

Comprehensive Plan guidelines and consideration numbers 2, 7 and 13 are relevant to this study and are listed in part as follows:

2. Provide for additional medium to high density residential development in areas with access to arterial roadways from collector streets.
7. Reserve wetlands and tidelands in public ownership for fish and wildlife habitat and open space/natural areas.
13. Parks and Recreation recommends a number of parks, trails, a community garden and stream corridor improvements. Those recommendations include:
 - (b) Upgrade the DZMS and the Switzer Creek/Richard Marriott trail;
 - (d) Reserve a stream corridor on Switzer Creek;
 - (i) Review the area for suitability for mini-parks;
 - (k) Establish a community garden area.

Currently, the study area contains areas zoned for D-5 (maximum density of 5 units per acre) and D-15 (maximum density of 15 units per acre), Figure 8. It is assumed that development will occur consistent with current zoning. Rezoning to a higher density is a possibility; but would require approval by the CBJ Planning Commission and Assembly.

Developable areas are identified as areas with slopes under 18%. Once the developable areas are identified, three distinct areas result and they are Development Areas 1, 2 and 3; which are 58 acres, 8.0 acres and 62 acres respectively.

These areas are further reduced for high value wetlands; 200 foot minimum setbacks for anadromous fish streams; 50 foot minimum setbacks for creeks, drainages and Waters of the United States; initial development right-of-way; and for awkwardly shaped pieces not likely to be developed.

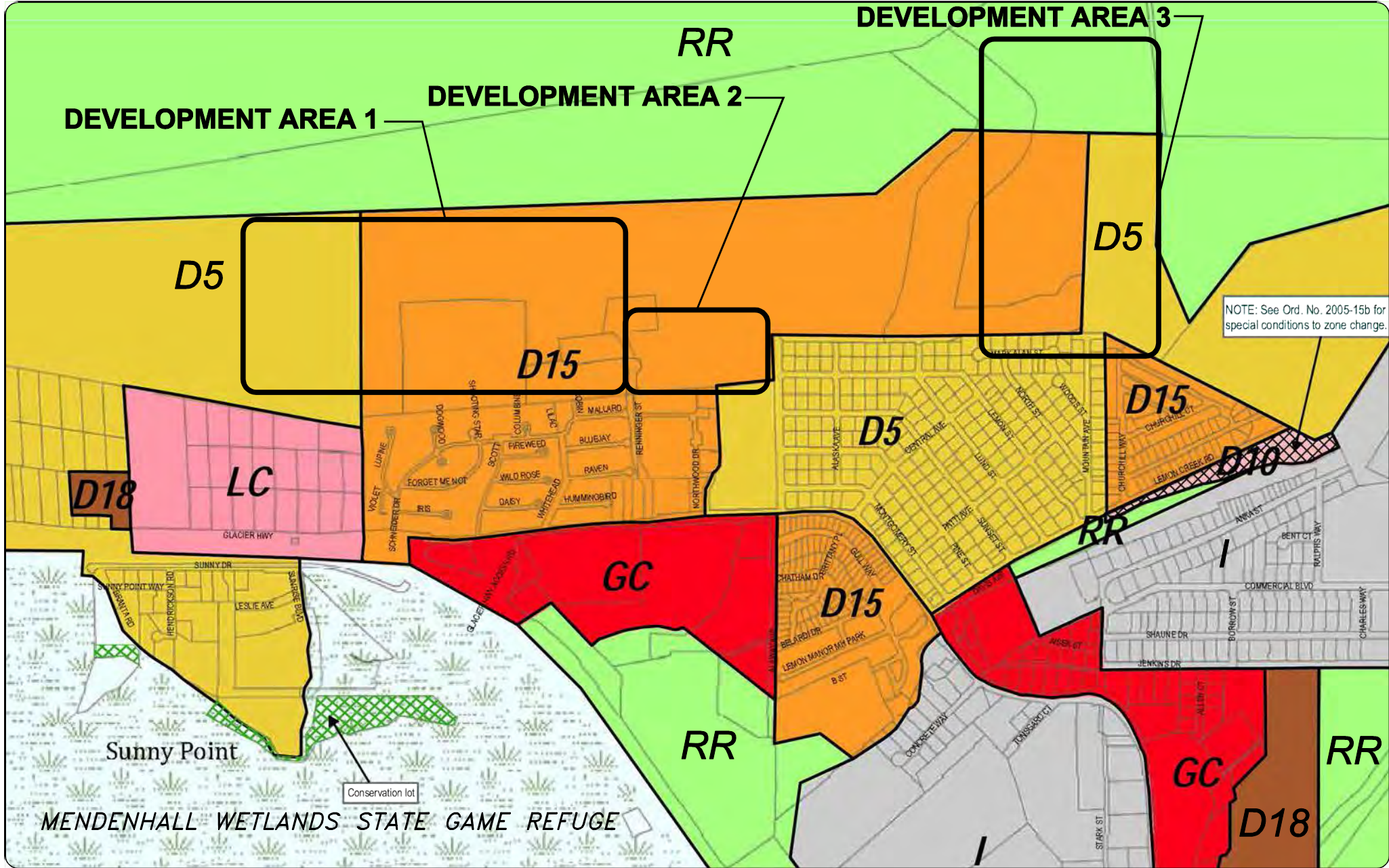
Once the above constraints are accounted for, Development Area 1 is reduced to 31 acres. We identified 4.4 acres north of DZMS and 6.8 acres in the southwest corner of the development area for possible residential development. The remaining 20 acres could yield some additional housing; but is left as the future school site and for preservation of the existing trail system at this time.

