DESIGN SUMMARY REPORT

ATKA ROADS PROJECT
ATKA, ALASKA

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

PRELIMINARY ENGINEERING REPORT
ATKA ROADS PROJECT

1.0 INTRODUCTION

This report is intended to satisfy the requirements of the required reports for the Feasibility, Hydrology, and Foundation phases of the Bureau of Indian Affairs (BIA), typical transportation project development.

The report summarizes the results of site reconnaissance, surveys, and subsurface explorations, and presents engineering recommendations for design and construction of improvements to existing roads in Atka, Alaska (see Figure 1, Vicinity Map).

Deleted: of a new All Terrain Vehicle (ATV) trail

The work described in this report was performed by the Bureau of Indian Affairs (BIA), Alaska Region Office, Branch of Transportation between 2001 and 2005. BIA chose to design the project internally after the Atka IRA Council (IRA) declined to enter into a self-determination (Public Law 93-638) contract for the project.

1.1. Project Components

Two of the purposes of this report are to 1) determine which proposed project components are feasible and 2) present alternatives for design and construction of the feasible components. Discussions of the feasibility of the components and alternatives are presented later in this report. Based on IRA's resolutions and conversations with the IRA and their project representative, Mr. Fred Elvsaas, we considered the following possible major project components during preparation of this report (see Figure 2):

- Rehabilitation of portions of Atxax Way, the main road between Old Atka and the airport
- Rehabilitation of two roads in the New Atka Subdivision (NAS), Chavichax Lane and Chagix Road.

1.2. Other Upcoming Construction Projects

We understand that Atka has several other engineering projects in various stages of design or construction that include:

- The Alaska Department of Transportation and Public Facilities (ADOT) is designing a new airport that will include a new, longer, realigned airstrip. Depending on the final design, roadways near the airport may need to be abandoned and/or relocated. Currently, we anticipate that the BIA road project will end near a wye south of the airport. ADOT's geotechnical engineering report is referenced later in this report.
- The Alaska Energy Authority (AEA) is funding design and construction of a new hydroelectric system along Chuniisax Creek.
- AEA is also responsible for plans to construct a new bulk fuel storage facility to be located along the inland side of Atxax Way near its intersection with Chavichax Lane.
- AEA will replace the existing diesel generators, which will serve as a backup to the hydroelectric power source.
- HDR Alaska has completed preliminary studies for water and sewer system replacements, the City of Atka has applied for funding, but the schedule is uncertain. BIA initially planned to wait until after completion of the water and sewer project to begin road construction so that new roads would not be subjected to disturbance caused by trenching, etc. However, with the uncertain schedule, BIA is currently not treating the water and sewer project as a major factor in determining when construction will begin. Also, we understand that most road disturbance will occur in Old Atka, outside the road project area.
- McClintock Land Associates performed the ANCSA 14(c) survey and monumentation that is the base of BIA's mapping in Atka. All references made to existing ROW in this report are based on plat maps provided by McClintock.

1.3. Regional Setting

The City and Village of Atka are located on Atka Island in the Andreanof group of the Aleutian Island chain. Atka is approximately 1100 air miles southwest of Anchorage, and 90 air miles east of Adak at approximately:

52.22°N, 174.21°W

Topography

Atka Island is generally mountainous with steep slopes and bays surrounded by cliffs. The northern portion of the project, in the vicinity of the airport, consists of a low, narrow isthmus that separates Korovin and Nazan Bays and connects two mountainous portions of the island to the north and south. The southern portion of the project crosses steep hilly terrain cut by ravines carved by small streams, with occasional shallow ponds and lakes in locally flat areas. Military activity during WWII altered much of the low lying topography on the isthmus and between the airport and Old Atka. It is our understanding that most or all of Atxax Way was constructed by the U.S. Army to replace trails. Bombing by the Japanese resulted in craters that are still visible in the project area today.

Climate

Atka is located in a maritime climatic zone in which winters are relatively mild, and summers are cool. No weather data is available for Atka; the following data are from Adak, approximately 90 miles west of Atka. Recorded temperature extremes for summer and winter are 77°F and 12°F, respectively. February is typically the coldest month with the warmest weather usually occurring in August. Precipitation averages approximately 60 inches annually, with the wettest period between September through November. Snowfall occurs from October through May, with the deepest accumulations in

February and March. We understand that winds combined with rolling topography without trees often result in deep snow drifts that cover roadways and limit mobility.

High winds occur frequently; records at Adak indicate prevailing west-southwest winds at an average of 13 knots. Residents in Atka have reported gusts to over 120 mph during a storm in October 1977 (ADOT, 2003).

The following table presents temperature index values for use at Atka. The ADOT values are based on data from Adak, but the BIA values are based on a subjective evaluation of the trends exhibited by data along the entire Aleutian Chain. In both cases, the calculations were made in accordance with the definitions in the Alaska Environmental Atlas (Hartman et. al., 1978) and weather data reported by the Western Regional Climate Center.

INDEX	ADOT	BIA
Air Freezing Index	1	35
Design Air Freezing Index	77	55
Air Thawing Index	3016	3000
Design Air Thawing Index	3362	3000

Vegetation

In general, the ground surface over most of the project area is predominantly vegetated with grass and moss. The density of vegetation generally decreases with proximity to the beach.

General Geology

ADOT (2003) reports that the area between the Village of Atka and the airport is underlain by bedrock consisting of basaltic to andesitic lava flows with local pyroclastic deposits. Our observations of outcrops and rock

encountered in shallow hand borings indicate that much of the shallow bedrock is scoria that weathers rapidly and can be excavated by ripping with a dozer, or through use of an excavator-mounted impact breaker. Although these materials would make excavation relatively easy, they are easily degraded and, therefore, would make poor roadway surface course aggregate.

Thin layers of soil overlie bedrock over most of the project area. South of approximate Station 45+00, these soils consist of weathered bedrock and interbedded layers of weathered volcanic ash, tuff, and organics. Local poorly drained areas are underlain with thicker, very soft soil layers typically consisting of peat and organic silts. At least some of these areas appear to be shallow ponds and lakes that were gradually filled over time by alternating beds of volcanic ash and organics.

North of approximate Station 45+00, Atxax Way roughly parallels dunes adjacent to the Nazan Bay beach. Between Stations 45+00 and 56+00, a lava flow outcrops as a steep bluff along the left side of the road; at Station 56+00, the bluff diverges from the roadway. In general, Atxax Way north of approximate Station 45+00 is underlain by fill and native soils consisting of recent beach and dune deposits typically consisting of sand and occasional gravel.

It has been reported that the U.S. Army's early attempts at building roads in Atka consisted of stripping away vegetation and constructing embankments using local materials placed directly over the typically soft/loose subgrade soils. Due to the tendency of such roads to sink into the subgrade, the Army later began to leave the vegetative mat in place to reduce settlements. Many of the roads were surfaced with rounded beach gravels that are far more durable than any of the currently available materials (Shannon & Wilson, 1995).

Existing roadway fill materials we observed generally consisted of silty, sandy gravel to silty gravelly sand. The gravels were generally of the native, igneous extrusive and pyroclastic rock types discussed above. As discussed later, none of the material sources that have been identified in recent years contain rock that would typically be considered durable enough for road surfacing. Consequently, we expect that the gravels have degraded resulting in a large percentage of fines. Our observations indicate that the existing roads have not been adequately maintained. In addition to poor grading of the road surface, the primary deficiency is a lack of drainage ditches and other surface water drainage measures.

2.0 PROCEDURES AND RESULTS

Detailed reconnaissance and subsurface explorations for the existing roads were performed by Eric Zeimer, civil engineer, in August 2002. Observations and photographs made during the reconnaissance were presented in a trip report dated February 2003. Additional surveys, explorations, and reconnaissance were preformed in July 2003 in areas of the project that were later deleted. No trip report was prepared for the 2003 field work.
Note that the observations and recommendations included in the Trip Report for the 2002 field work were made before the current right-of-way (ROW) plats were available and may no longer be applicable in light of the actual locations of ROW's. Also note that the stationing referred to in the trip report does not coincide with the stationing referred to in this report. The stationing system referred to in the trip report was based on an approximate system used for reference during reconnaissance. The system utilized in this report is based on preliminary design alignments produced since then (Figure 3).
This section includes portions of the Trip Report (2002); however we have updated the stationing and added more recent observations and discussions of ROW issues.

The following sections break the project into Station-to-Station segments and describe the topography and surface conditions, existing road conditions, right-of-way and adjacent structures, surface water drainage, likely road improvements, subsurface conditions, and other topics as necessary (e.g., soil contamination, utilities, etc.)

2.1. Atxax Way Rehabilitation

This portion of the project was identified by the Atka IRA Council as their highest priority and consists of rehabilitating existing unpaved roads that connect Old Atka with the existing airport. Conditions for construction vary drastically along the approximately 1.1-mile-long route as described below.

In many locations, particularly between the beginning of the project in Old Atka to the Atka Pride Seafoods (APS) plant (approximate Station 46+00) the roadway is at or below the adjacent ground, resulting in poor drainage and weak subgrade. Given the typically narrow ROW between Stations 14+00 and 21+42, improvements such as raising the road grade and constructing ditches and culverts will be limited.

2.1.1. Station 14+00 to 23+25

This section of road climbs from Old Atka to the crest of the hill that separates Old Atka from APS, the New Atka Subdivision, the school, airport, etc. The grade averages 5.8% between Stations 14+00 and 23+25; local grades vary from approximately 0% to 13.3%.

Topography and Surface Conditions

This section of the alignment is located on the south side of the large hill that separates Old Atka from the remainder of the village. Most of the surface is vegetated with grasses, as is typical of Atka.

Existing Road Conditions

As with most of this project, the roadway is generally at or below the adjacent ground, resulting in poor drainage and weak subgrade. Our observations indicate that maintenance activities have been insufficient and, in some instances, inappropriate.

This segment of the route begins at the start of a righthand curve, where the grade begins its climb of the hill. Approximately the first 75 feet of this segment is at an approximate 13.3% grade, the steepest section of roadway on the south side of the hill's summit. The grade begins to flatten as the alignment exits the curve into a tangent section that contours along the south side of the hill between approximate Stations 15+30 and 16+80. In general, the road widens from approximately 13 feet at Station 14+00 to 20 feet at Station 16+80. The road between approximate Stations 16+00 and 17+25 is particularly potholed as shown on photos P2 and P3. As shown in photo P2, in 2002 we observed a wet area in the existing roadway at approximate Station 16+10. Residents reported that the area remained wet or icy all year. Mayor George Dirks reported that the City of Atka had installed some kind of trench subdrain at this location without effect. However, when we returned in 2003, the road surface was dry. In our opinion, the abundance of potholes along the relatively flat section of road between Stations 16+00 and 17+25 is primarily due to a lack of proper surface water drainage measures, as discussed below.

At approximate Station 16+80, the alignment turns left and begins to climb more directly up the hill. Along the adjacent tangent, between approximate Stations 18+50 and 19+70, the road rises at a relatively uniform grade that averages 5.4%. The road continues to widen between Stations 16+80 and 17+20 (approximately 21 feet wide), but then narrows to about 15 feet. At approximate Station 19+25, the road begins to rapidly widen as the road enters a sharp lefthand curve (see below).

Between approximate Stations 19+70 and 20+85, the roadway curves sharply to the left as the road switches back on the hill's south face. The road widens to a maximum of approximately 24 feet around the curve, before narrowing again at the end of the curve. As discussed below, a shop along the inside of the curve significantly decreases sight distance on the curve. A parking area and two small sheds are located on the outside of the curve between approximate Stations 20+00 and 20+50 (see photos P7 through P9).

Upon exiting the switchback curve, the roadway enters a short tangent, then a right hand curve that climb at an approximate average grade of 8.6%.

Between approximate Stations 22+70 and the end of this segment of the route at Station 23+25, the road's grade flattens to about 1% as the road nears the summit of the hill. The road widens to approximately 22 feet.

Right-of-Way and Adjacent Structures

Most of the existing road between Stations 14+00 and 19+25 is outside of the 15-foot-wide ROW on the left, right, or both sides, as shown on Figure 3. As a result, a new road will have to be significantly narrower than the existing road along much of this portion of the road. Also, as discussed below, a good ditch is required along the one or both sides of the road which, considering the adjacent steep slope, will require additional ROW. As shown on Figure 3, there are two houses and an old foundation along the right side of the road in this area. As shown on photo P1, the northwest corner of the house at approximate Station 15+00 is very close to the edge of the road and ROW boundary. Consequently, grade changes will be limited in this area. Also, superelevation of the curve will shed water toward the house and providing measures to properly divert the water within the limited ROW will be challenging.

As the road makes the sharp curve between approximate Stations 19+70 and 20+85 the road widens even further, with both sides of the existing road extending up to 8 feet outside of the ROW. Although not shown on Figure 3, we observed a shop located along the inside of the curve that will limit site distance (photos P7 through P9). Maintenance of access to the shop will restrict grade changes along this section of the roadway.

The ROW widens to 50 feet at approximate Station 21+42, and the existing road is relatively centered within it. It should be possible to construct a road of adequate width, and add a good ditch along the right between here and the end of this road segment (Station 23+25); however a ditch would drain upstation toward the narrower ROW which will not accommodate a similar ditch.

Surface Water Drainage Conditions

Surface water drainage between Stations 14+00 and 23+25 is very poor.

As discussed above, an abundance of potholes was observed along the relatively flat grade between approximate Stations 16+00 and 17+25. In our opinion, the lack of a ditch adequate to drain the large adjacent slope is the primary cause of the exceptionally poor road surface in this area. The flat road grade contributes by allowing water to pond along the edge of the road for prolonged periods, saturating the moisture-sensitive roadbed materials. Along steeper sections, the steep grade allows water to more easily flow despite obstructions, etc. A well maintained, 2-foot-deep ditch draining to the creek at approximate Station 13+60 would likely reduce roadbed instability to an acceptable level. However, the 15-foot-wide ROW will make such a ditch unlikely. As shown on photo P1, superelevation of the curve between approximate Stations 14+00 and 15+30 will direct water toward the right edge of road and the adjacent house. Currently a berm along the edge of road acts

like a curb, directing the water down the steep roadway grade and causing erosion.

As shown on photo P5, there currently is no culvert to carry water flowing along the right side of the road beneath Agisax Rd./Rte. 22 (approximate Station 17+50). Water ponds along the sides of the road and we expect that during storms is forced to flow over Agisax Rd./Rte. 22. Water discharged by a culvert at this location could utilize existing drainages to direct it away from the roadway at approximate Station 16+75, as shown on P4 and P6. Based on observations, we expect that a 24-inch-diameter pipe should be installed here. Water flowing upstation in the lefthand ditch could be conveniently diverted to the same existing drainage by installing a (24-inch-diameter) culvert beneath the roadway near Station 16+75.

Only primitive ditches were observed between Stations 17+50 and 19+75 (both sides). Again, the 15-foot-wide ROW will severely limit construction of adequate ditches.

Between approximate Stations 19+75 and 20+75, superelevation of the sharp curve will likely drain surface water toward the left side of the road. As shown on photos P7 through P9, a shallow swale along the edge of the ROW will probably be required to convey this water to a deeper ditch that would start at about Station 19+75, left and drain upstation.

Likely Road Improvements

Improvements will likely include raising the road grade and installing surface drainage as described above. However, the extent of the improvements between Stations 14+00 and 21+42 will be limited by the narrow ROW. If the spring in the roadway at approximate Station 16+10 becomes active again, or if another one appears elsewhere, subdrainage may be required.

Subsurface Conditions

We performed no subsurface explorations along this segment of the project. However, our observations of the ground surface topography and behavior of the roadway indicated that subsurface conditions encountered during construction should consist of existing fill and volcanic soils, as discussed in Section 1.3. If sufficient ROW becomes available, construction of a ditch as described above will required cutting into the slope along the left side of road between approximate Stations 14+50 and 17+00. As discussed in detail elsewhere in this report, cuts into native soils around Atka are difficult to revegetate and erode when subjected to long-term precipitation and runoff. Therefore, special erosion control measures and revegetation will likely be installed to prevent erosion and slumping of the exposed cut slopes.

Utilities, Contamination, and Miscellaneous

We observed evidence that telephone and/or cable TV lines are buried along the left side of the road, at least between Stations 14+00 and 18+00. Street lights and power to the shop along the curve, approximate Stations 19+75 to 21+00 indicate that power lines are buried on one or both sides of the road and possibly cross beneath the road somewhere in this vicinity.

P1 – Looking upstation at Atxax Way from approximate Station15+25.

P2 – Wet area at approximate Station 16+10. Residents report that in years preceeding the photo, the area was wet or icy all year long. We observed dry conditions in July 2003

P3 – Looking downstation from approximate Station 16+25. Note numerous potholes.

P4 – Looking southwest at existing drainage, approximate Station 16+75, right. This would be a good place to discharge a culvert.

P5 – Looking downstation along right edge of existing roadway from approximate Station 17+30. A culvert is needed to drain water along right side of road, beneath intersection with Agisax Rd.

P6 -- Looking upstation from approximate Station 17+50. Culvert discussed in P21 would discharge into existing drainage on this photo, which drains into existing drainage shown on P4.

P7– Looking upstation from approximate Station 20+00.

P8 – Looking upstation from approximate Station 19+75. Shop is on left, parking area on right.

P9 – Looking upstation at curve, from approximate Station 20+75, right. Shop is on right side of photo, sheds and parking area on left.

P10 – Portion of existing, slumping cut slope that extends between approximate Stations 21+50 and 24+50, right.

2.1.2. Station 23+25 to 30+50

This segment of the project consists of the area of the "summit" of Atxax Way as it crosses over the hill that separates Old Atka from the rest of the village. The segment ends at the intersection of Qayax Road and Atxax Way.

Topography and Surface Conditions

This segment of Atxax Way is located near the top of a large hill. The summit of the route is located in a pass between higher elevations to the east and west, as shown on photo P12. North of the pass, the route skirts the eastern edge of a wet, marshy area and appears to be constructed on shallow sidehill fill as shown on photos P12 through P14.

