valley crossing Butte Creek (MP 15), Delusion Creek (MP 28.8), and Deadman Creek (MP 37.6). At MP 32.3, the Butte Creek (East) alignment follows the Seattle Creek (North) alignment to the Watana dam site.

The Butte Creek (East) corridor requires approximately 42.5 miles of new roadway, which is the shortest of the alternatives that were considered. However, accessing the corridor requires traveling approximately 53 miles on the Denali Highway, making the dam site approximately 92.8 miles from the Parks Highway. This was the longest of all the corridors. From Hurricane, this alignment takes an additional 80 miles to get to the dam site as compared with the Hurricane (West) alignment.

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[8] Depending on the traffic associated with the operation of the dam, it may be possible to remove the traffic signal and turn lanes after dam construction is complete.
[9] This dirt road appears to provide access to a house/cabin located on Butte Creek.

For the Butte Creek (East) corridor, approximately 53 miles of the Denali Highway will need to be upgraded. Likely improvements to the Denali Highway include:

- Widening 53 miles of the highway by 8 feet (from 24 feet to 32 feet)
- replacement of approximately 116 culverts (including 13 small fish culverts and 1 large fish culvert)
- replacing an existing bridge over Seattle Creek
- replacing a multiple pipe culvert structure with a new bridge structure
- Additional signage
- Improvement of the Parks Highway/Denali Highway intersection to include a traffic signal and turning lanes[10]

For additional information on improvements to the Denali Highway, please see Appendix C.

At the alignment start on the Denali Highway the elevation is 2,500 feet; the highest elevation on the alignment is approximately 3,200 feet along the side of the hill just west of Butte Creek and at a saddle southwest of Big Lake. The north bank of the Susitna River at the dam site has an elevation of 2,000 feet.

3.3.5.1 Butte Creek—Raptor Trail Variant (East—Raptor Trail)

On November 16, 2010, a United States Air Force (USAF) F-22 Raptor crashed in the Watana Creek valley. During March and April 2011, a winter trail was constructed from the Denali Highway to the crash site to recover the wreckage. When the Watana Transportation Access Study began, it was believed that the trail could be used as a potential access route to the Watana dam site. During the aerial reconnaissance flights, project team members discovered that very little of this trail remains and would need to be re-built to be used for the Watana project. During the reconnaissance flights, it was also noted that the alignment should be placed farther toward the center of the Watana Creek valley so the alignment would make better use of flatter terrain. After refining the Watana Creek alignment based on the over-flight, it would make only partial use of the crash-site access trail and previously disturbed grounds are not usable for most of this proposed alternative.

At 100.6 miles (53.5 on Denali Highway and 47.1 of new roadway), the Raptor Trail variant was the longest of all the identified alternatives. Being the furthest from the Parks Highway, this alternative is anticipated to have the longest travel time between the Parks Highway and the Watana dam site. Based on these factors, it was concluded that the Raptor Trail variant was less desirable as an access corridor than the Butte Creek (East) alignment and it was dismissed as a variant from the corridor.

3.3.5.2 Butte Lake Variant (A and B)

Connecting to the Watana dam site through the Butte Lake area was also considered. The Butte Lake A variant intersects the Denali Highway at MP 94.5 to head southwest toward Butte Lake. Between the highway and the lake, the alignment threads through numerous small and large

[10] Depending on the traffic associated with the operation of the dam, it may be possible to remove the traffic signal and turn lanes after dam construction is complete.

ponds. After passing the lake the alignment runs southwest along a fairly wide, broad, level valley to reach Deadman Creek (MP 29); it then travels along the southern side of Deadman Creek until it passes between Deadman Lake and Big Lake. The alignment crosses Deadman Creek twice to skirt around the east side of Deadman Lake, then travels west to connect to the Seattle Creek alignment. From there it traverses the last 20 miles on the same alignment to the dam site.

At the alignment start on the Denali Highway, the elevation is approximately 3,100 feet. The highest elevation on the alignment is approximately 3,500 feet between MP 11 and MP 15; which is between Butte Lake and Deadman Creek. The Butte Lake A variant is approximately 40 miles long, and would require upgrading approximately 40 miles of the Denali Highway.

The first 3.5 miles of this alignment crosses an area with numerous ponds with a high water table. The quality of the subsurface soils around the ponds (near the Denali Highway) is not known and is assumed to be permafrost. The area where the valley is drained by Deadman Creek and the valley leading back to Butte Lake appears to have a high water table and wetlands are prevalent. In order to use drier ground and avoid ponds and oxbow lakes in the area, the alignment crosses Deadman Creek multiple times and would require two bridges. Near Deadman Creek, the alignment crosses another 2.5 miles of soils with a high water table and wetland conditions. Field reconnaissance to confirm soil suitability was not conducted in this area due to poor weather conditions. As a result, it was concluded that the Butte Lake A variant would be kept in the corridor.

Another variant for the Butte Creek (East) corridor was considered. This option, Butte Lake B, departed the Butte Lake A variant southwest of Butte Lake and included a connection to the Butte Creek (East) alternative at approximately the midway point. This option would be 43 miles long. An alignment following Butte Creek may have difficulty in constructing a road in the steep 5-mile portion of the Butte Creek Valley. The valley bottom appears too narrow and active for both the creek and road. In the area where the creek makes a 45-degree bend to the east, the side walls of the valley are too steep for economic road construction due to expected extensive rock excavation. Due to the lack of field reconnaissance in this area, it was determined that the Butte Lake B variant should remain in the corridor.

In summary, the project team started with five corridors. Within these corridors, there were five alignments and multiple variants. Based on existing information about the corridors and aerial reconnaissance, all the variants except five were not reasonable enough to retain in the corridor. The Kettle Lake and Deadman East variants of the Seattle Creek (North) are potential locations for the access road. These variants were included in the Seattle Creek (North) corridor but were not studied in further detail in this report. Chulitna Variant—Road was included in the Hurricane (West) corridor but was not studied in greater detail for this report. Butte Lake A and B variants also were retained in the Butte Creek (East) corridor but were not studied in further detail in this report.

The following five corridors/alignments were advanced into a two-tiered screening process described in Section 5:

- South Road
- South Rail
- Hurricane (West)

- Seattle Creek (North)
- Butte Creek (East)