Development Area 2 is reduced to 4.6 acres once the above reductions are made. We identified 3.2 acres immediately east of Renninger Street and an additional 1.4 acres further to the east for possible residential development.

Development Area 3 is now 27 acres once the above reductions are made. Some of this acreage would likely be lost to future Right-of-Way (ROW) development; but would still yield a substantial acreage for possible residential development.

The total area available for residential development is 42 acres; 13 acres in D-5 and 29 acres in D-15. It appears that the area zoned D-5 could be up-zoned to D-15 without conflict. D-15 zoning would yield over 700 dwelling units at maximum density; however, to conform to the existing housing in the area and development of the existing shape and contours of the land; the actual development will likely be significantly less dense. Development in Lemon Creek and the Mendenhall Valley in D-15 zoning usually results in a density closer to D-10. The Pederson Hill Access Study used D-10 zoning for projects and for purposes of uniformity, we suggest using D-10 to determine the probable number of dwelling units that could be developed in the Switzer area, which yields approximately 473 dwelling units. Table 1 shows the possible dwelling units assuming D-15 zoning being developed at a D-10 density.

Table 1. Development Areas and Probable Densities		
Development Area	Probable Developed Acreage (1)	Approximate Dwelling Units (2)
1A	4.4	43
1B	6.8	68
Remainder of Development Area 1 (3)	Possible Future School Site with Existing Trails	NA
2A	3.2	32
2B	1.4	14
2A & 2B	4.6	46.0
3A (4)	5.0	50
3B (5)	5.0	50
3C	14.3	143
Totals:	43	400
Footnotes:	<p>(1) Probable Developed Acreage represents area not impacted by stream or fish buffers, steep slopes, high value wetlands, Right-of-Way (ROW), or unusual shape.</p> <p>(2) Approximate Dwelling Units are based on D-10 density of the Probable Developed Acreage.</p> <p>(3) The remainder of DA 1 is tentatively reserved for a future school and existing trails. The 23 acres that could be developed for housing would be reduced by ROW.</p> <p>(4) DA 3A could up be up to 100 units, but it is thought 50 units would be the size of an initial development.</p> <p>(5) The Fire Marshall cited Section D-106 in the Fire Code, and noted that up to 100 units would be allowed before a second access is necessary.</p>	



5. Transportation Access Analysis

An overview of potential future roads through the project area was developed and is shown in Figure 9. Some of these roads are necessary to access the three development areas: The roads west and north of Renninger Street provide access to Development Area 1; the road east of Renninger Street provides access to Development Area 2. The extension of Mountain Avenue provides access into development Area 3. There is also a road link shown between Development Area 2 and 3, which could improve local traffic circulation and would be desirable if both areas are developed. The road at the top of Figure 9 is identified in the Juneau Comprehensive Plan as a potential road. The other roads shown on Figure 9 are possible links to that potential road.

The road access alignments are identified for each of the development areas and profiles were generated for each road alignment to evaluate the required profile grade for each option. The CBI road design criteria calls for collector road grades to be below 12%. Grades below 8% are desired to allow for school and transit bus access. Base level traffic information was obtained and a brief discussion of existing and future traffic issues was conducted to evaluate the feasibility of each access option. A detailed traffic study will likely be required once actual development of any phase is known.

5.1 Transportation Infrastructure

5.1.1 Glacier Highway





Glacier Highway is under State of Alaska Department of Transportation and Public Facilities (ADOT&PF) jurisdiction and is classified as a major arterial with an Annual Average Daily Traffic (AADT) of 12,278 vehicles per day (ADOT&PF 2010). The posted speed is 40 miles per hour (mph). The road in this section has two, 12-foot lanes, and a 12-foot center, two way, left–turn lane. Through the project area, there is curb and gutter and a sidewalk along the north side of the highway. From the underpass to Sunny Point east through the Walmart area, there is also curb and gutter and a sidewalk on the south side of the highway. This section of Glacier Highway is illuminated. There are bus stop shelters on both sides of the street, near Walmart. Near Davis Avenue, there is a bus stop on the south side and there is another bus stop on Davis Avenue just north of Glacier Highway.

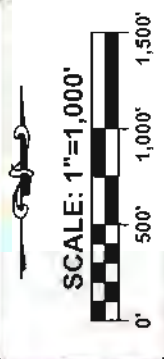
The 2012-2015 ADOT&PF STIP includes project #26112 to add sidewalks on the south side of Glacier Highway from Anka Street to Wal-Mart, and improve bike lanes on Glacier Highway (consistent width, install and maintain signage, etc.). It is scheduled for design in FY 12-14 and construction in FY 15.