Existing Road Conditions

This segment of Atxax Way begins on a relatively short tangent that extends to approximate Station 24+25. The average grade along the tangent is only about 1%. Between Stations 23+25 and 24+25, the road widens from approximately 21 feet to 28 feet. This section of roadway was the most badly potholed of any we observed as shown on photo P11.

At approximate Station 24+25, the alignment curves to the right. The mild (1%) uphill grade continues through the curve and into the adjacent tangent as the road narrows to a minimum of about 14 feet at approximate Station 26+50.

The road reaches a maximum elevation on a tangent section at approximate Station 25+40, begins to descend, then negotiates a series of short curves; first to the right, then left, then right again as it skirts the meadow discussed above. The average grade between the summit and the end of this segment is approximately –3.5%, with local grades varying between –2% and –5.9%. The road width between Stations 26+50 and 30+50 varies from 14 feet (Station 26+50) to 22 feet (Station 29+30).

An existing cut slope along the inside of a righthand curve between approximate Stations 30+00 and 32+00 currently limits site distance, especially for southbound vehicles approaching the intersection.

Right-of-Way and Adjacent Structures

The road along this segment is relatively centered within a 50-foot-wide ROW. We expect that this ROW will be sufficient to accommodate raising the road grade and/or construction of drainage ditches and culverts. In some locations where the existing road is wide (e.g., Station 24+25), some narrowing will probably be necessary.

As shown on Figure 3, Atxax intersects non-project roads at approximate Stations 25+00 right and 27+00 left. If the grade of Atxax Way is increased, transitions to these two roads will be necessary.

As discussed above, an existing cut slope along the inside of a righthand curve between approximate Stations 30+00 and 32+00 limits site distance and creates a safety hazard. Widening the cut could be of benefit; however, the top of the existing cut slope is already beyond the ROW boundary so additional excavation will require additional ROW, a slope easement, or a retaining structure.

No structures were observed adjacent to the ROW boundary and no conflicts are expected.

Surface Water Drainage Conditions

Insufficient ditches and culverts combined with relatively high runoff have resulted in very poor surface water drainage conditions along most of this segment of Atxax Way.

The right side of the road along the entire segment is subjected to runoff from a large slope (see photos P12 through P14). Similarly, the left side of the road between approximate Stations 25+00 and 27+00 is

immediately adjacent to a slope that sheds water toward the roadway. The drainage area of this slope is much smaller, however.

A good ditch draining upstation along the right side of Atxax Way from its intersection with the non-project road at approximate Station 25+00 is badly needed. As noted above, the most badly potholed portion of Atxax Way occurs between Stations 23+25 and 24+25. In our opinion, the poor road conditions are primarily due to poor drainage of surface water from the righthand side of the road. This, in turn, is partially due to the flat longitudinal grade, which allows water to pond on and beside the side of the road, saturating the roadbed. As discussed above, narrowing of the ROW at approximate Station 21+42 may prevent extension of the ditch further upstation. Instead, one or more culverts to pass the water beneath the road may be installed. To reduce the volume flowing down the steeper portions of the ditch, additional culverts could be installed between approximate Stations 24+50 and 22+00. Note, however, that discharging culverts onto the steep slope along the left side could result in excessive erosion unless erosion control measures are properly installed and maintained (off of the ROW).

A ditch should also drain upstation along the left side of the road, starting from the crest at about Station 25+40. The easiest way to drain the ditch flow would be to discharge the ditch onto the steep slope near Station 24+50. We expect that, given the short length of ditch and relatively small drainage area, this discharge would not cause excessive erosion. However, following construction, the City should monitor the slope and be prepared to install additional erosion control measures if needed. Another alternative may be to utilize a reverse gradient ditch between approximate Stations 24+75 and the crest of the roadway (Station 25+40) to drain the water northward to tie in with a ditch draining downgrade.

A ditch draining downstation to the intersection of Atxax Way and Aangsux Road/Rte. 5 should be installed regardless of whether or not a

reverse gradient ditch is constructed. A culvert would be needed to carry the water beneath Aangsux Road/Rte. 5 to discharge in a meadow (see photos P12 and P13). The meadow should be left as undisturbed as possible; the water discharged into it should follow natural channels northward, away from the roadway.

We expect that Atxax Way will need to be shifted left to provide adequate room along the right for construction of a ditch between the road at Station 25+00 and the end of this segment (Station 30+50). As discussed below, the subsurface conditions beneath the meadow on the left are not favorable for placing additional fill. Also, widening the ditch along the right may require enlarging the existing cut slope. As shown on photo P13, such cuts would be prone to erosion and slumping and special erosion control measures would probably be required.

Likely Road Improvements

As discussed above, most road improvements will probably be related to the drainage of surface water. The road will probably be elevated and crowned such that water flows off of the road surface instead of ponding on its surface and infiltrating into the roadbed. Ditches that extend a minimum of 1 foot below the adjacent top of subgrade (preferably 2 feet or more) and that will be reasonably easy to maintain should be constructed as discussed in above. In many locations, constructing such ditches will involve excavating and stabilizing cut slope. Similarly, culverts will probably be installed in locations as discussed above.

The cut slope along the inside of the righthand curve between approximate Stations 30+00 and 32+00 limits sight distance. Our survey indicates that the top of the cut already extends outside of the ROW, so widening the cut to improve safety will be limited unless additional ROW or a slope easement can be obtained. A retaining structure could also be utilized; however, we expect that the cost would be prohibitive.

Subsurface Conditions

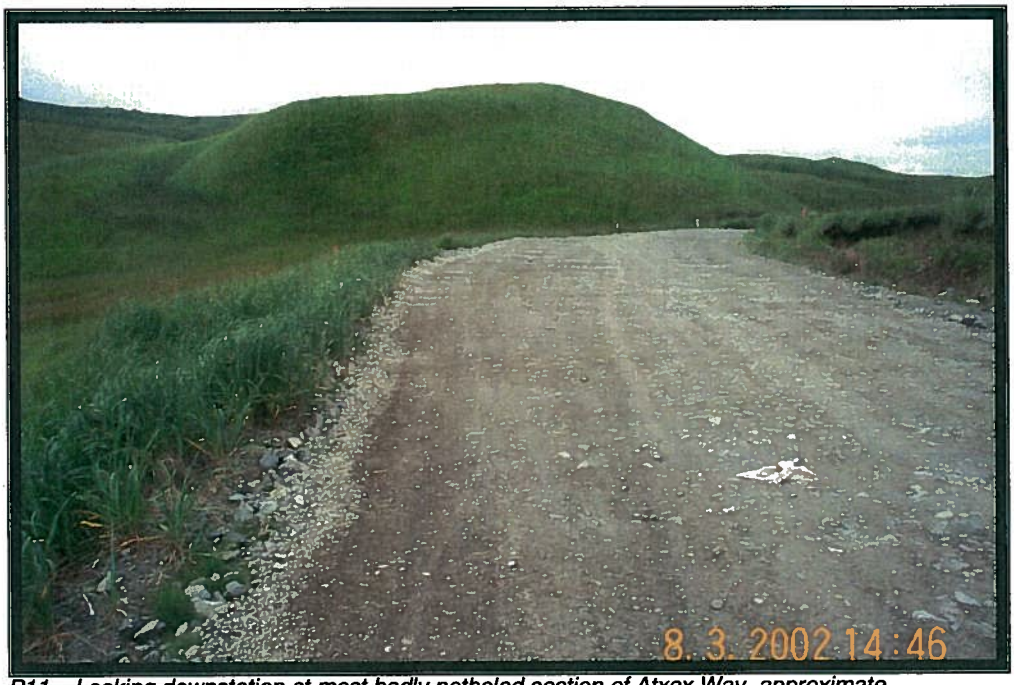
Subsurface explorations completed along this segment of the project consisted of hand boring HB-02-03, drilled in the meadow that extends between approximate Stations 27+50 and 30+50 (see Figure 3).

HB-02-03 encountered an approximately 6-foot-thick surficial layer consisting of very loose, dark brown peat and silt with numerous organics interbedded with layers of very loose, gray sand (volcanic ash). A water table was encountered at approximately 1 foot deep. Beneath this layer, the hand boring penetrated an additional 2 feet but no sample could be obtained due to the high flow of groundwater into the uncased hole and caving of the hole whenever the auger was withdrawn. Based on drilling action, it is our opinion that the material penetrated between approximately 6 and 8 feet deep consisted of very loose sand (volcanic ash?). The portion of the existing road across the edge of the meadow probably settled several feet after construction and additional fill was added to raise the grade. Therefore, we expect that the very loose materials encountered in the hand boring are partially consolidated beneath 3 to 6 feet of granular roadway fill. New fill placed on the meadow would settle similarly unless surcharged prior to construction. Due to the high groundwater table, it would not be practical to excavate and replace the soft native soils to reduce settlement.

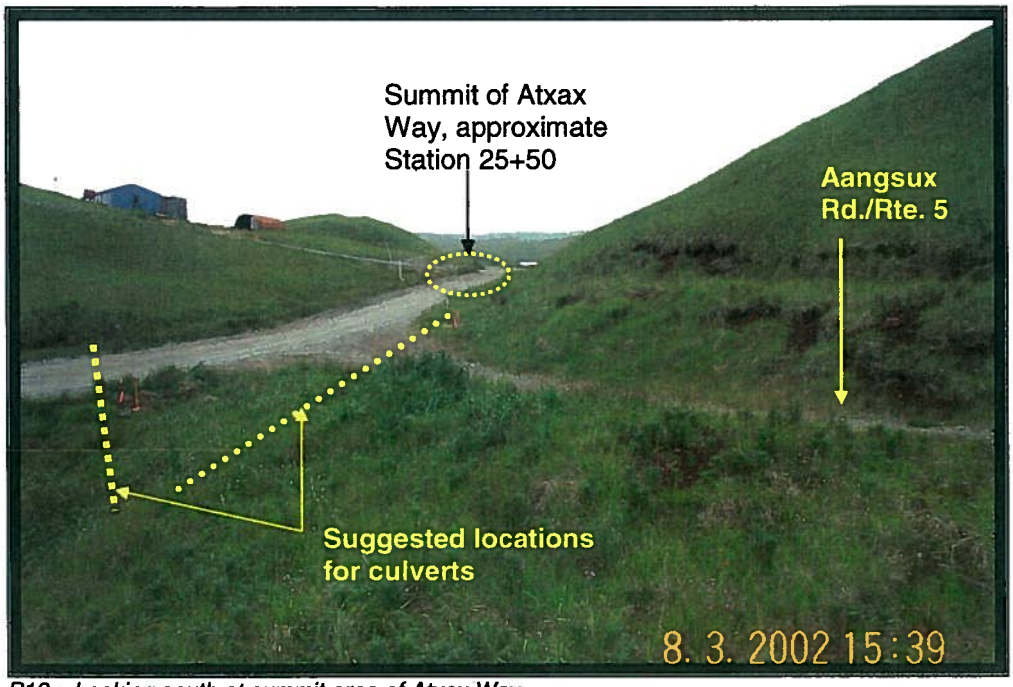
Elsewhere, our observations indicate that the subsurface conditions are probably similar to the typical conditions discussed discussed in Section 1.3. The subsurface conditions observed along the existing cut slope between approximate Stations 30+00 and 32+00 as well as those encountered in subsurface explorations made behind the face of the cut are included in the discussion of conditions for the segment between 30+50 and 41+50.

Utilities, Contamination, and Miscellaneous

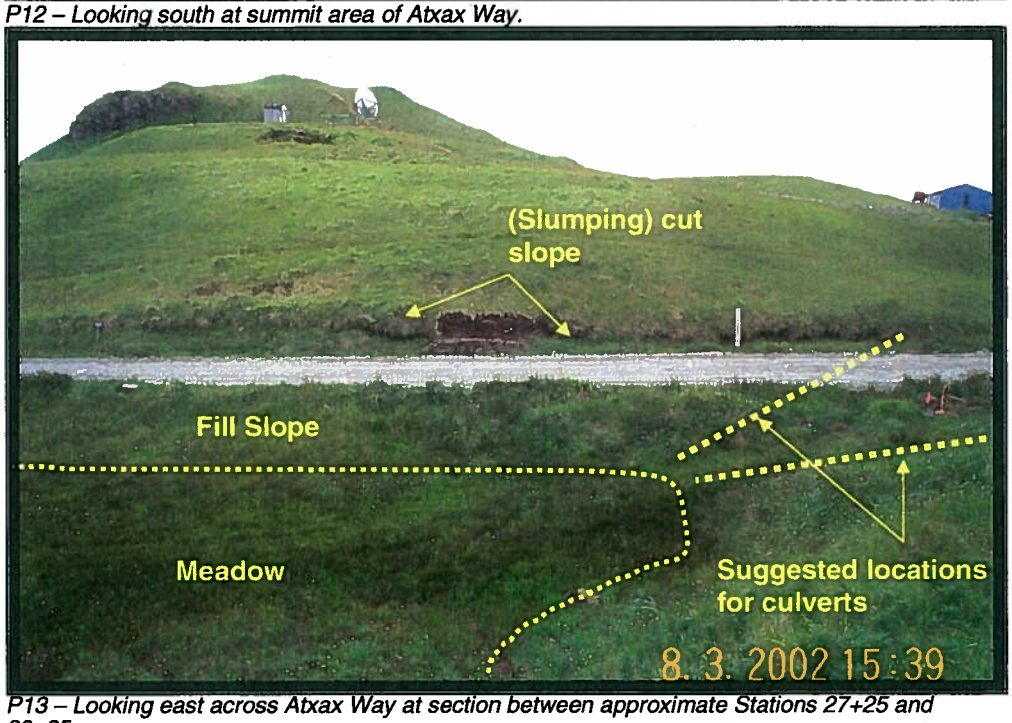
Our observations indicate that utility cables are buried on both sides of the roadway along this segment. It appears that power lines pass from the right to left side of the road near Station 26+00 and that the power lines extend downstation along the left. Cable TV and/or telephone lines also appear to be present along the left side between approximate Stations 25+00 and 30+50.



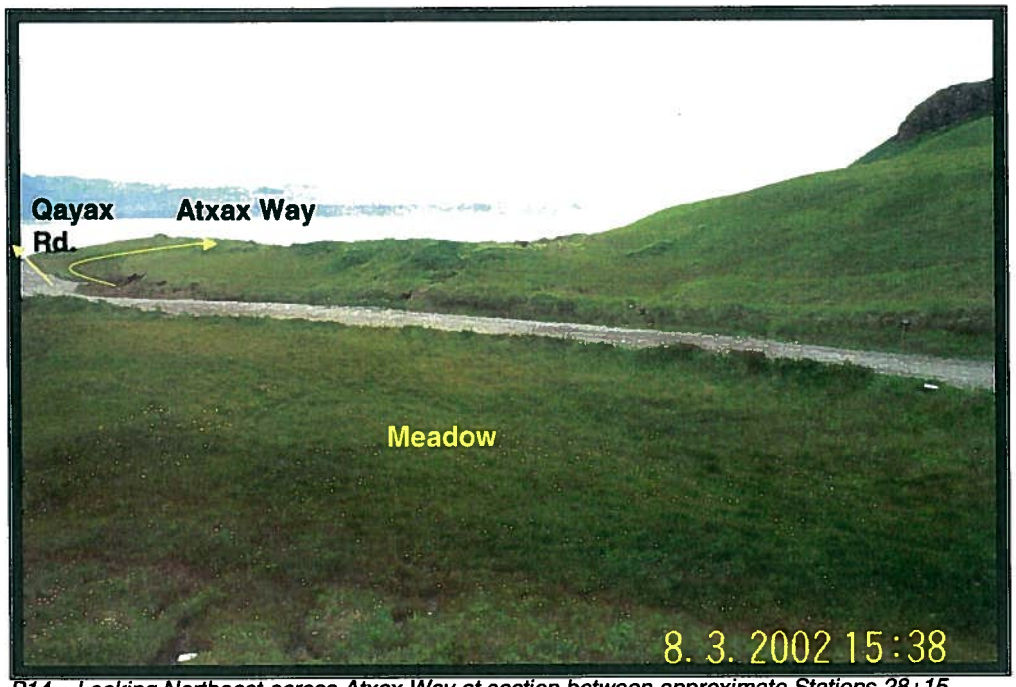
P11 – Looking downstation at most badly potholed section of Atxax Way, approximate Stations 23+25 to 24+25.



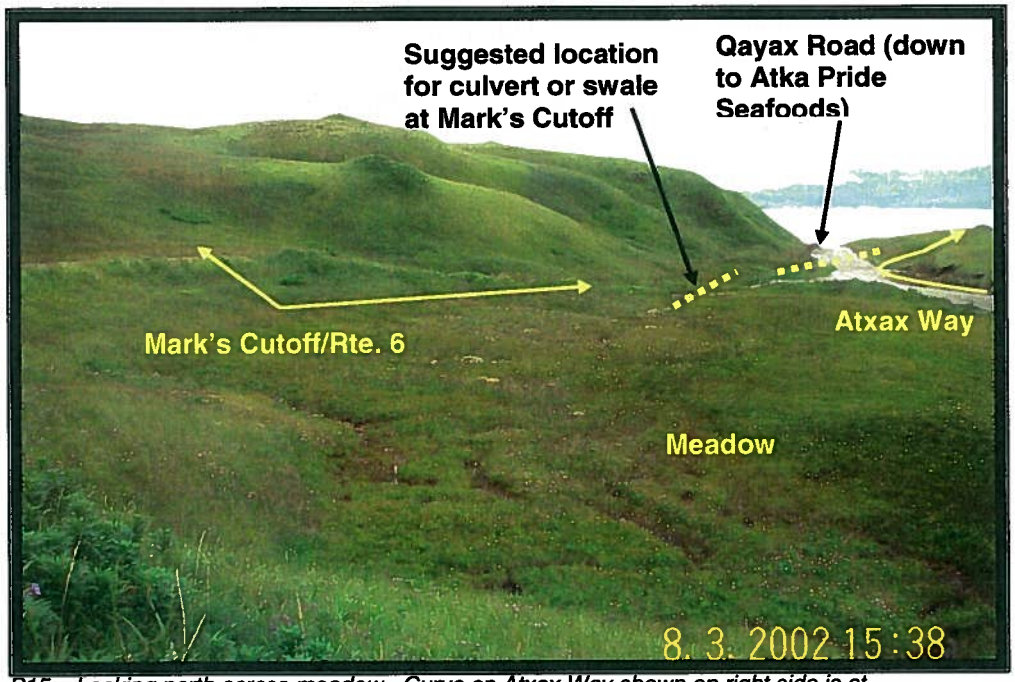
P12 – Looking south at summit area of Atxax Way.