5.1.2 Renninger Street

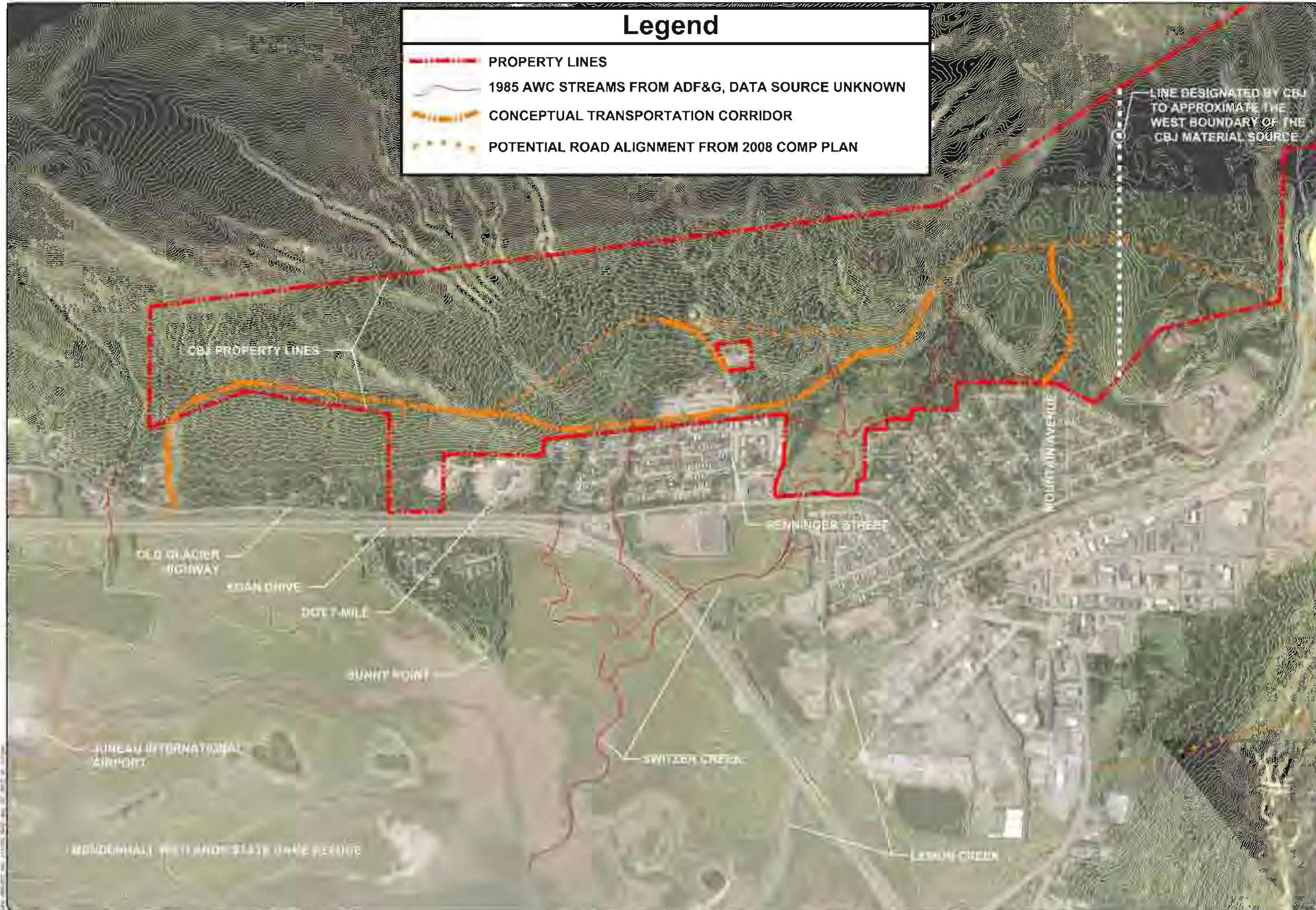
Renninger Street is a CBI street and is classified as a collector street based on AASHTO criteria. ADOT&PF data indicates the Peak Hour Volume of the Intersection is 1091. The posted speed is 25 mph. The road in this section has two 12-foot lanes; curb, gutter and sidewalk on the western side of the street; and a 5.5-foot bike path on the eastern side of the street. Intersections along Renninger Street are illuminated.

Legend

-  PROPERTY LINES
-  1985 AWC STREAMS FROM ADF&G, DATA SOURCE UNKNOWN
-  CONCEPTUAL TRANSPORTATION CORRIDOR
-  POTENTIAL ROAD ALIGNMENT FROM 2008 COMP PLAN



CONCEPTUAL ROAD ALIGNMENTS
 CBJ SWITZER LANDS
 RESIDENTIAL DEVELOPMENT STUDY
 JUNEAU, ALASKA



LINE DESIGNATED BY CBJ TO APPROXIMATE THE WEST BOUNDARY OF THE CBJ MATERIAL SOURCE

Bus stops on both sides of Glacier Highway are just west of the Renninger Street and Glacier Highway intersection.

5.1.3 Davis Avenue

Davis Avenue is a CBJ street and is classified as a collector street based on AASHTO criteria. ADOT&PF data indicates an AADT of 2,637 vehicles per day (ADOT&PF 2010). The posted speed is 25 mph. The avenue has two 11-foot lanes; curb, gutter and sidewalk along the northern side of the avenue; and a separated bike path on the southern side of the avenue. The entire avenue is illuminated. There is bus service down Davis Avenue to the end of Lemon Road near the Lemon Creek Jail. There is a bus shelter on Davis Avenue near the intersection with Glacier Highway; and one on the south side of Glacier Highway near the intersection.

5.1.4 Mountain Avenue

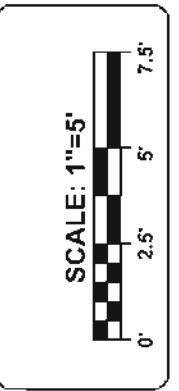
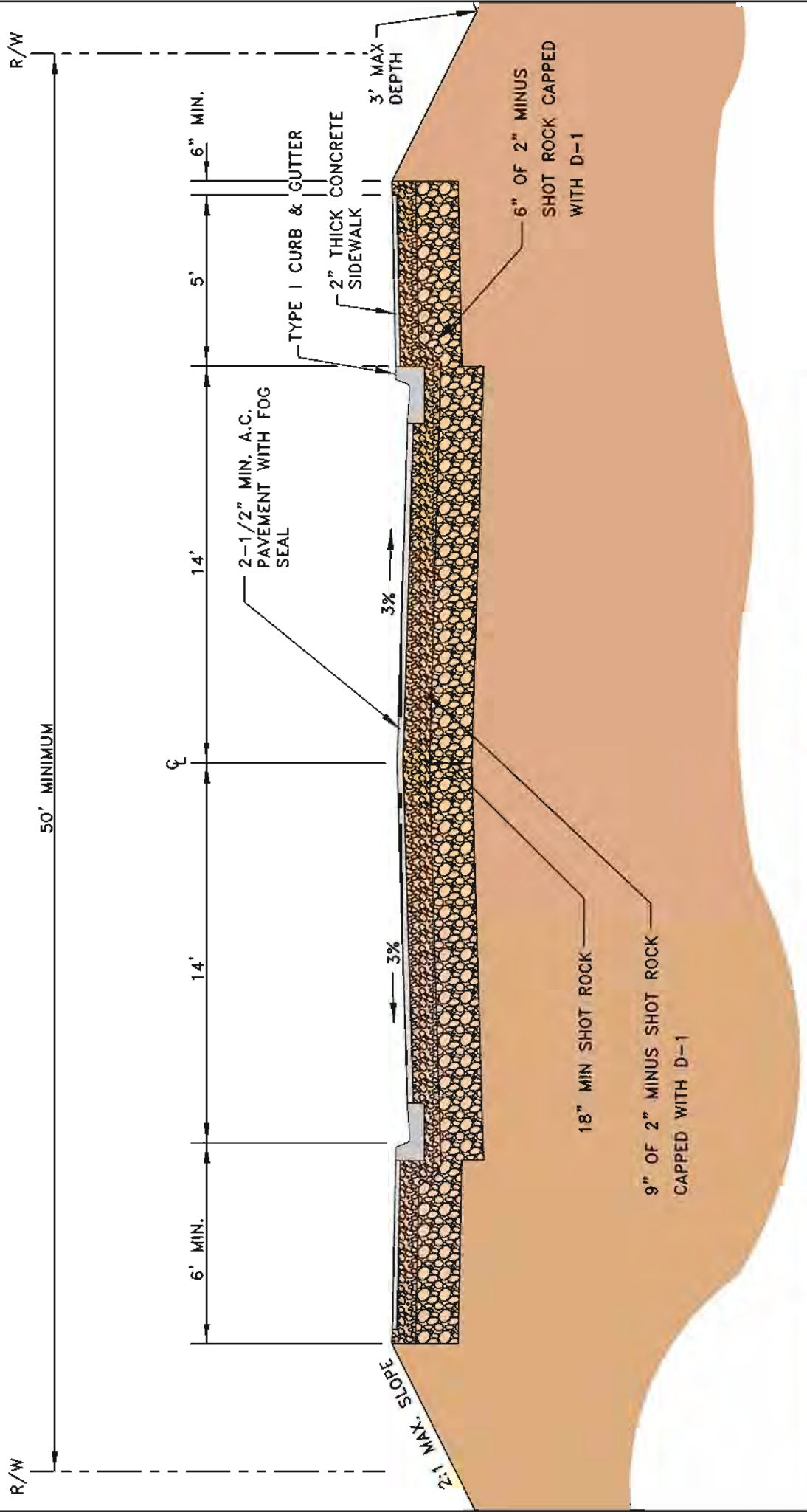
Mountain Avenue is a CBJ street and is classified as a Local Street based on AASHTO criteria. The posted speed is 25 mph. The avenue has two 12-foot lanes and a 1.5-foot shoulder on each side of the street. The entire avenue is illuminated. There is no bus service on Mountain Avenue, but there is bus service at the intersection of Mountain and Davis Avenues. The nearest bus stop shelter is on Davis Avenue near the intersection with Glacier Highway.

5.2 Transit and Pedestrian Facilities

Capital Transit provides bus service to the Lemon Creek area. Routes three and four make stops in Lemon Creek going towards both the Valley and Downtown. Buses run every half an hour from 7:30 AM to 11 PM Monday through Saturday. On Sundays, buses run every half an hour from 9:30 AM to 6 PM. The bus stops at the turnaround by the jail, at the intersection of Mountain Avenue and Davis Avenue and on Davis just before the Glacier Highway intersection. In development Area 1 and 2, pedestrians would need to walk to the current bus stops on Glacier Highway just west of the intersection of Renninger Street and Glacier Highway. In development Area 3, pedestrians would need to walk to the intersection of Mountain and Davis Avenues. If a connection between Development Area 2 and 3 was created, Capital Transit should add a loop from the jail turnaround down Mountain and then west to Renninger Street.