P13 – Looking east across Atxax Way at section between approximate Stations 27+25 and 28+25.



P14 – Looking Northeast across Atxax Way at section between approximate Stations 28+15 and 31+00.



P15 – Looking north across meadow. Curve on Atxax Way shown on right side is at approximate Station 30+50.

2.1.3. Station 30+50 to 41+50

This section of Atxax Way extends from the upper (southern) intersection with Qayax Road down the northern face of the hillside to relatively flat ground. This segment of road ends before the road passes through the APS plant .

Topography and Surface Conditions

Most of this section of Atxax Way descends the large hill that separates Old Atka from the remainder of the village. Slopes extend up from the road along most of the right side of this section with existing cuts in many areas. The most prominent cuts (see photos P16 through P19) are located along the insides of two sharp curves between approximate Stations 30+00 and 34+50.

Most of the left side of the road appears to be supported on low fills supported on flatter, wet ground as shown on photos P20 through P23.

Existing Road Conditions

This segment of Atxax Way begins on a righthand curve. As discussed above, the existing cut slope along the inside of the curve limits sight distance. Similarly, a cut slope along the right side of a curve between approximate Stations 33+00 and 34+50 limits site distance. The road surface in similar condition to the other segments.

Right-of-Way and Adjacent Structures

The ROW is 50 feet wide along this entire segment of roadway and, in general, the existing road is relatively centered within it. Except as noted below, we expect that road improvements can be accomplished within the ROW boundaries, although reinforced fill slopes may be necessary in some areas.

Sight distance along two righthand curves between approximate Stations 30+00 and 34+50 is poor. However, the existing cut slopes already extend over the ROW boundaries in several locations, so modifying them to improve sight distance would require additional ROW, slope easements, or retaining structures.

Surface Water Drainage Conditions

Ditches are required along the righthand side of the roadway. Existing cut slopes will, therefore, need to be enlarged and protected from erosion.

Water draining downstation into this segment in a right hand ditch should be routed along the base of the existing cuts to approximate Station 33+50 where a (24-inch) culvert would divert it beneath the road to an existing major drainage, as shown on photos P18, P19, and P22. Due to the probable difference in elevation between the culvert outlet and the bottom of the drainage, we anticipate that special energy dissipation/erosion control provisions will be required near the culvert outlet.

As shown on photos P18 and P21, an existing culvert beneath the road near Station 35+50 should be replaced (36-inch-diameter). Downstation ditch flow between the culverts at Stations 33+50 and 35+50 should also be diverted through this culvert. In our opinion, no new channel should be constructed at the culvert outlet – the culvert should discharge into an existing, natural drainage system that flows through the adjacent meadow (see photo P21).

Ditch flow along the right side between the culvert at approximate Station 35+50 and 37+75 could be diverted through a cleft in the hillside and drained away from the road as shown on photo P21, if a drainage easement can be obtained. A culvert at this approximate location could also be used to drain water from the left side of the road to the right side for discharge. We expect that a 36-inch-diameter culvert would be adequate. It

may be necessary to excavate a ditch to drain the combined ditch and culvert flows to discharge away from the roadway.

Runoff into the righthand ditch downstation of the proposed diversion channel at Station 37+75 should be diverted to the beach near Station 41+50.

As shown on photos P21 through P23, water discharged by the proposed culverts at approximate Stations 33+50 and 35+50 and runoff from the meadow and surrounding slopes would flow in existing, natural drainages toward the left edge of road at approximate Station 41+50. Due to the large drainage area, we expect that a large culvert (36- to 48-inch-diameter) will be required to drain the combined flow to the beach at Station 41+50 (this culvert would replace an existing culvert constructed of 55-gallon drums). Existing culvert outlets in the vicinity are probably difficult to find because storms bury them with sand and debris. Therefore, we expect that special outlet protection of this culvert will be required.

Likely Road Improvements

We anticipate that road improvements will consist of raising the road grade and construction of surface water drainage improvements as discussed above. If additional ROW or slope easements can be obtained, the existing cut near Station 31+00, right, may be widened to improve sight distance.

Subsurface Conditions

Based on our subsurface explorations and observations, it is our opinion that the roadway forms a crude boundary between two general types of subsurface conditions.

On the right side, the subsurface conditions are those typified by the hilly areas of Atka as represented on the faces of the cut slopes between approximate Stations 30+00 and 34+50 and hand borings HB-02-04, -05, and

–06. The generalized subsurface conditions indicated by our explorations and observations consist of 3.4 to 5.0 feet of medium stiff to stiff, dark brown to reddish brown to black, silt, sandy silt, and silty sand with occasional layers of roots, overlying 0.2 to 1.3 feet of weathered rock that grades to sounder rock. Weathered rock retrieved from our explorations consisted of dense to very dense light brown to gray, silty, sandy gravel to coarse sand and angular gravel. Refusal on sounder bedrock was encountered at 3.7 to 6.3 feet. Although coring of rock was not completed, our observations indicate that they anticipated excavations could be completed by ripping with a large dozer. Although the cuts average 32 degrees from horizontal, it should be noted that such unprotected cuts are subjected to weathering and subsequent erosion and slumping of the vegetative mat, as shown on photos P16 through P19.

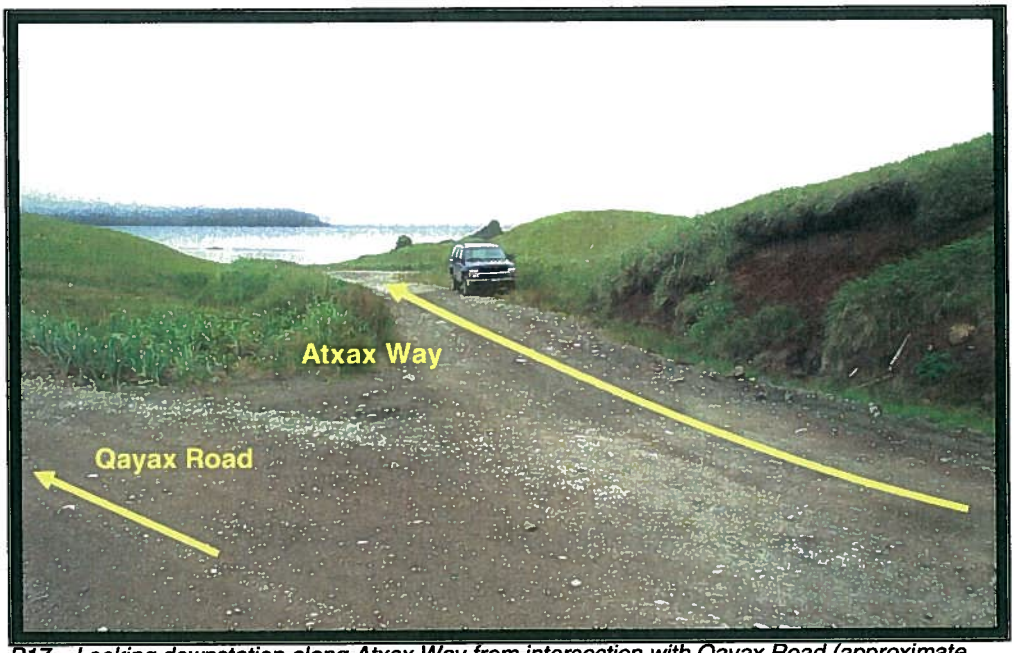
On the left, the subsurface conditions are similar to those found in other wet, marshy areas such as described for approximate Stations Stations 27+50 to 30+50. Hand boring HB-02-07 was completed in this area and generally confirms these conditions. This hand boring was completed approximately 13 feet off of the left side of the road near Station 35+50. The boring penetrated a 1.2 foot-thick surficial layer consisting of soft, dark brown to black, sandy silt to silt; moist with numerous organics. Beneath this surface layer, the exploration encountered a medium dense to dense, dark gray, slightly silty sand similar to the sands commonly found on Atka beaches. In our opinion this layer is road fill. This layer extended from 1.2 feet deep to 2.7 feet deep; a perched water table was encountered at 2.5 feet. From 2.7 to approximately 5 feet, the boring penetrated a layer of very soft, brown, sandy silt to silty sand; wet with abundant roots and organics. Some beds within this layer classify as peat. Caving of the uncased hole, due primarily to groundwater flow into the boring, prevented the boring from being advanced any deeper. In our opinion, this layer was the surface layer prior to placement of road fill. All of the materials encountered in HB-02-07 are poorly suited as foundation for embankments, especially because the ground surface is sloped.

As shown on photo P20, we observed surface features such as a head scarp and toe bulge that indicate past instability on this slope. Due to the high seismicity of the region and the liquefiable soils encountered in our boring, it is possible that this slide was triggered by an earthquake.

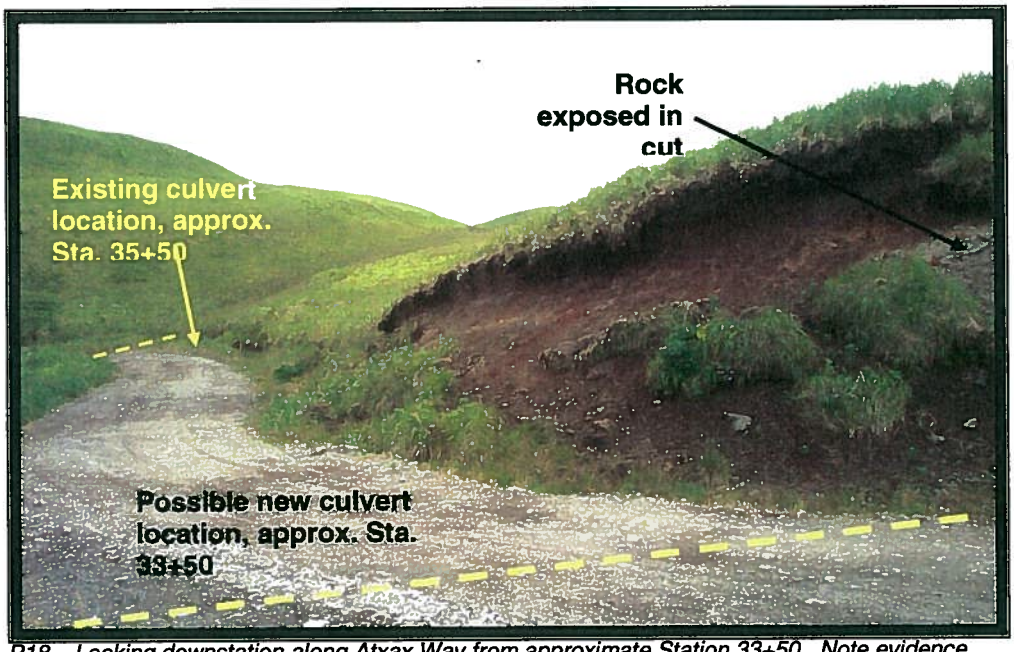
Utilities, Contamination, and Miscellaneous

We observed no evidence of buried utilities or contamination along this segment of the existing roadway ROW.

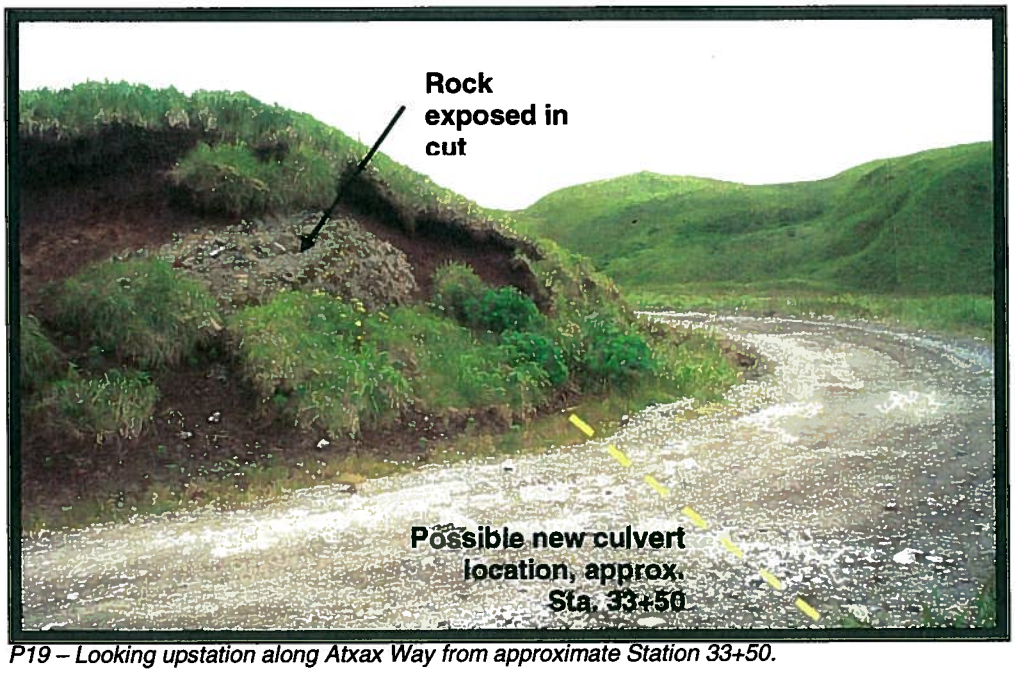
P16 – Looking upstation (southwest) at existing cut slope along right side at intersection of Atxax Way and Qayax Road This cut hinders sight distance. This cut is representative of the conditions observed along cuts throughout Atka: difficult revegetation, erosion, and slumping of vegetative mat.



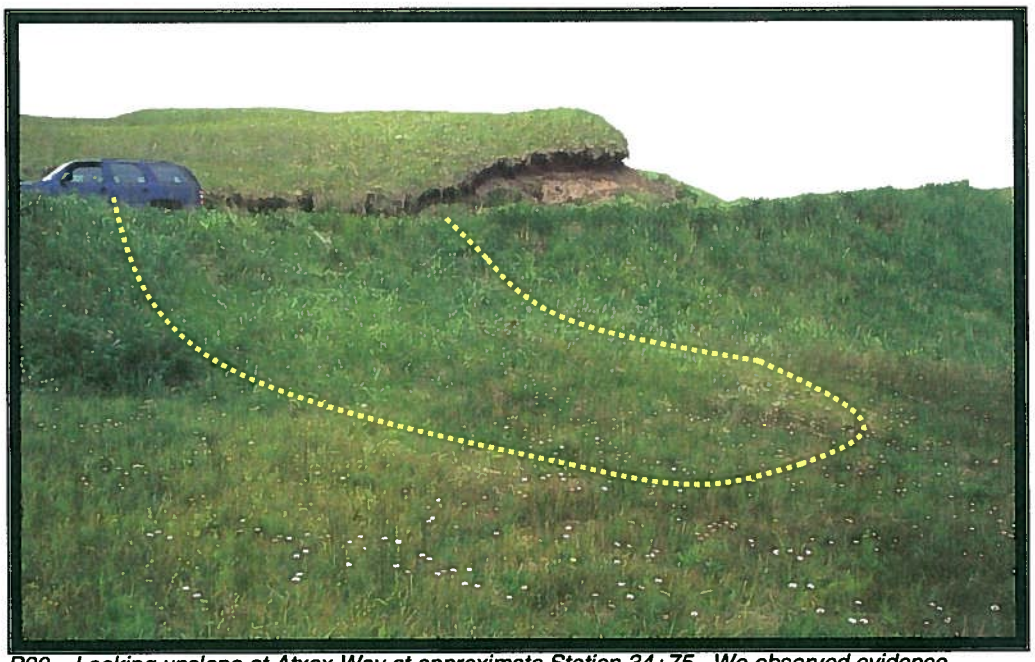
P17 – Looking downstation along Atxax Way from intersection with Qayax Road (approximate Station 30+50).



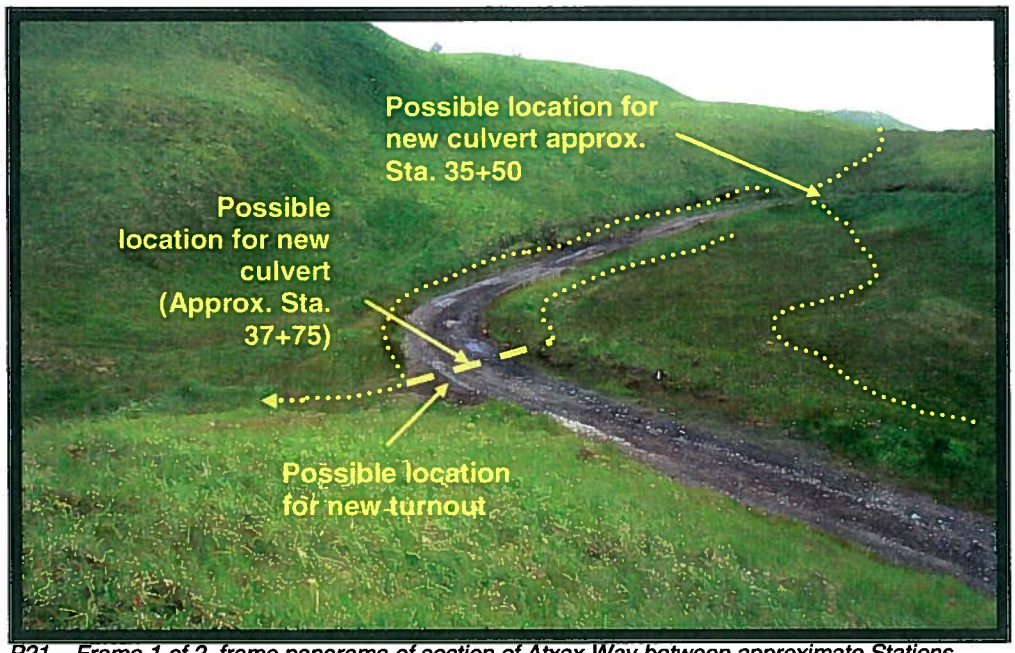
P18 – Looking downstation along Atxax Way from approximate Station 33+50. Note evidence of ongoing slumping of cut.