5.3 Typical Section

The proposed typical section for new access roads would follow the current CBJ Standard Details, which is shown in Figure 7. All cost estimates use this typical section as a basis for improvements. A narrower width of the traffic lanes could be considered as a cost savings measure. Most of the proposed roads would be low volume and AASHTO recommends a minimum traveled way width of 12 feet; but allows a 10 foot width for low-speed facilities, which all of the access roads would be.



**TYPICAL SECTION
CBJ SWITZER LANDS
RESIDENTIAL DEVELOPMENT STUDY
JUNEAU, ALASKA**

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ALASKA'S CAPITAL CITY

AASHTO allows 9 foot lane widths for low-volume residential areas; which most of these roads would be; however, if bus service up Mountain Avenue is a possibility in the future, a 10 foot width should probably be the minimum considered. The widths discussed above would not include the curb and gutter.

5.4 Access Alternatives

Four access routes were considered for reaching developable lands, but three were determined to be the most efficient to reach each of the developable areas. Plan and profile sheets for each access route alignment are included in Appendix A.

5.4.1 Access to Development Area 1A, north of Renninger Street

This alignment would allow access to a portion of Development Area 1 north of DZMS. It would be 1,162 feet long. The maximum grade on this alignment would be approximately 12 percent. The access would continue north on Renninger Street along the water tower access road and then turn west accessing potential residential development areas. It is our belief that residential development generated by this access will not create enough traffic to require any additional capacity development of Renninger Street.

5.4.2 Access to Development Area 1B, west of Renninger Street

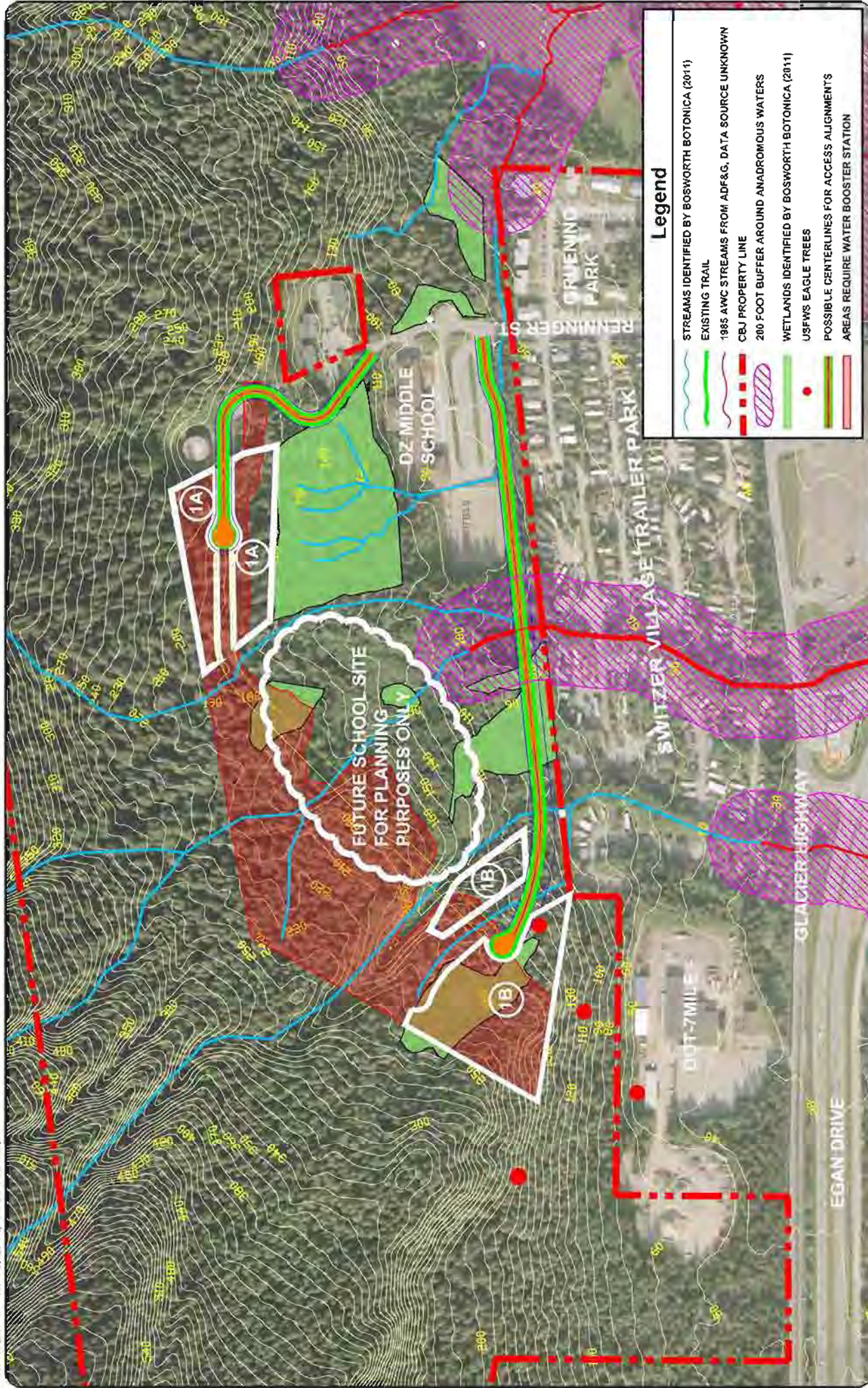
This alignment would allow access to the southwest portion of Development Area 1. It would be 2,330 feet long. The maximum grade on this alignment would be approximately 12 percent. The access would intersect Renninger Street in the first one hundred feet of the southeastern end of the DZMS parking lot and be stop controlled. It is our belief that residential development generated by this access will not create enough traffic to require any additional capacity development of Renninger Street.

This alignment crosses Spruce Trib where it has a 200 foot anadromous stream buffer. It also crosses Jay Trib, Wimpy Trib and an unnamed creek that all have 50 foot stream buffers. In addition, it runs parallel to and has impact to the Wimpy Trib buffer for approximately 400 feet. The alignment would also impact 0.69 acres of high value wetland.

In addition, this access may have issues with eagle trees that are in, or near, the southwest portion of this development area.

5.4.3 Access to Development Area 2, east of Renninger Street

This alignment would allow access to Development Area 2. Access to 2A would be approximately 220' plus a cul-de-sac; however 2A could be accessed from the existing cul-de-sac on Renninger Street at a lower cost. Access to 2B would be approximately 780 feet long plus a cul-de-sac. The maximum grade on these alignments would be approximately 5 percent. The access would intersect Renninger Street at the southern end of the DZMS and be stop controlled.



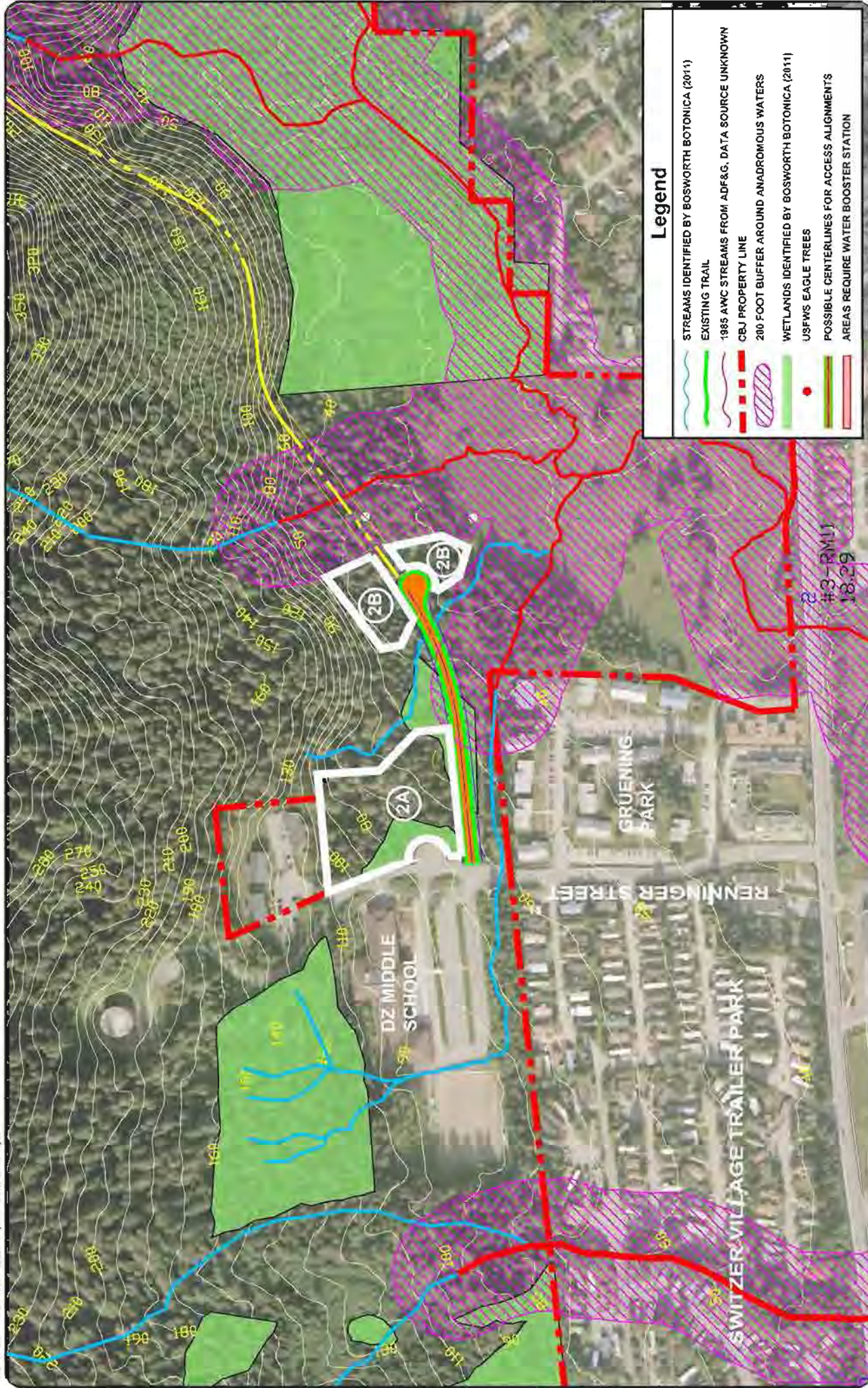
Legend

- STREAMS IDENTIFIED BY BOSWORTH BOTONICA (2011)
- EXISTING TRAIL
- 1985 AWC STREAMS FROM ADF&G, DATA SOURCE UNKNOWN
- CBJ PROPERTY LINE
- 200 FOOT BUFFER AROUND ANADROMOUS WATERS
- WETLANDS IDENTIFIED BY BOSWORTH BOTONICA (2011)
- USFWS EAGLE TREES
- POSSIBLE CENTERLINES FOR ACCESS ALIGNMENTS
- AREAS REQUIRE WATER BOOSTER STATION