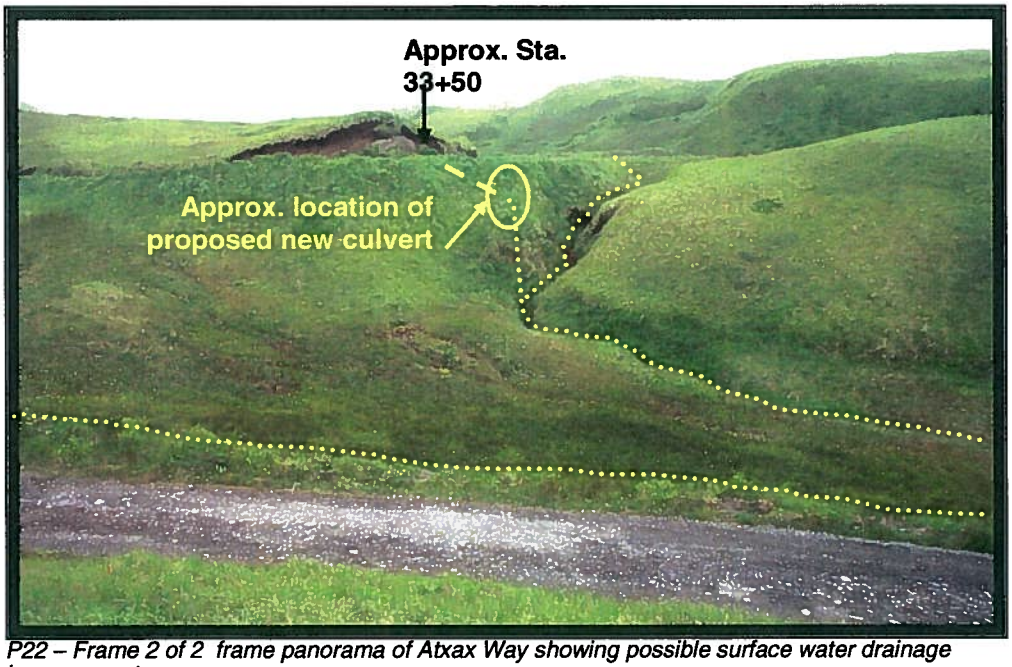
P19 – Looking upstation along Atxax Way from approximate Station 33+50.



P20 – Looking upslope at Atxax Way at approximate Station 34+75. We observed evidence of previous slope instability along approximate line shown. Based on soils encountered in hand boring HB-02-07, it is our opinion that slump may have been caused by liquefaction during an earthquake.

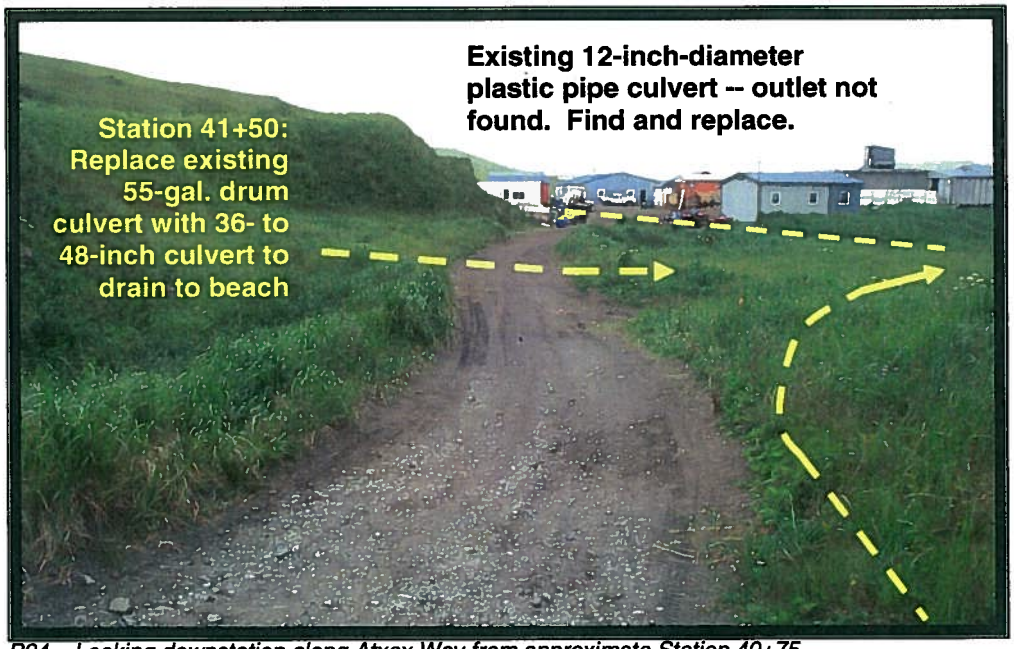


P21 – Frame 1 of 2 frame panorama of section of Atxax Way between approximate Stations 34+00 and 39+00 showing possible surface water drainage improvements. This frame is looking southwest.



P22 – Frame 2 of 2 frame panorama of Atxax Way showing possible surface water drainage improvements.

P23 – Looking downstation along Atxax Way from approximate Station 38+50. Lines on left schematically show natural drainage from meadow converging for discharge by culvert at approximate Station 41+50. Line on right shows proposed ditch that would be diverted to beach near Station 41+50.



P24 – Looking downstation along Atxax Way from approximate Station 40+75.

2.1.4. Station 41+50 to 47+00

This relatively short segment of Atxax Way passes through the APS plant and includes the lower (northern) intersection with Qayax Road.

Topography and Surface Conditions

As shown on photos P25 and P27, this section of Atxax Way generally follows the toe of a slope (left), with the Nazan Bay beach at varying distances to the right. At approximate Station 43+00, the route enters the APS plant. Permanent structures are all along the right side of the road while shipping containers, trailers, and materials storage are located along the left. As shown on photos P25 through P27, the edge of road is not distinct – the road transitions into parking and work areas with no kind of delineation.

Much of the area along this segment of the route has been disturbed by recent development of the APS plant. However, it is our understanding that very little fill was placed during construction of the facility.

Existing Road Conditions

The roadway between the beginning of this segment (Station 41+50) and the APS facility (Station 43+25) is roughly 12 to 14 feet wide and at a very flat grade. As shown on P25, the roadway is generally lower than the adjacent ground surface.

Within the APS facility (Stations 43+25 and 46+25), the road is not delineated from the adjacent parking and work areas, as shown on photos P25 through P27. The grade climbs approximately 3.3 feet between approximate Stations 43+50 and 45+50 (maximum grade of about 1.9%), then begins to gradually descend (-1.6% max.) through the end of this segment.

The road surface material along this segment of Atxax Way was generally sandier than observed elsewhere on the project. It was not evident whether the beach sand was deposited as fill, or by natural processes (e.g., dune formation).

Right-of-Way and Adjacent Structures

Between approximate Stations 41+50 and 44+75, the existing roadway is relatively centered within a 50-foot-wide ROW. At about Station 44+75, the road begins to skew toward the right side of the ROW, with the right edge of road crossing the ROW boundary briefly in the vicinity of Station 45+80. Also, between approximate Stations 45+00 and 46+00 the ROW widens as Atxax Way and Qayax Road intersect. We expect that the ROW will be adequate for construction of the likely road improvements.

As shown on the photographs there are several permanent structures and a number temporary ones along the roadway between approximate Stations 43+25 and 46+25. Our surveys indicate that all of the permanent structures are outside of the ROW, but some temporary structures and shipping containers extend into it.

Surface Water Drainage Conditions

The existing road is generally lower than the adjacent ground. Two crude culverts are located beneath this section of road, but improvements are needed to better drain runoff from the roadway and adjacent slopes.

As discussed in the previous section, a badly deteriorated culvert constructed of 55-gallon drums passes beneath the road at approximate Station 41+50 and will likely be replaced. As shown on photo P25, a pair of approximate 8-inch-diameter plastic pipes drain beneath the road at approximate Stations 43+45. We expect that the existing pipes will continue to

function without replacement, although maintenance to clear the pipes is recommended.

Likely Road Improvements

This section of the road would benefit from raising the grade and a new surface course. However, APS operations require that forklifts and other equipment cross back and forth across the road at various locations between approximate Stations 43+50 and 44+75. Because embankment slopes would interfere with APS operations, the magnitude of grade changes will be limited.

In our opinion, the 50-foot-wide ROW is not sufficient for construction of the roadway and two mildly sloped swales. One alternative for draining the area within the APS facility would be to utilize a uniform cross slope of 2% to 3% all the way from the right ROW boundary to a swale along the left ROW boundary. This swale could then drain upstation (south) toward the culvert inlet near Station 41+50. This alternative would lower the roadway (at centerline) approximately 6 to 12 inches. Therefore, constructing a new surface course would require overexcavation.

Subsurface Conditions

Our only exploration along this segment of road was hand boring HB-02-08, drilled left of the left edge of road near Station 45+50. The location for HB-02-08 was selected to obtain information for potentially shifting the road alignment to the left. The area was wet and several small drainages were observed in the vicinity. The upper 3.9 feet of the boring encountered medium dense to dense, dark gray ("black") fine to medium sand; moist with roots in the upper 6 to 8 inches. Between approximately 3.9 and 4.2 feet deep, the sand was silty and roots were observed. In our opinion, this layer represents a period in which the ground surface elevation was relatively constant. From 4.2 to 8.1 feet deep, the boring penetrated medium dense to dense, dark gray, fine

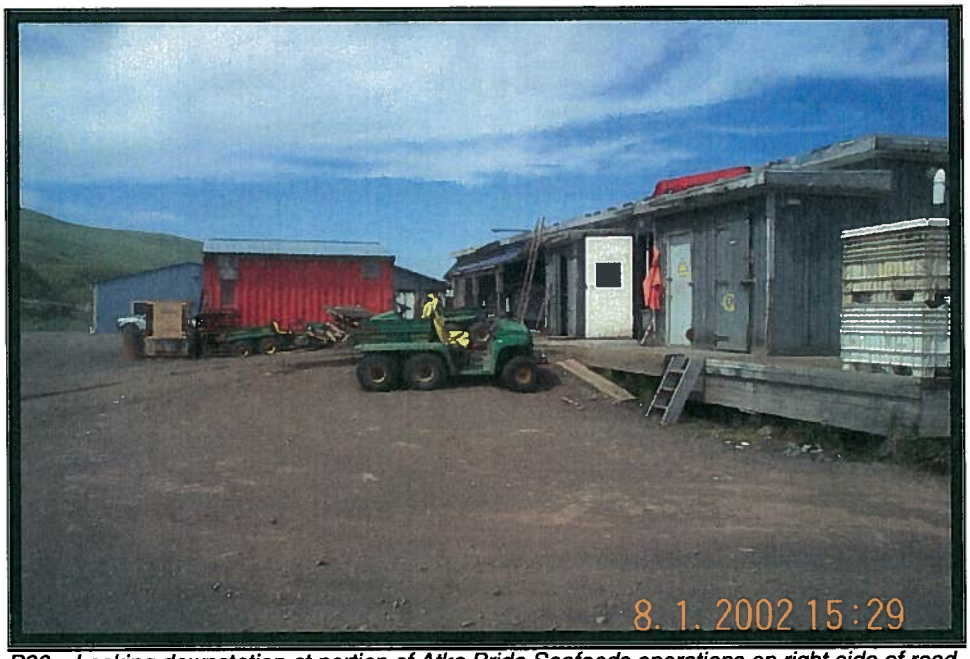
to medium sand; moist with occasional roots and grass. Interestingly, some of the grass as deep as 8 feet was still green. Local residents reported that they had no recollection of fill placed in this area. Despite the proximity of small streams, no groundwater table was encountered in the boring.

Rock outcrops were observed behind (east) the APS buildings and on the steep slope along the left side of the road in the vicinity of 45+50 and 47+00. However, based on our exploration and the relatively shallow excavations that are expected, we anticipate that soils encountered during excavation will consist of dry to moist sands and silty sands with possible layers of roots and organics. Except for organics, the excavated materials should be suitable for use as backfill in trenches excavated for culvert replacements, in our opinion.

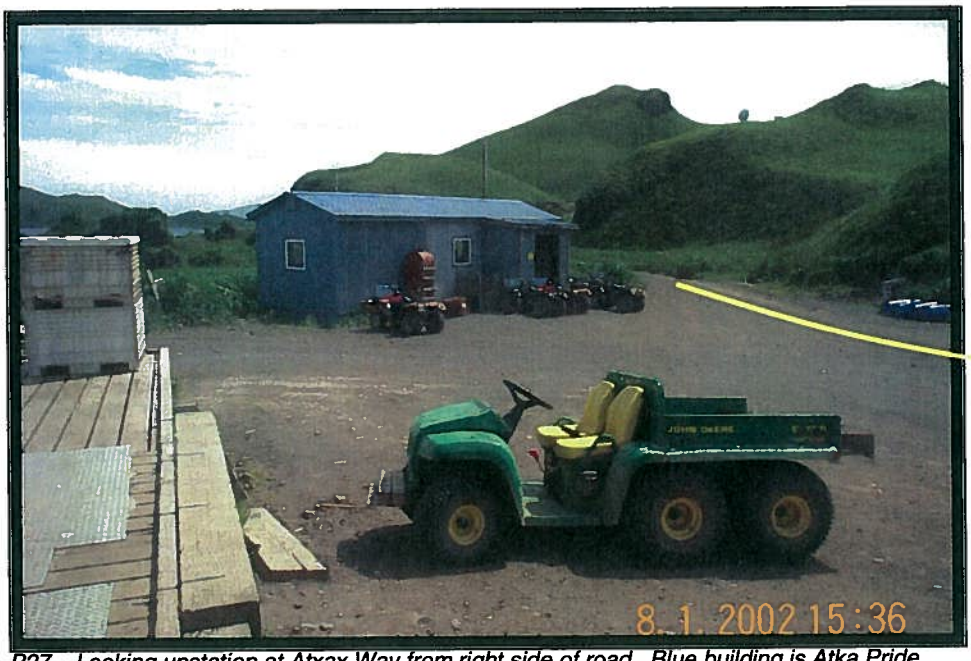
Utilities, Contamination, and Miscellaneous

We expect that power and other utilities are buried beneath and adjacent to the road throughout this segment. As discussed in the previous section, we observed no evidence of buried utilities along Atxax Way between Stations 30+50 and 41+50 and we suspect that utility lines are buried along Qayax Road. Utilites to APS likely cross from Qayax Road between approximate Stations 43+50 and 45+00. Because excavations will probably be limited to less than 1.5 feet of overexcavation, the probability of utility conflicts is low, in our opinion.

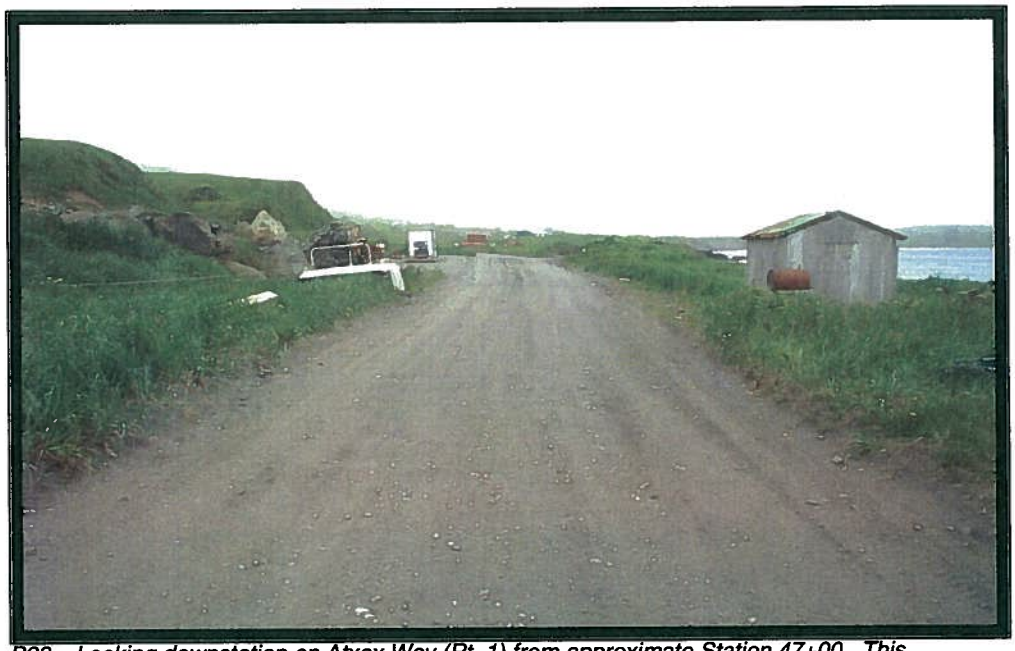
P25 – Looking downstation along Atxax Way through Atka Pride Seafoods. Dashed line shows approximate location of twin plastic culverts



P26 – Looking downstation at portion of Atka Pride Seafoods operations on right side of road.



P27 – Looking upstation at Atxax Way from right side of road. Blue building is Atka Pride Seafoods office which is located at about Station 43+40. Yellow line indicates approximate location of Atxax Way centerline.



P28 – Looking downstation on Atxax Way (Rt. 1) from approximate Station 47+00. This segment of road seemed plenty wide and could accommodate 3- to 4-foot grade increase (including crowning roadway) to facilitate drainage.