**DEVELOPMENT AREA 1
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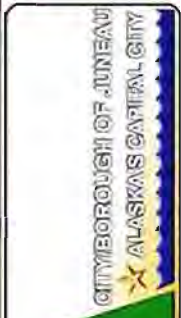
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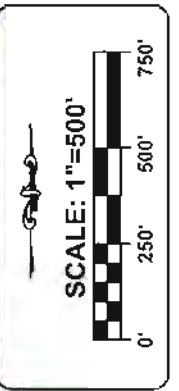
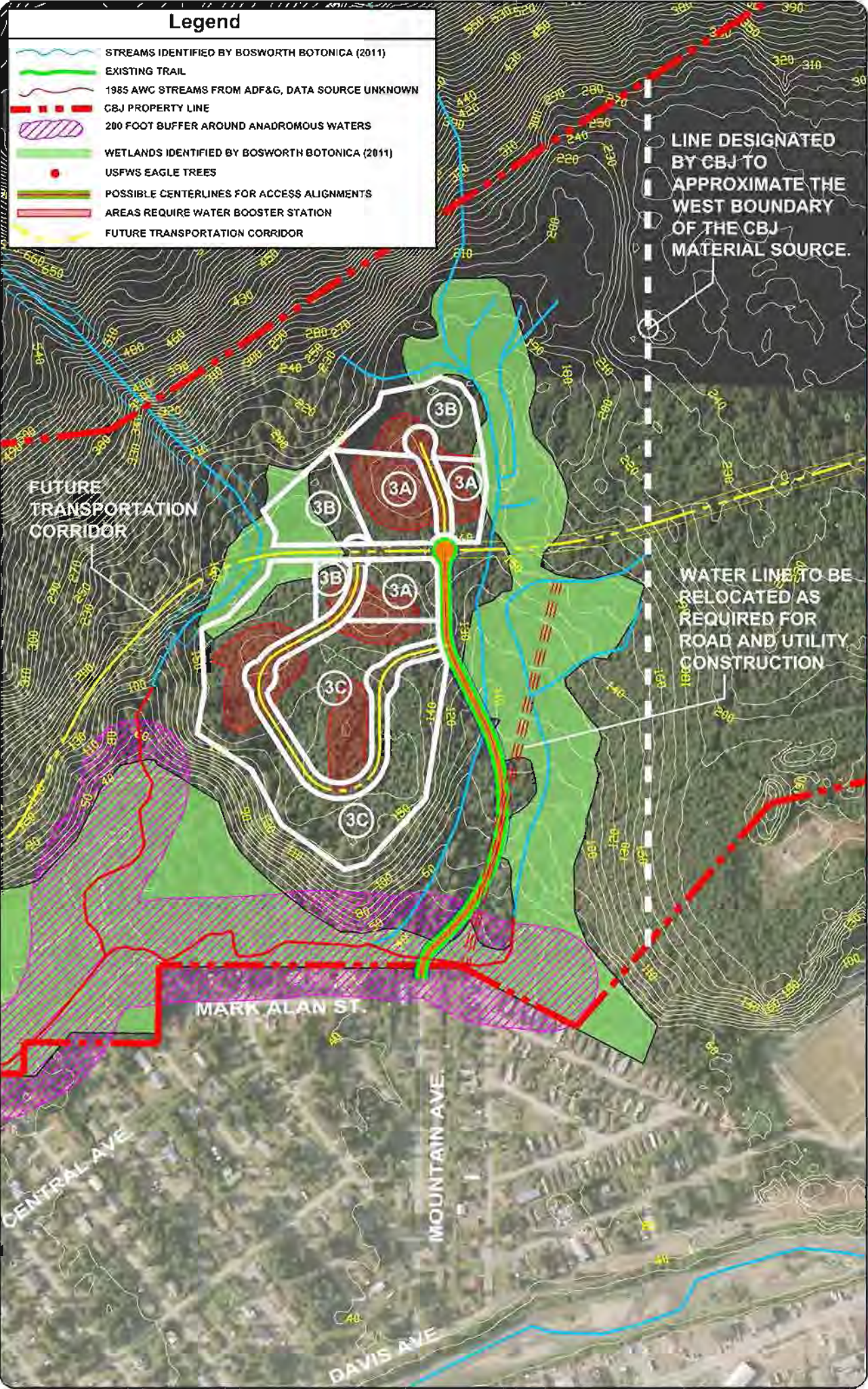
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- USFWS EAGLE TREES
- POSSIBLE CENTERLINES FOR ACCESS ALIGNMENTS
- AREAS REQUIRE WATER BOOSTER STATION