2.1.5. Station 47+00 to End of Alignment

This segment of Atxax Way extends from the APS plant to the end of the alignment at approximate Station 72+85. In general, this portion of the project is in better condition than other sections, and there are few adjacent structures to limit road improvements.

Topography and Surface Conditions

This segment of Atxax Way appears to be primarily constructed on sand dune deposits that separate the Nazan Bay beach from a rock bluff. Based on surface features and the World War II era history of the area, it is our opinion that at least the northern portion of this area was disturbed by earthwork operations related to construction of U.S. Army facilities, including an airfield and seaplane base. A series of relatively small streams flow off of the rock bluffs. At some locations culverts convey the streams beneath the roadway; at others water is impounded by the roadway embankment forming small ponds and marshy areas.

Existing Road Conditions

In general, this segment of roadway is wider and in better condition than the portions discussed above. The existing roadway meanders within the 50-foot-wide ROW. In many areas the roadway is below the adjacent ground surface and would benefit from a raised grade to improve drainage.

Between Stations 47+00 and 50+50 the road is nearly tangent, 24 to 25 feet wide, and the grade is nearly horizontal. The roadway is skewed to the right side of the ROW with its right edge almost coincident with the ROW border in the vicinity of Station 48+50. Therefore, raising the road grade will require that the centerline be shifted closer to the center of the ROW.

Between approximate Stations 50+50 and 55+00 the road negotiates a left curve, then a right curve and grades remain very flat. The road width through the curves decreases from approximately 24 feet to as little as 18 feet and the roadway moves closer to the center of the ROW.

Between approximate Stations 55+00 and 58+00, the road gradually shifts into the right side of the ROW, then back to near the center. The road along this segment narrows from approximately 21 feet to 17 feet. Raising the grade could probably be achieved without shifting the road centerline.

Between approximate Stations 58+00 and 59+50, the road rises approximately 6 feet (maximum grade approx. 4.4%). The grade then climbs more gradually with at grades of less than 2%. As the road gradually curves to the right between approximate Stations 58+00 and 63+00, the road shifts to the right side of the ROW with the right edge as close as approximately 3 feet from the ROW boundary. Between Stations 61+00 and 63+00, the road crosses to the left side of the ROW. The road between Stations 58+00 and 59+00 is about 17 feet wide, but the road then begins to gradually widen to 25 feet (approx. Sta. 60+50).

Between approximate Stations 63+00 and 69+50, Atxax Way generally climbs at grades of less than 1.2%. The grade between about 68+75 and 69+50, on the approach to the intersection with Chavichax Lane, steepens locally to approximately 1.7%. Horizontally, the existing road is relatively straight between Stations 63+00 and 69+50. However, the road shifts from the left side of the ROW to slightly right of center. At approximate Station 69+35 (left), Atxax Way intersects Chavichax Lane. On the right side, a trail (no ROW) passes through a gap in the dunes and onto the beach at Nazan Bay.

The road is relatively straight between Stations 69+50 and 72+00, then curves left between Station 72+00 and the end of the alignment. The vertical alignment generally rises as mild grades between approximate Stations 69+50 and the end of the alignment.

Right-of-Way and Adjacent Structures

The ROW along this segment of road is uniformly 50 feet wide. At the time of our reconnaissance, several structures were located along the left side of the road between approximate Stations 58+00 and 66+00, including a City shop building and the Nazan Bay Inn. It is our understanding that AEA will be constructing a fuel tank farm along the left side of the roadway in the same area. If the roadway is elevated relative to its current location, new driveways may be necessary to provide access. We suspect, however, that grade changes will be small enough that a gradual transition/drainage swale between the road and adjacent parking areas will be sufficient.

Surface Water Drainage Conditions

The roadway along this segment is typically below the adjacent ground surface, so surface water is forced to pond and infiltrate the embankment, probably weakening the subgrade. Elevating the roadway 1 foot or more above the existing road surface in combination with appropriate maintenance would alleviate this problem, in our opinion.

Water impounded on the left side of the road drains to the beach at approximate Station 51+62. Our survey did not indicate the presence of a culvert at this location, but based on the flow rate and features observed along the right side of the road, we expect that a culvert is present. All other culverts observed in the area are CMP, so we expect that a culvert at this location is of similar construction.

A 24-inch-diameter CMP culvert passes a small stream beneath the road at approximate Station 57+75. The survey notes indicate two pipes, but photos by McClintock only show a single culvert t this location.

Due to a scarcity of culverts to drain water from the left side of the road to the beach, water is forced to pond behind the embankment in many areas, particularly between approximate Stations 47+00 and 59+00. Because infiltration of this water into the embankment could cause additional subgrade instability, it is not a desirable condition. However, based on the relatively good condition of the existing road, it is our opinion that raising the road grade combined with ditching to speed flow to the existing culverts should be adequate; no additional culverts should be necessary. Also, culverts in this area would need to discharge on the beach and, therefore, would need to be relatively long and would be subject to storm damage.

In many areas, we observed ponded water along the right side of the road. In our opinion, this water collects because the outer dune ridge and the road embankment create drainage basins that have no surface water outlets. Instead, water must infiltrate into the soil, or evaporate. To avoid disturbance of these wet areas and the dunes, and to avoid additional maintenance requirements, we recommend that these areas remain as-is.

The most significant surface water drainage feature in the project limits, the Dancing Creek culvert, crosses beneath this segment of roadway near the end of the alignment (culvert is skewed relative to roadway). The existing 48-inch-diameter CMP culvert was apparently constructed by the U.S. Army during WWII and has badly deteriorated. We observed evidence that the culvert is already collapsing in at least one location and is likely to fail completely in the future. Failure of the culvert would impound water behind the road embankment and inundate a large area. Overtopping of the roadway

embankment would probably cause excessive erosion, making the road impassable. By resolution, the Atka IRA eliminated replacement of the Dancing Creek culvert from the road project. We understand that the City of Atka is currently looking for sources of funding to replace the culvert with a more "fish friendly" crossing.

Likely Road Improvements

Road improvements along this segment of road will likely consist of the surface water drainage improvements discussed above in addition to raising the grade 1 foot or more (including construction of a new surface course).

Subsurface Conditions

Subsurface explorations performed along this segment of roadway include hand borings HB-03-11, -12, and -13, drilled along the estimated alignment of the Dancing Creek culvert. Of these three borings, only HB-03-13 was drilled relatively close to the roadway. This boring encountered approximately 2 inches of loose, dark gray ("black") slightly gravelly sand over medium dense, brown, gravelly silt that extended to approximately 1.2 feet deep. In our opinion, both of these materials are road fill. From 1.2 to 21.1 feet deep the boring encountered a relatively homogeneous layer consisting of medium dense, dark gray ("black") fine to medium sand; moist. Two gravel size pieces of coal were encountered between 3 and 4 feet deep, indicating that at least part of this layer is fill. Note that we estimate that the invert of the Dancing Creek culvert is approximately 17.5 feet below the ground surface near HB-03-13. No groundwater table was observed in the boring, probably because of the material's high permeability.

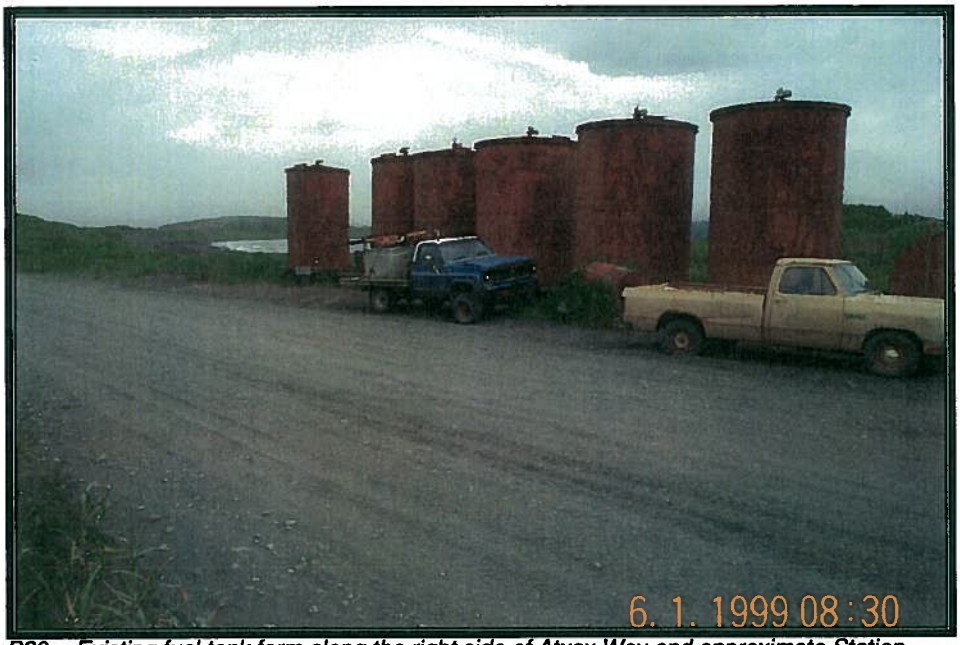
Utilities, Contamination, and Miscellaneous

Six vertical, above-ground, steel fuel tanks in addition to several smaller (empty?) horizontal tanks are located along the right edge of the roadway between approximate Stations 55+50 and 56+50. We understand that these fuel tanks are currently in use but will be replaced as discussed previously. Due to the apparent age of the tanks and the lack of provisions for spill containment and clean-up, we expect that soils beneath the tanks and surrounding area are contaminated with hydrocarbon compounds. However, excavation of the contaminated materials should not be necessary.

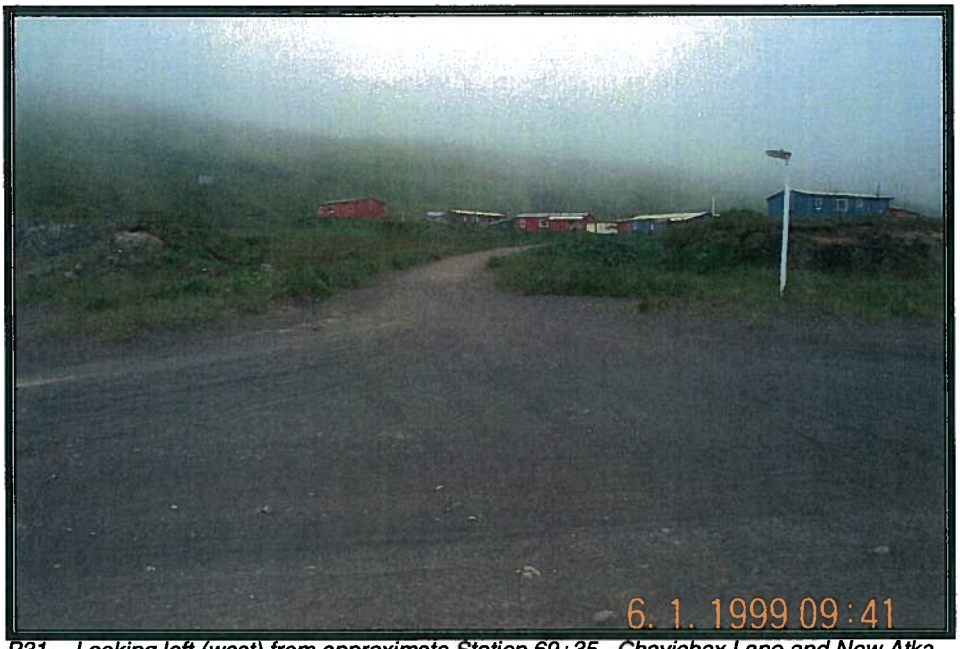
A sanitary sewer line draining the New Atka Subdivision passes beneath Atxax Way at the intersection with Chavichax Lane, approximate Station 69+35. Cuts and fills along this section of the project should be small enough that there will be no impacts on the sewer line.

Based on the locations of light poles and structures, we suspect that electrical power lines are buried along the left side of the existing roadway. Cable TV boxes similarly indicate that lines are buried along the left side of the roadway.

P29 – Looking upstation from approximate Station 55+00. Atka Pride Seafoods visible in background. Date/time shown is not correct.



P30 -- Existing fuel tank farm along the right side of Atxax Way and approximate Station 56+00. Date/time shown are not correct.



P31 -- Looking left (west) from approximate Station 69+35. Chavichax Lane and New Atka Subdivision. Date/time shown is not correct.

2.2. Chavichax Lane/Chagix Road Rehabilitation

These two short dead-end roads serve the New Atka Subdivision (NAS), as shown on Figure 2.

Topography and Site Conditions

As shown on P31, the homes of NAS are located above a steep (lava flow) bluff that rises from relatively flat ground that separates the bluff from the seaward dune. Once above the bluff, the ground continues to slope gently upward toward higher hills to the west.

Existing Road Conditions

Chavichax Lane climbs between its intersections with Atxax Way and Chagix Road at grades of up to approximately 8.5%. The grade continues

to climb, but at decreasing rates as the road enters the housing area. The alignment peaks near the center of a cul-de-sac.

Chavichax Lane varies from approximately 14 to 22 feet wide, although beyond the intersection with Chagix Road, the edges of road are not as distinct – they taper into parking areas that are typically found in front of houses. The road begins at Station 100+00 relatively centered within the ROW, but the edges of the wide intersection extend outside the boundaries. The road then shifts right to within approximately 2 feet of the ROW boundary near Station 102+00. Between approximate Stations 102+00 and 104+00, the existing centerline shifts left with a portion of the intersection with Chagix Road extending outside the left ROW boundary. Between Stations 104+00 and 105+00, the road shifts right again; between 105+00 and the end of the alignment, the centerline is skewed toward the left side of the ROW.

The road surface of Chavichax Lane was relatively poor. Little surface course aggregate was observed and the road surface was potholed.

The general shape of the Chagix Road profile is similar to Chavichax Lane's profile. From the start of the alignment at the intersection with Chavichax Lane (Station 200+00), Chagix Road climbs at grades of approximately 4% to 10% between Stations 200+00 and 202+85, with the maximum grade occurring between approximate Stations 201+80 and 202+20. Between approximate Stations 202+85 and 203+20, the road grade is nearly horizontal. The final 40 feet of the profile consists of an approximately 4-inch-deep swale with 3% slopes.

Chagix Road varies in width from approximately 13 feet (Station 201+25) to 18 feet wide. The final 50 feet widens to approximately 31 feet as an informal cul-de-sac. As noted above, a portion of the intersection of Chagix

Road and Chavichax Lane is outside the left ROW boundary. Between approximate Stations 200+25 and 202+00, the road is relatively centered within the ROW; between Stations 202+00 and 203+00, the alignment is skewed left with the left edge of road coming within 5 feet of the ROW boundary. The right side of the informal cul-de-sac extends outside the ROW approximately 1 foot. However, because the cul-de-sac is informal and the edge of road indistinct, this should not affect design of a new road alignment.

The road surface of Chagix Road was in good condition relative to Chavichax Lane. The aggregate particles were generally larger, which was beneficial to a certain degree. However, we observed cobble-sized particles that made the roadway rougher than necessary.

Right-of-Way and Adjacent Structures

The ROWs for both Chavichax Lane and Chagix Road are both 40 feet wide. As noted above, neither road is centered within the ROW and small portions of the existing road extend outside of the ROW. Based on preliminary design analyses that shift the centerlines to the centers of the ROWs, we expect that a small portion of Chagix Road will extend outside the ROW unless soil improvement technologies or retaining structures are employed.

Surface Water Drainage Conditions

As elsewhere on project, in many areas berms along the edges of the roads and/or depressed road grade trap water on the road, causing saturation and weakening of the subgrade.

Longitudinal grades tend to drain water trapped on road upstation, causing localized erosion of the road surface. Localized low areas along the road apparently do not drain surface water and large puddles are likely formed.

The grades for both roads peaks near the centers of the cul de sacs. Our observations indicate that drainage of these areas will be difficult unless drainage ditches are constructed along the perimeters of the cul de sacs. This would require the construction of driveways and culverts to maintain vehicle access to the houses. The homeowners would have to accept losing the ability to drive onto and off of the road at any location in exchange for improved surface water drainage.

Likely Road Improvements

We expect that improvements to NAS roads will include a new aggregate surface course and drainage improvements. The geometrics may also be modified to better center the roadway in the ROW.

As described above, portions of the existing roads are near or across the ROW boundaries. The Atka IRA Council should consider new horizontal alignments so that the roadways and related slopes and drainage features are within the ROW's. Modification of the road profiles, particularly Chavichax Lane prior to its intersection with Chagix Road, could also be made to flatten the grade. As noted above, our preliminary design analyses indicate that it should be possible to improve road alignment geometry as well as drainage without significant ROW issues.

The NAS roads will likely be resurfaced with crushed rock surface course, as discussed for Atxax Way. Regardless of the degree of geometric and drainage improvements made to the roads, we expect that the roads will include cross-slope and/or crowns to facilitate drainage of water away from the road. In some areas such as the upper portions of Chavichax Lane, it may be necessary to overexcavate existing subgrade soil so changes in grade due to addition of the new surface course does not create problems for adjacent property owners.

As noted above, surface water drainage is poor along both roads, but especially on the upper portions of Chavichax Lane, beyond the intersection with Chagix Road. In this area, drainage will be difficult to achieve due to increasingly flat grade and the existing usage patterns in front of houses. Based on preliminary design analyses, it is our opinion that the only feasible way to significantly improve surface water drainage would be to include drainage ditches all the way around the edge of the cul de sac and down both edges of the road. Due to limited ROW, the ditch may need to have slopes too steep for traversing with vehicles. Instead, driveways and culverts would be needed to maintain vehicle access to the properties. Our observations indicate that trailers, boats, and fishing tackle are often stored around the houses. Locating and sizing driveways should include consultation with the individual homeowners so that they can continue to use their lots as they have in the past. Other alternatives would be to install a storm sewer system, or to route collected surface water to the existing sanitary sewer system. However, we suspect that the sanitary sewer pipe is not large enough to carry the combined sewer flow, and a separate storm sewer system would be too costly to construct and maintain.

Subsurface Conditions

No subsurface explorations were conducted along either road in NAS. Based on exposures along the bluff climbed by Chavichax Way, we expect that bedrock is relatively shallow beyond approximate Station 103+00 and beneath Chagix Road. Materials overlying bedrock likely consist of fill and the volcanic soils typical throughout the project area.

Utilities, Contamination, and Miscellaneous

We observed evidence of the following buried utilities within the road ROW in NAS:

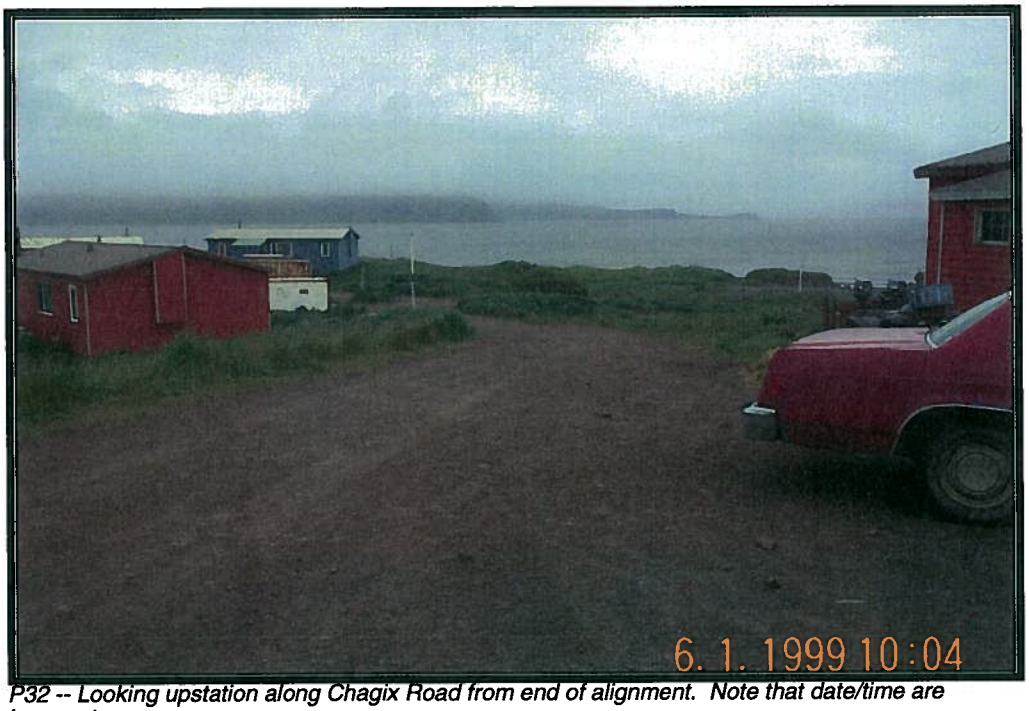
- Water (fire hydrant along edge of ROW, Chavichax Lane cul de sac.
- Cable TV pedestals along right sides of Chavchax Lane and Chagix Road
- Electricity (light poles along right side of both Chavichax Lane and Chagix Road. We expect that all houses are served by buried power lines, so a power line is also likely around Chavichax Lane cul de sac and down left side of Chavichax Lane, at least as far as Chagix Road.
- Sanitary sewer (manholes near intersection of Chavichax Lane and Chagix Road, along right side of Chavichax Lane near Station 103+60, and on the right side of Atxax Way at Station 69+24, 52 ft right.

Based on preliminary design analyses, we anticipate that the deepest excavations would occur in drainage ditches and would be on the order of 3 to 4 feet deep. We expect that power, water, and sewer are buried deeper than these proposed excavations, but telephone and cable TV may be buried shallow enough to require relocation during road construction. All utilities should be located by the construction contractor prior to making any excavations. Note that many areas, such as Chavichax Lane between Stations 101+80 to 103+20, will probably not require the excavation of ditches.

Our surveyor, McClintock Land Assoc., failed to tie in the location of a sanitary sewer manhole along the right side of the Chavichax Lane in the vicinity of Station 103+60; at the time of this report, the location and elevation can only be estimated based on sketches we made during our reconnaissance. We expect that the roadway in this area would need to be shifted approximately 12 feet to the right to center it in the ROW and prevent the left edge of road from extending outside the ROW. Based on our observations, we expect that the manhole would interfere with the road shift --

the existing manhole extends several feet above the existing ground surface and the preliminary design grade. Therefore realignment of this portion of Chavichax Lane will likely require shortening the manhole so that its cover is at or below the proposed new road surface. A review of the sewer design should be made to determine the effects of lowering the manhole elevation.

If possible, we plan to tie in the location of the manhole during a future site visit. Based on McClintock's ANCSA 14(c) plat maps, which shows a sewer easement outside of the right ROW boundary between approximate Stations 101+00 and Station 103+10, we expect that from the manhole (near Station 103+50), the sewer line runs downhill passing below portions of Chavichax Lane and Atxax Way near their intersection. A sewer manhole on the right side of Atxax Way is on an extension of this pipe as it drains toward Nazan Bay.



P32 -- Looking upstation along Chagix Road from end of alignment. Note that date/time are incorrect.

2.3. Existing Materials Site

We recommend the expansion of the existing quarry, along the left side of Atxax Way near Station 50+00 for production of materials for the proposed project. We understand that the subsurface, as part of the Alaska Maritime Wildlife Refuge, is administered by the U.S. Fish and Wildlife Service (USFW) and that a Special Use Permit will be required for excavation of rock. USFW charges $1.50 per cubic yard for excavated materials. A resolution granting access to the site has been obtained from the owner of the surface estate, the village corporation (Atxam).

ADOT & PF conducted investigations of this and alternate materials site, including petrographic analysis of rock samples. These analyses classified the rock as green chloritized andesite with patchy carbonate.

ADOT & PF also performed degradation, L.A. abrasion, and sulfate soundness loss tests on samples collected from the quarry. Although test results indicated that the rock would not satisfy ADOT & PF standard specifications for surface aggregate, they were significantly better than those of the alternate sites. The quarry is also centrally located and thus would result in shorter total haul distance than other potential sites identified by ADOT & PF.

Explorations by ADOT & PF and observation of the existing quarry slopes indicate that bedrock in the area is overlain by 5 to 10 feet of overburden (volcanic ash, etc. as described above)

Because the materials will not meet standard specifications for degradation and no practical alternate materials source is available, we recommend that the degradation parts of the standard specifications be waived for this project. However, it may still be possible to monitor quarry operations to make qualitative assessments of the rock quality. If zones of

weaker rock are encountered, they should either be wasted, or processed into materials other than surface course (e.g., Select Borrow).

We anticipate that following removal of overburden, drilling and blasting will be required to excavate and fracture bedrock. Processing to meet the gradation requirements of Select Borrow, Surface Course Aggregate, and other miscellaneous materials will probably consist of crushing and screening.

For reference, selected portions of the ADOT & PF (2003) report are included in Appendix A.

3.0 FEASIBILITY

The rehabilitation of Atxax Way, Chavichax Lane, and Chagix Road as described in this report should be feasible, in our opinion. The primary obstacles for completing construction will likely be funding and ROW. As described below, the acquisition of additional ROW near the beginning of Atxax Way, and possibly other locations will enable the construction of adequate road prism and surface drainage without resorting to costly structures and/or storm sewer systems. We anticipate that embankment slope reinforcement will be required in some areas so that slopes can be steepened sufficiently to fit within existing ROW.

4.0 DISCUSSION

4.1. Right-of-Way

Surface water drainage is deficient along almost all portions of the existing roads, as discussed in Section 2.0. In most cases raising the road grade, construction of ditches, and installation of culverts are all that would be needed to adequately improve drainage. However, the ROW in many areas is

too narrow to accommodate ditches *and* a road cross section that meets AASHTO geometric design requirements. In these areas, alternatives include obtaining additional ROW and/or constructing portions of the road narrower than specified by AASHTO.

4.2. Road Maintenance

Our observations indicate that the existing roads have not received adequate or appropriate maintenance in the past.

The City of Atka has signed an agreement with BIA to maintain the roads following the construction project. We anticipate that regular required maintenance will include cleaning culverts, cleaning and grading ditches, and grading the roadway to facilitate drainage of water off its surface. The only equipment required to complete the maintenance activities should be a backhoe, a road grader, and a dump truck.

We also observed several "short-cut" trails that intersect project roadways. These trails will tend to block drainage in ditches that they cross. Therefore, the City should consider discouraging the use of such short-cuts.

Although the design should include economically feasible means to minimize maintenance, the City must realize that it will be their responsibility to prevent premature deterioration of the roads. We recommend that the City obtain training (preferably on-site) about properly maintaining the roads and their drainage systems. The BIA Regional Construction and Maintenance Engineer should be contacted for information about training opportunities. The City should also budget adequately for frequent inspections and maintenance activities. Our observations were not made over a long enough period to estimate the frequency and extent of inspections and maintenance, but we recommend that at least 8 to 16 hours per week be used for initial budgeting. Detailed records about the work completed and the required time and

materials would allow the City to adjust future maintenance budgets to better match the typical needs.

Grading should not result in road materials piled along the edge of the roadway. This traps water on the road surface where it can infiltrate (and cause weakening of the subgrade) or, on slopes, erode gullies into the road surface. It also typically places the most expensive material, the surface aggregate, where it is of no benefit.

4.3. Guard Rails

As discussed below, we anticipate that final designs may require steep embankment slopes adjacent to the edge of the traveled way. See the Earthwork Section of this report for discussion

5.0 RECOMMENDATIONS

5.1. Geometric Design Criteria

Geometric design of *new* village roads is typically in accordance with AASHTO Guidelines for Geometric Design of Very Low-Volume Roads (2001). For rehabilitation of existing roads, AASHTO indicates that existing roads need not be widened unless evidence of a site-specific safety problem is observed. During our reconnaissance, the only possible safety issue identified was sight distance near the southern intersection of Atxax Way and Qayax Road, as discussed in Section 2.

Section 2 of this report describes locations at which rehabilitation of existing roads could include realignment. In general, the realignments are proposed to either shift the road into the center of the ROW, or to make difficult sections of the road easier to negotiate (i.e., improve geometric design).

Surface water drainage is very poor along almost all sections of the existing project roads and drainage improvements should be a part of any road rehabilitation project that is designed for Atka. Such work will require installation of culverts and ditches, the sizes of which will depend on whether or not geometric improvements are also made. Based on preliminary design analyses, we anticipate that in some areas it will be necessary to construct roads narrower than existing to accommodate drainage ditches without extending beyond ROW boundaries. Based on our observation of the types of vehicles and traffic, it is our opinion that road width can safely be sacrificed so that good ditches can be constructed. Figure 3 presents recommended typical cross sections based on preliminary designs. These sections will need to be modified during final design to fit ROW and other constraints. Designers should keep in mind that nearly all traffic consists of residents who are familiar with the roads (Atka gets few visitors and is not connected by road to any other community), and most traffic consists of four-wheelers.

5.2. Earthwork

As discussed elsewhere, our observations indicate that cuts steeper than 1H:1V can be made, but weathering of the exposed soils eventually results in weakening and sliding. This process has prevented vegetation from becoming naturally established on most old cut slopes.

We recommend cut slopes of 2H:1V where there is adequate ROW. If necessary, cuts as steep as 1H:1V can be made. Regardless of the slope angle, surface water should be diverted away from cut slopes and cuts should be revegetated during construction. Rolled erosion blankets would be an effective alternative since they are easily installed without specialized equipment, but provide good erosion protection. Note that Atka's high winds would necessitate extra anchorage to prevent erosion blankets from blowing off of slopes.

In our opinion, most native soils likely to be excavated during construction will be unsuitable for reuse as fill. The volcanic soils are typically silty and wet which will make proper compaction very difficult. Materials containing significant quantities of organics, such as typically found in Atka's low, wet areas, should not be used for fill due to their poor strength and settlement characteristics. However, organic soils should be stockpiled for placement in the outer cells of reinforced slopes (see below).

We recommend that embankments be constructed of materials meeting the requirements of FP-03 704.07 (Select Borrow). This material should be relatively insensitive to moisture and, therefore, easy to compact properly. We anticipate that these materials will be produced by crushing and screening rock excavated from the existing rock quarry. Embankments constructed of Select Borrow should be designed with side slopes of 2H:1V or flatter, where possible. If ROW constraints require it, the slopes can be steepened to 1.5H:1V. Steeper slopes should be reinforced as discussed below. Material meeting the gradation requirements for Select Borrow should not be particularly susceptible to erosion due to precipitation or sheet flow. Therefore, erosion protection should be focused on preventing concentrated flows across unprotected embankment slopes.

As noted, embankment slopes steeper than 1.5H:1V should be reinforced to improve stability. We recommend that a cellular confinement system be used to construct steepened slopes. If necessary layers of geosynthetic reinforcement could be incorporated to create a reinforced mass similar to a gravity retaining wall. We recommend that cell infill as well as cell backfill consist of Select Borrow. The outer row of cells of each panel could be backfilled with topsoil and seeded to help camouflage the completed slopes. The manufacturer's recommended methods should be used to design and construct reinforced slopes, but the following are provided for guidance:

Vertical Areal Surcharge: 200 psf

$\varphi = 40°$ (Select Borrow)

$\varphi = 30°$ (Native Soil)

$\delta = 24°$ (friction between Select Borrow and back of cellular confinement panels

$c = 0$ psf (Select Borrow and native soils)

$\gamma = 130$ psf (Select Borrow assuming fully drained conditions)

$\gamma = 115$ psf (native soils)

$a_h = 0.4g$ (horizontal seismic acceleration)

Minimum Width of Cellular Confinement Panels: 4 feet

Subdrainage system installed at back of reinforced zone

Our preliminary analyses indicate global stability design criteria will be satisfied when the width of the reinforced zone is at least 0.5 times that exposed height.

Subdrainage should consist of perforated pipe located at the lower rear edge of the reinforced zone connected to tightlines to direct the collected water out to daylight.

5.3. Culverts

The drainage basins for most of the proposed culverts were beyond the range of our surveys and USGS 7.5-minute maps are not available for Atka. Therefore, hydrologic analyses to size culverts were not completed. The culvert recommendations contained in this report are based on our observations of site conditions and the performance of existing drainage structures. The following table presents our culvert size recommendations. Refer to Section 2 for descriptions of recommended culvert locations.

Note that constraints in lowering ditch grades or raising road grades may result in problems achieving sufficient cover over the pipes. Therefore,

equivalent arch pipes may need to be substituted for the pipe sizes shown in Table 1.

Additional culverts will be required if driveways are constructed. We anticipate that site constraints will necessitate using relatively small diameter (12- to 18-inch diameter) culverts at these locations.

We recommend that all culverts be installed in accordance with the requirements of ADOT & PF Standard Drawing D-01.02 and corresponding Standard Specifications.

TABLE 1 -- RECOMMENDED CULVERT SIZES AND APPROXIMATE LOCATIONS

CULVERT NO.	ROAD	STATION	DIAMETER (IN.)
1	Atxax Way	16+80	24
2	Atxax Way	17+60	24
3	Atxax Way	27+40	24
4	Atxax Way	28+00	24
5	Atxax Way	31+00	24
6	Atxax Way	32+00	36
7	Atxax Way	32+50	24
8	Atxax Way	36+10	36
9	Atxax Way	42+00	36
10	Atxax Way	58+50	36
11	Chagix Road	200+20	24
12	Chavichax Lane	104+30	24

5.4. Permanent Traffic Control

The Manual on Uniform Traffic Control Devices (MUTCD) should be consulted for selection of permanent traffic signs to be placed along the project roadways. However, MUTCD allows the use of judgment in applying its standards. Based on our reconnaissance, it is our opinion that traffic characteristics (e.g., almost all users are very familiar with roads) and maintenance issues justify limited use of traffic signs. The issue of traffic signs should be discussed at public meetings.

5.5. Guard Rails

The steep slopes near the edge of roadways will create a hazard to traffic. In most areas of the U.S., the solution would be the installation of a guard rail. However, experience in remote Alaskan villages indicates that the affects of guard rail installation should be fully discussed with tribal members before designers specify guard rail installation. Some reasons why the tribe may not want guard rails include:

- The City of Atka does not have the resources to properly repair damaged guard rails. Damaged guard rails can be a greater hazard than the steep slopes.
- Guard rails may interfere with snow removal and road grading.
- Injuries sustained by the operator of a four wheeler that collides with a guard rail may be more serious than those sustained by driving down a steep slope.

Installations would require additional width in the very area where ROW width is a problem. This would require steeper slopes. Including taper zones as typically required would likely necessitate extending the length of reinforced slopes significantly. This would add to project costs.

6.0 REFERENCES

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Hartman, C.W. and Johnson, P.R. (1978). *Environmental atlas of Alaska.* 2nd Ed. Fairbanks: University of Alaska.

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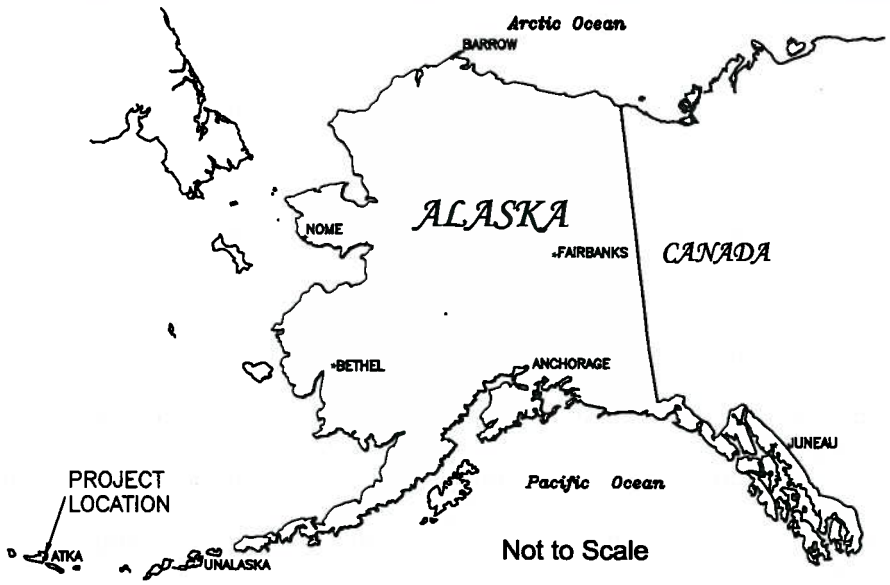
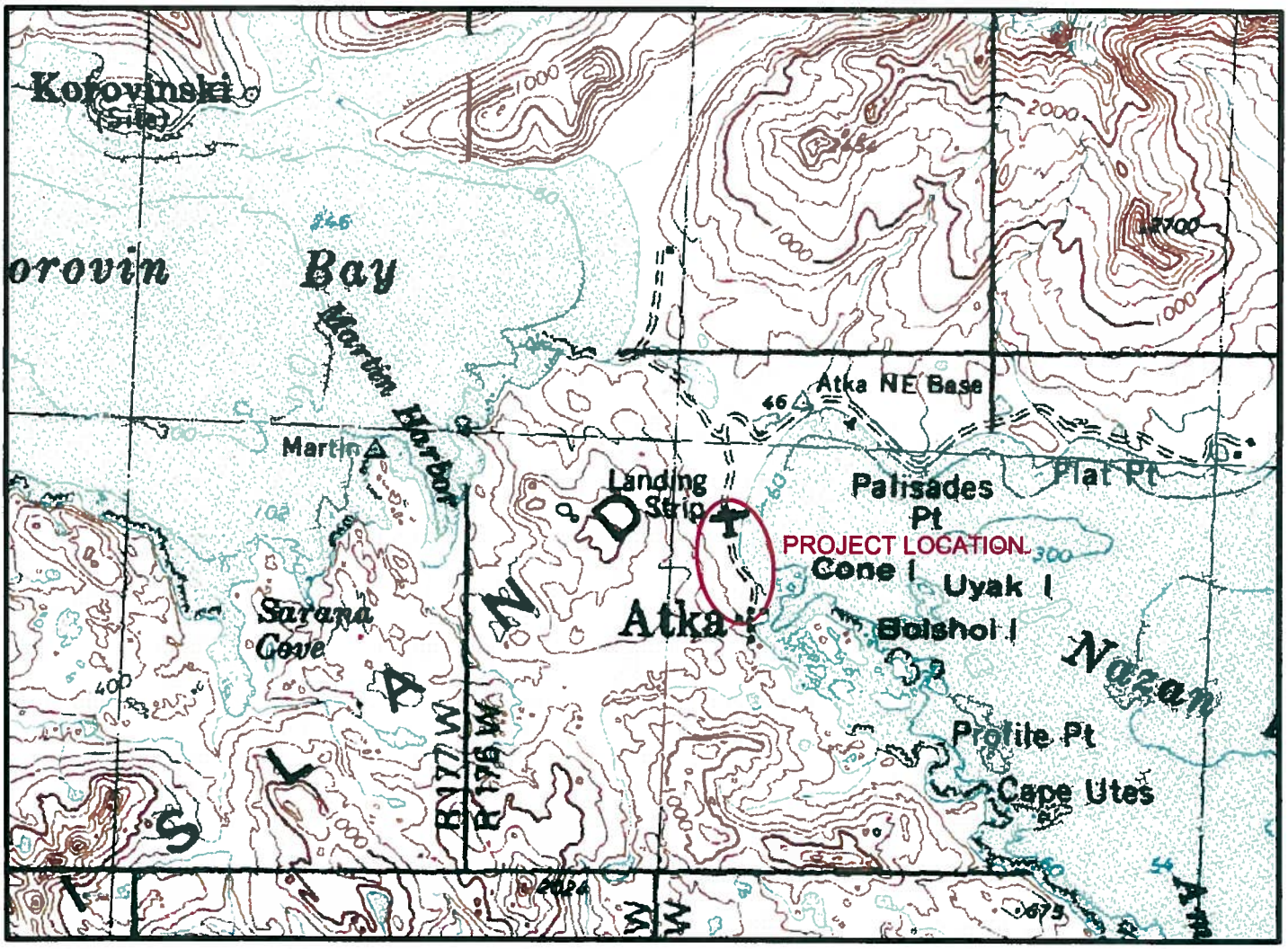
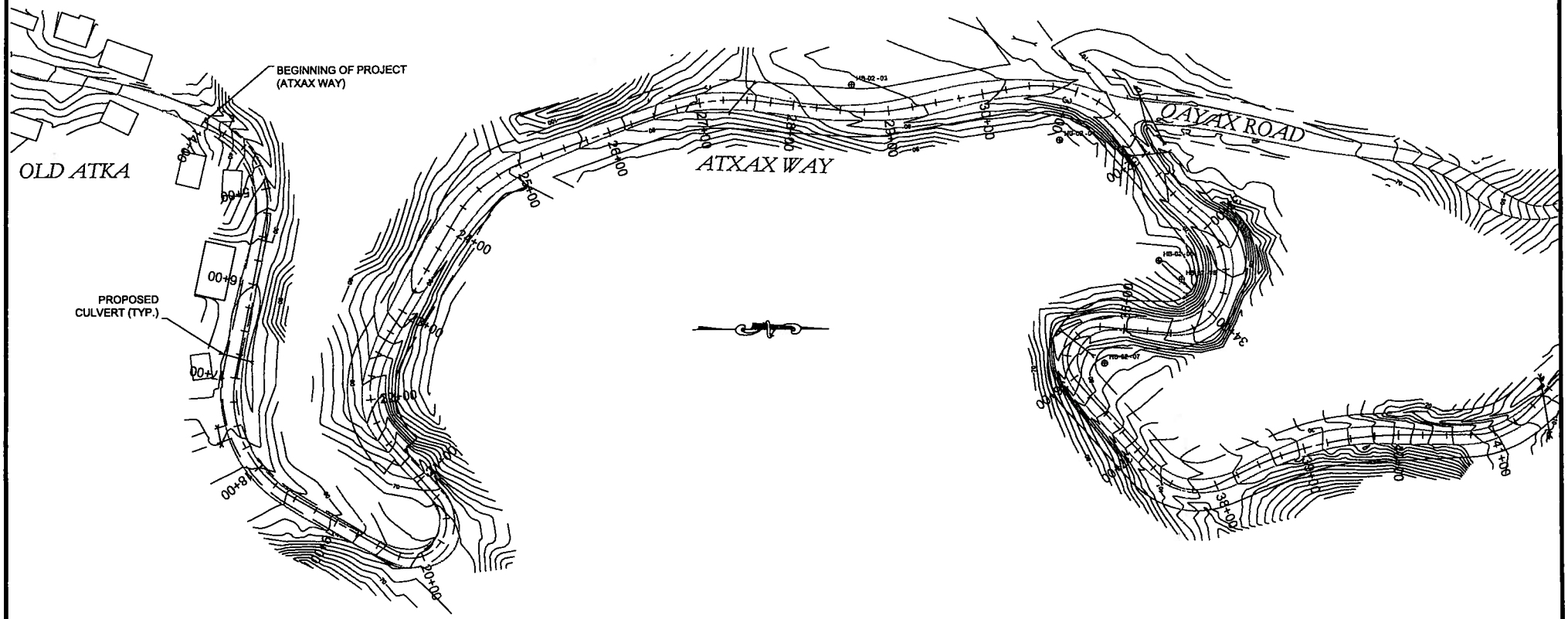




1 inch = 2 miles

VICINITY MAP

United States Department of the Interior Bureau of Indian Affairs Alaska Region Office - Juneau Branch of Transportation	ATKA ROADS
Date: April 2005	BIA Project No. 120
Drawn By: EDZ	Figure 1



PLAN VIEW

SCALE IN FEET
100 0 100

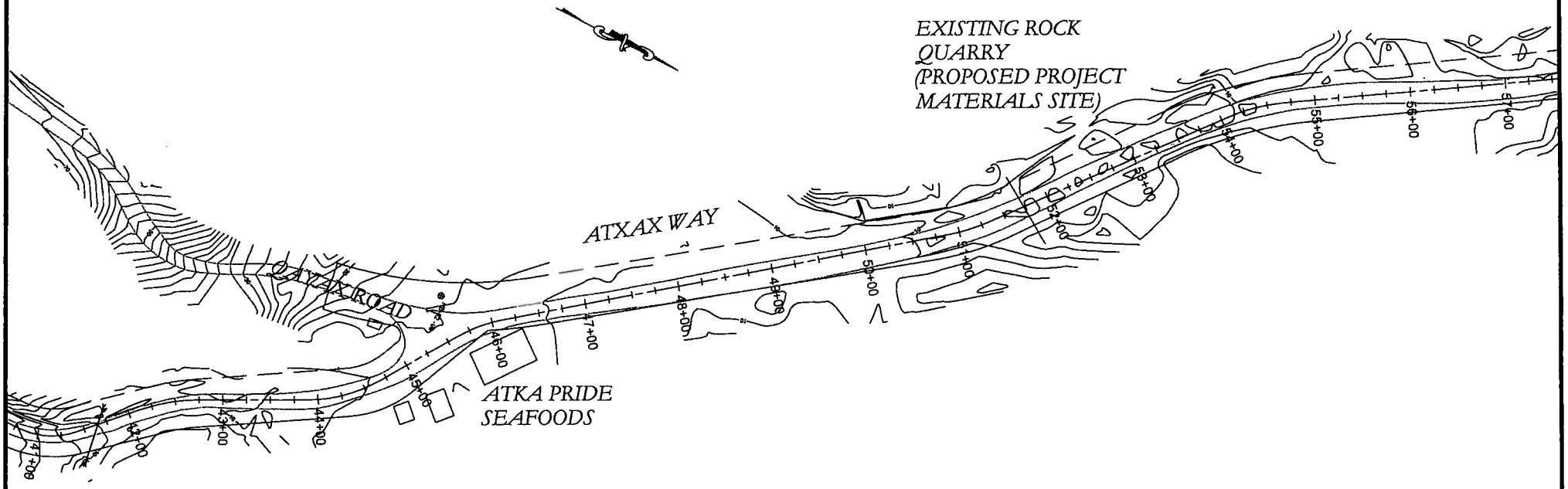
United States Department of the Interior
Bureau of Indian Affairs
Alaska Region Office - Juneau
Branch of Transportation

ATKA ROADS PROJECT	
Date: DEC. 2005	BIA Project No. E0012000
Drawn By: EDZ	Figure 2 (1 of 4)

ERIC ZEIMER, P.E. December 6, 2005

DATA REPORT SITE PLAN

REPORTS\GEOTECHNICAL REPORT\ATKA PLAN FIG 2. DWG



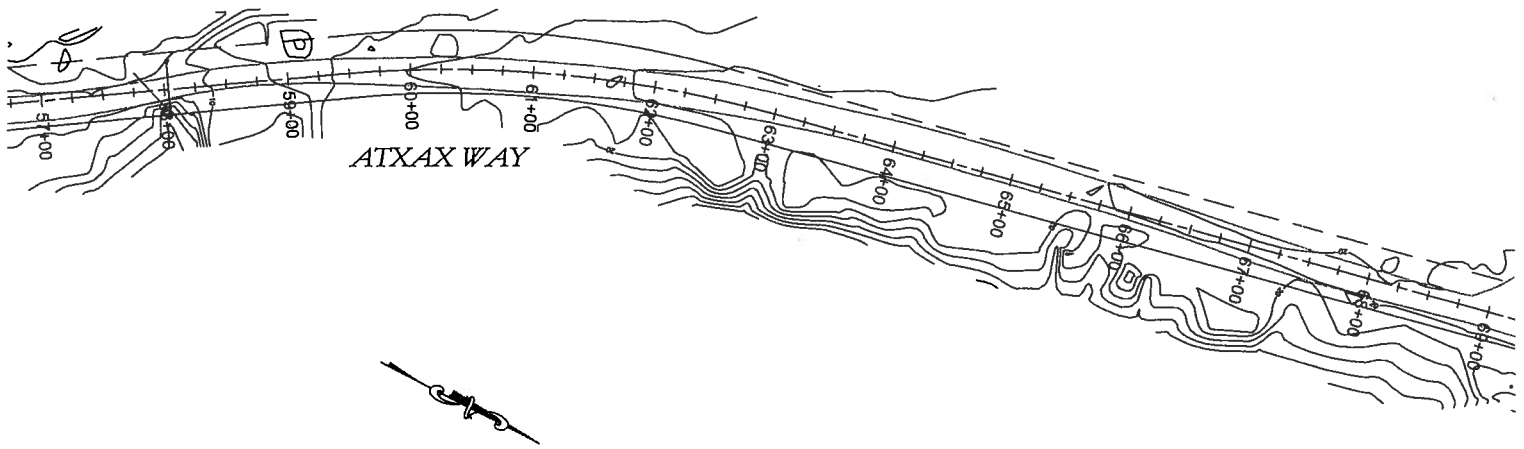
PLAN VIEW

SCALE IN FEET
100 0 100

United States Department of the Interior
Bureau of Indian Affairs
Alaska Region Office - Juneau
Branch of Transportation

ATKA ROADS PROJECT	
Date: DEC. 2005	BIA Project No. E0012000
Drawn By: EDZ	Figure 2 (2 of 4)

DATA REPORT SITE PLAN



PLAN VIEW

SCALE IN FEET
100 0 100

United States Department of the Interior
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ATKA ROADS PROJECT	
Date: DEC. 2005	BIA Project No. E0012000
Drawn By: EDZ	Figure 2 (3 of 4)

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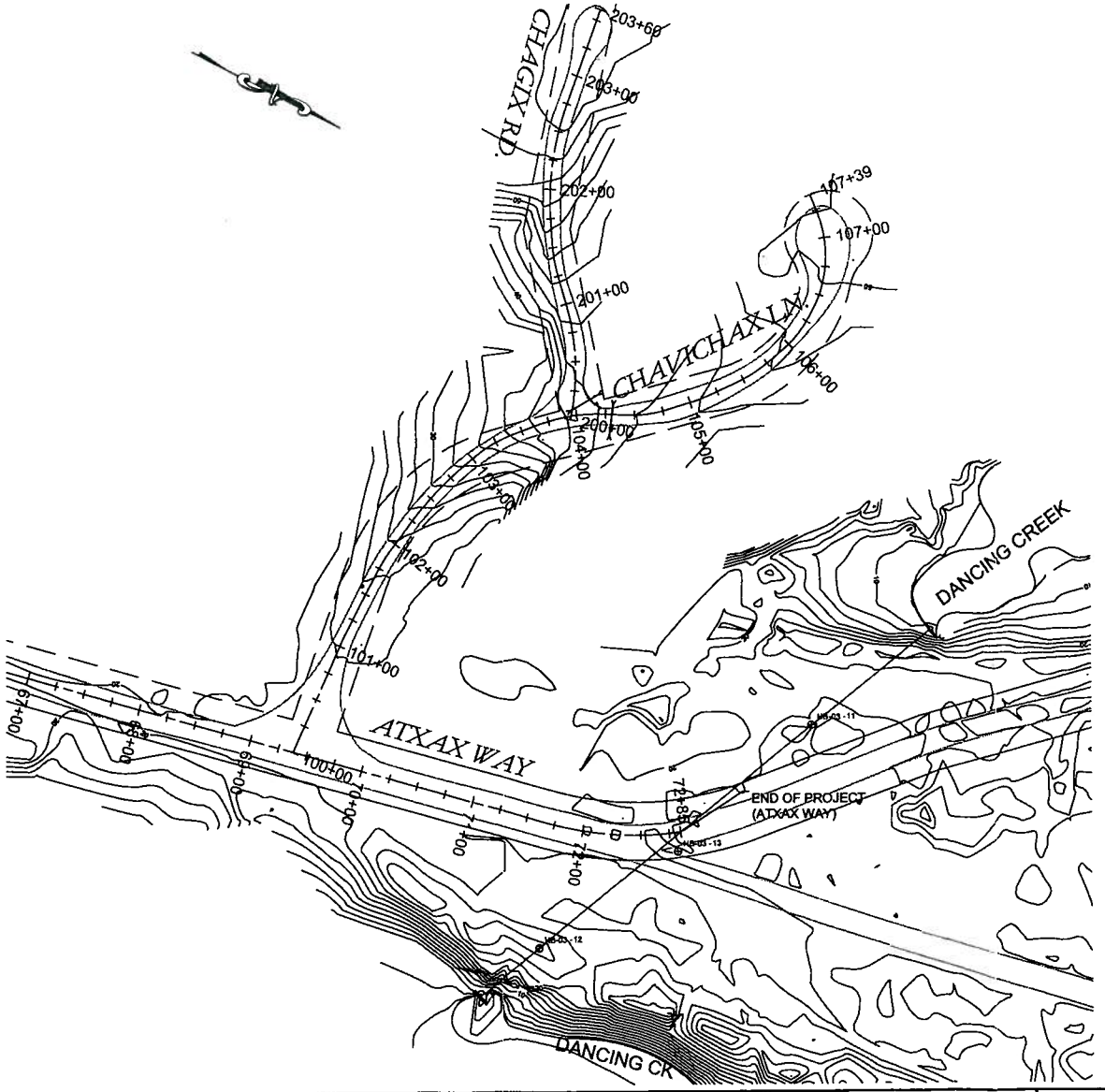

PLAN VIEW

SCALE IN FEET

100 0 100

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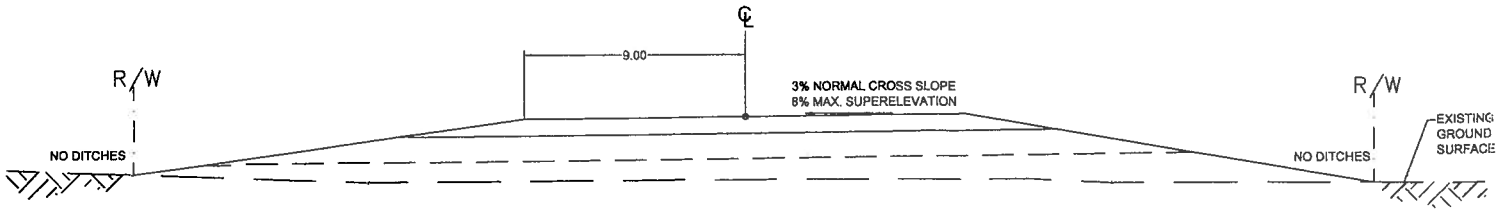
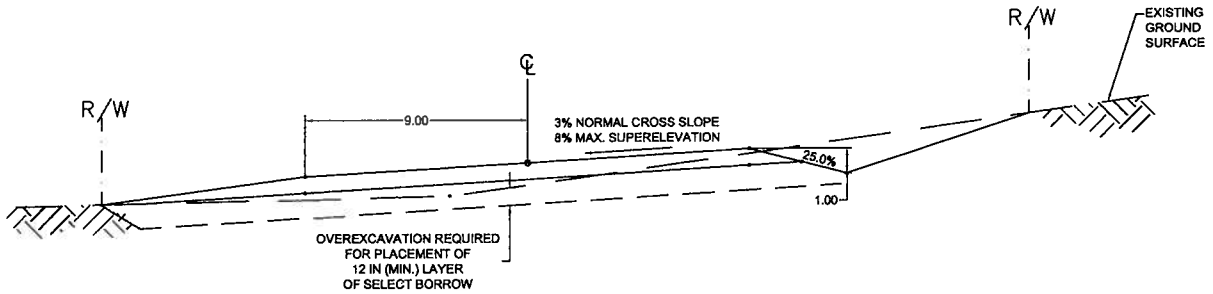
ATKA ROADS PROJECT	
Date: DEC. 2005	BIA Project No. E0012000
Drawn By: EDZ	Figure 2 (4 of 4)

ERIC ZERMER, P.E. December 6, 2005

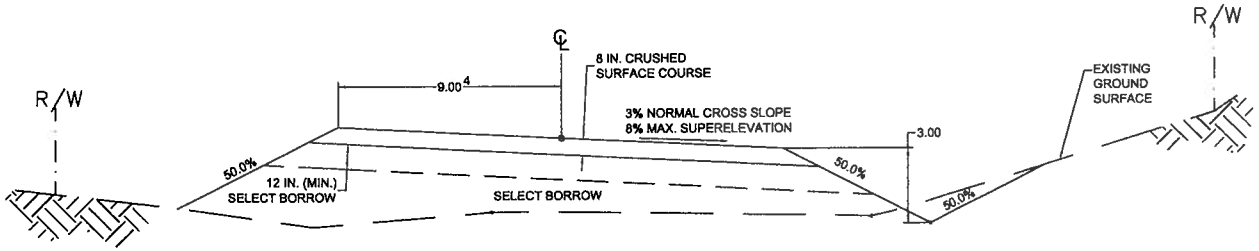
DATA REPORT SITE PLAN



C TYPICAL SECTION – ATXAX WAY
STA. 44+50 TO 46+50 NTS



B TYPICAL SECTION – ATXAX WAY
STA. 19+50 TO 19+90 NTS



A TYPICAL SECTION
ALL ROADS NTS

PROPOSED TYPICAL ROAD SECTIONS

TYPICAL SECTION NOTES

1. AS SHOWN ON SECTION A, THE PROPOSED ROAD PRISM AT ALL LOCATIONS SHOULD CONSIST OF 8 INCHES OF CRUSHED SURFACE COURSE OVER A *MINIMUM* OF 12 INCHES OF SELECT BORROW. SUBEXCAVATION AND REPLACEMENT WILL BE REQUIRED IN SOME LOCATIONS TO MEET THESE LAYER THICKNESS REQUIREMENTS.
2. STATIONING REFERRED TO ON DRAWINGS CORRESPONDS TO STATIONING OF EXISTING ROADS SHOWN ON FIGURE 2. STATIONING FOR PROPOSED ROADS WILL VARY DEPENDING ON DESIGN ALIGNMENTS.
3. EXCEPT AS SPECIFICALLY NOTED, THE REQUIREMENTS SHOWN ON THE CROSS SECTIONS ARE SYMMETRICAL (I.E., THEY APPLY TO BOTH SIDES OF CENTERLINE).
4. NORMAL CROSS SLOPE SHOULD BE 3%. THE DIRECTION OF CROSS SLOPE SHOULD BE ADJUSTED TO BEST FIT THE DESIRED SURFACE WATER DRAINAGE AND ROAD CURVATURE. SUPERELEVATION TRANSITIONS WILL LIKELY NEED TO OCCUR MORE RAPIDLY THAN SPECIFIED BY AASHTO.
5. THE TOP WIDTH OF ATXAX WAY ROADWAY SHOULD BE 18 FEET (MIN). PRELIMINARY ANALYSES INDICATE THAT THIS DIMENSION WILL NEED TO BE REDUCED TO 16 FEET FOR CHAVICHAX LANE AND CHAGIX ROAD.
6. THE INDICATED CUT SLOPE ANGLES SHOULD BE USED WHERE R/W IS SUFFICIENT. AT LOCATIONS WHERE THE CUT SLOPE ANGLE WOULD EXTEND BEYOND THE R/W BOUNDARY, THE SLOPE ANGLE CAN BE BE STEEPENED (1H:1V MAX.) SUCH THAT THE SLOPE INTERSECTS THE EXISTING GROUND SURFACE AT THE R/W BOUNDARY. STEEP CUT SLOPES WILL REQUIRE SPECIAL EROSION CONTROL PROVISIONS.
7. THE INDICATED FILL AND DITCH FORESLOPE SLOPE ANGLES SHALL BE USED WHERE R/W IS SUFFICIENT. AT LOCATIONS WHERE THE INDICATED FILL SLOPES WOULD EXTEND BEYOND THE R/W BOUNDARY, THE FILL SLOPES CAN BE STEEPENED. FILL SLOPES STEEPER THAN 1.5H:1V SHOULD BE REINFORCED AS SHOWN ON SECTION D

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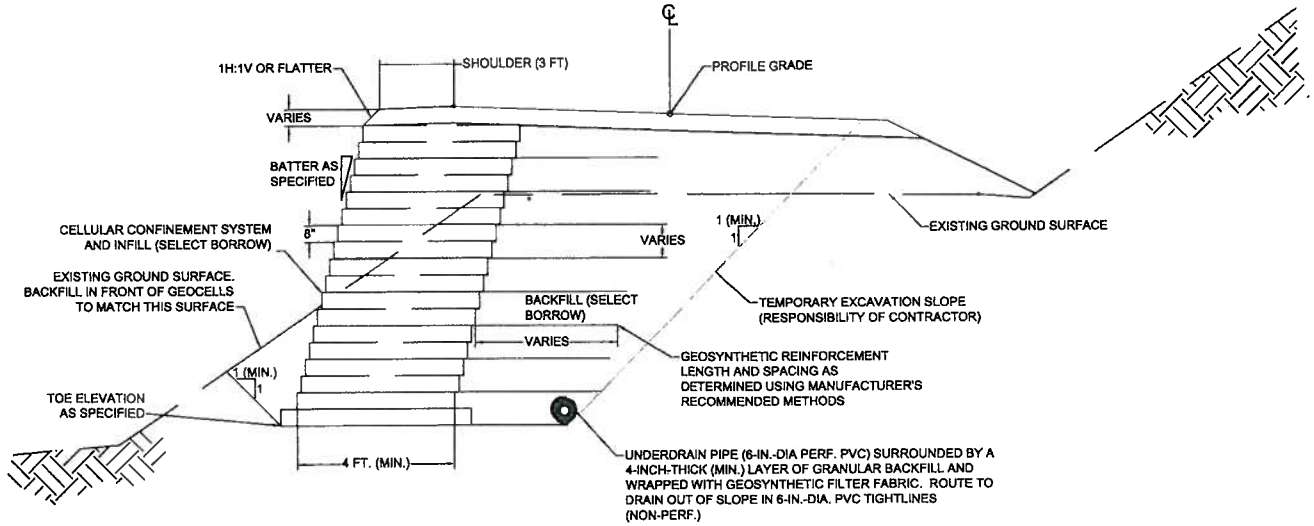
ATKA ROADS PROJECT	
Date: DEC. 2005	BIA Project No. E0012000
Drawn By: EDZ	Figure 3 (1 of 2)

PROPOSED TYPICAL SECTIONS ATKA

REPORTS\GEOTECHNICAL REPORT\ATKAPLAN FIG3.DWG



D — TYPICAL SECTION
REINFORCED SLOPES NTS

PROPOSED TYPICAL ROAD SECTIONS

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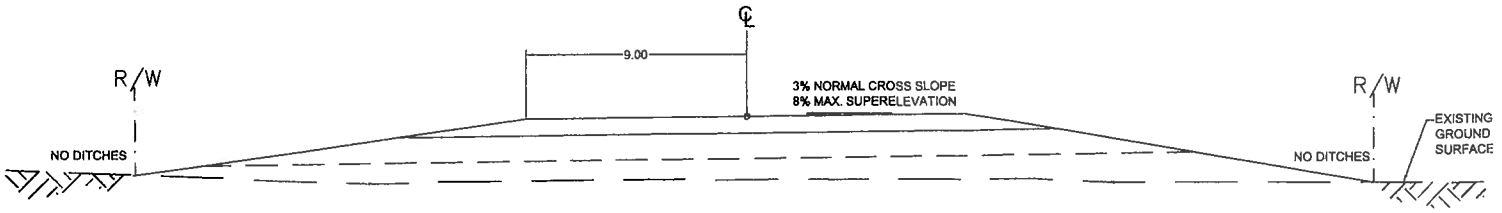
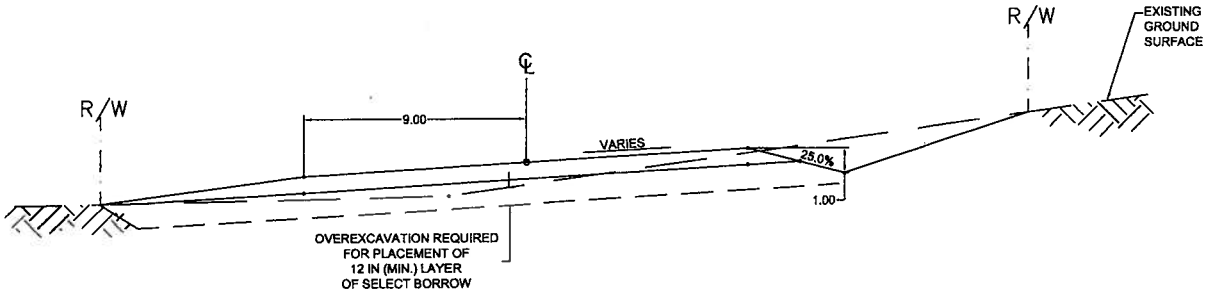
ATKA ROADS PROJECT	
Date: DEC. 2005	BIA Project No. E0012000
Drawn By: EDZ	Figure 3 (2 of 2)

ERIC ZEIMER, P.E. December 1, 2005
PROPOSED TYPICAL SECTIONS ATKA



C TYPICAL SECTION – ATXAX WAY
THROUGH APS FACILITY NTS



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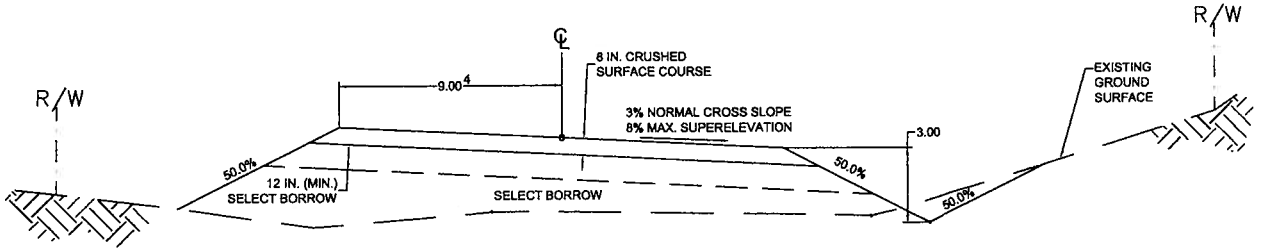
STA. 19+50 TO 19+90 NTS



A TYPICAL SECTION
ALL ROADS NTS

TYPICAL SECTION NOTES

1. AS SHOWN ON SECTION A, THE PROPOSED ROAD PRISM AT ALL LOCATIONS SHOULD CONSIST OF 8 INCHES OF CRUSHED SURFACE COURSE OVER A *MINIMUM* OF 12 INCHES OF SELECT BORROW. SUBEXCAVATION AND REPLACEMENT WILL BE REQUIRED IN SOME LOCATIONS TO MEET THESE LAYER THICKNESS REQUIREMENTS.
2. EXCEPT AS SPECIFICALLY NOTED, THE REQUIREMENTS SHOWN ON THE CROSS SECTIONS ARE SYMMETRICAL (I.E., THEY APPLY TO BOTH SIDES OF CENTERLINE).
3. NORMAL CROSS SLOPE SHOULD BE 3%. THE DIRECTION OF CROSS SLOPE SHOULD BE ADJUSTED TO BEST FIT THE DESIRED SURFACE WATER DRAINAGE AND ROAD CURVATURE. SUPERELEVATION TRANSITIONS WILL LIKELY NEED TO OCCUR MORE RAPIDLY THAN SPECIFIED BY AASHTO.
4. THE TOP WIDTH OF ATXAX WAY ROADWAY SHOULD BE 18 FEET (MIN). PRELIMINARY ANALYSES INDICATE THAT THIS DIMENSION WILL NEED TO BE REDUCED TO 16 FEET FOR CHAVICHAX LANE AND CHAGIX ROAD.
5. THE INDICATED CUT SLOPE ANGLES SHOULD BE USED WHERE R/W IS SUFFICIENT. AT LOCATIONS WHERE THE CUT SLOPE ANGLE WOULD EXTEND BEYOND THE R/W BOUNDARY, THE SLOPE ANGLE CAN BE BE STEEPENED (1H:1V MAX.) SUCH THAT THE SLOPE INTERSECTS THE EXISTING GROUND SURFACE AT THE R/W BOUNDARY. STEEP CUT SLOPES WILL REQUIRE SPECIAL EROSION CONTROL PROVISIONS.
6. THE INDICATED FILL AND DITCH FORESLOPE SLOPE ANGLES SHALL BE USED WHERE R/W IS SUFFICIENT. AT LOCATIONS WHERE THE INDICATED FILL SLOPES WOULD EXTEND BEYOND THE R/W BOUNDARY, THE FILL SLOPES CAN BE STEEPENED. FILL SLOPES STEEPER THAN 1.5H:1V SHOULD BE REINFORCED AS SHOWN ON SECTION D

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ATKA ROADS PROJECT	
Date: NOV. 2005	BIA Project No. E0012000
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TYPICAL SECTIONS ATKA

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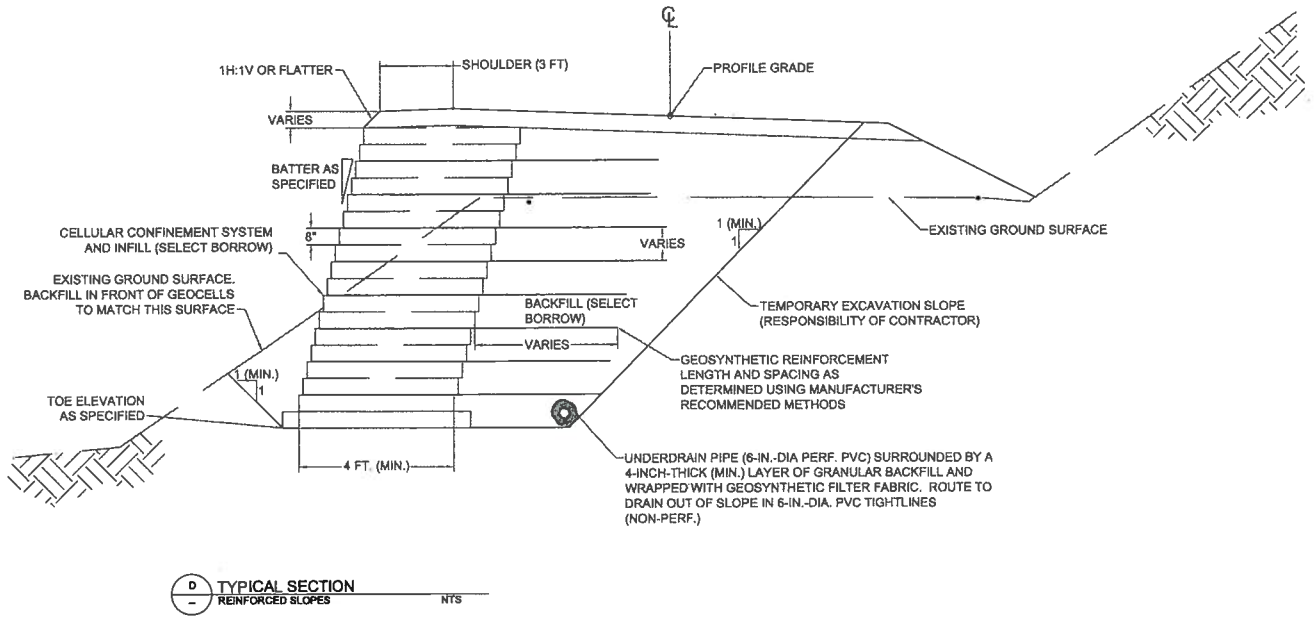

D – TYPICAL SECTION
REINFORCED SLOPES NTS

ERIC ZEIMER, P.E. November 30, 2005

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TYPICAL SECTIONS ATKA