FIGURE 12
PAGE 23 OF 29



**DEVELOPMENT AREA 2
CBJ SWITZER LANDS
RESIDENTIAL DEVELOPMENT STUDY
JUNEAU, ALASKA**





DEVELOPMENT AREA 3A, B & C
CBJ SWITZER LANDS
RESIDENTIAL DEVELOPMENT STUDY
JUNEAU, ALASKA



R&M PROJECT NO. 111379 DATES: May 07, 2012 to 2/24/2014

For approximately the first 270 feet, these alignments would be within the 200-foot buffer zone of a listed anadromous salmon stream, coming within 135 feet at its closest point. The alignment would also impact 0.47 acres of high value wetland on Wimpy Tributary of Switzer Creek. To get to Development Area 2B, the alignment would go over Crabapple tributary of Switzer Creek.

It is our belief that residential development generated by this access will not create enough traffic to require any additional capacity development of Renninger Street; however if Development Area 2 and 3 are connected at some point in the future, a traffic study would be warranted to address specific details.

5.4.4 Access to Development Area 3, north of Mountain Avenue

This alignment would allow access to Development Area 3. It would be 1,714 feet long. The maximum grade on this alignment would be approximately 10 percent. This access would extend Mountain Avenue north. The existing portion of Mountain Avenue would almost certainly be required to be upgraded with sidewalk to Davis Avenue as a condition of the Planning Commission approval of the development. Residential development generated by this access would create traffic that would be routed on to Davis Avenue. Davis Avenue and Glacier Highway intersection capacity utilization is at 51.7 percent which is a level of service A. A traffic study would likely be required for any substantial development of this area.

This alignment would go over the east tributary of Switzer Creek, which is a listed anadromous fish stream. It would cross the east tributary again further north beyond the extent of the salmon stream. The alignment would also impact 0.51 acres of wetland.

5.5 Non-Motorized and Pedestrian Access

It is important to designate and develop a connected trail system between new neighborhoods in this area, DZMS and a future elementary school. Trails should be built at the same time that roads are constructed. This will prevent problems that have occurred elsewhere in Juneau when homeowners protest against trail construction close to their homes that was designated, but not built, when they purchased their property. A connected non-motorized system in affordable housing neighborhoods, and this area in particular is important to promote safe access to and from school, encourage active and healthy lifestyles, and ensure social justice. Development Area 3 should have a new trail to DZMS and an upgrade of the Marriott Trail system. Pocket parks should be also be designated and connected via the trail system. These features should be identified in a master plan for the development area.

6. Utility Analysis

6.1 Existing Water

Water pressure in the Switzer Creek area is controlled by the water storage tank built on the hill above Renninger Street. Leaving the water storage tank is a 16-inch ductile iron pipe (DIP). The water passes through a pressure sensor and then through a reducer to control water pressure. The pipe follows

Renninger Street until connecting with the 16-inch DIP pipe that runs under Glacier Highway. This pipe is connected to another 16-inch DIP pipe that goes up Central Avenue and takes a right on Montgomery Street. At the intersection of Montgomery Street and Pattie Avenue, the pipe is scaled down to a 10-inch DIP pipe. This pipe is connected to a 10-inch DIP that runs along Davis Avenue. Mountain Avenue has an 8-inch DIP pipe connected to the 10-inch pipe running down Davis Avenue.

The existing mains are adequate for the three development areas, although Development Area 3 would benefit by a loop system. Development Area 3 would benefit from a second access to Renninger Street; but that should be compared to the costs of upgrading existing traffic; reconstructing existing sewer mains and the adequacy of “dead-end” water main system.

CBJ Water Department has determined that any development above elevation 170 feet will require a water pressure booster station. Portions of the Development Areas 1 and 3 are above 170 feet and we are assuming a water pressure booster station would be required. However, a survey should be conducted to verify elevations prior to spending time on water pressure booster station design.

6.2 Existing Sanitary Sewer

An 8-inch polyvinyl chloride (PVC) runs south the length of Renninger Street and connects into a 10-inch main in Glacier Highway and from there it goes to a CBJ sewer pump station on the south side of Glacier Highway just east of Renninger Street.

From Mountain Avenue, sewage flows down an 8-inch PVC through a network of 8-inch PVC pipes going up Woods Street, across Mark Alan Street to Central Avenue. At the intersection of Central Avenue and Montgomery Street, the PVC pipe is scaled up to a 10-inch line that connects to the 12-inch PVC line that runs west down Glacier Highway.

A sanitary sewer capacity analysis was conducted using the housing units per acre information and the following assumptions:

- 3 residents per unit;
- Average water consumption of 100 gallons per capita, per day (gpcd);
- Water consumption directly correlates to sanitary sewer effluent volume;
- Peak consumption and flow occur during the morning hours between 7 and 9 am; and
- One third of the daily water consumption occurs during the peak hours.

Groundwater infiltration is not taken into account in this estimate.

The 10-inch PVC from Central and Montgomery to Glacier Highway is the most restrictive sanitary sewer segment with respect to additional capacity. Assuming a minimum slope providing 2 feet per second velocity, the 10-inch line should accommodate approximately 140 additional dwelling units. The 8-inch and 12-inch lines should be able to accommodate approximately 250 and 230 additional dwelling units. If development in Area 3 exceeds the existing sewer capacity, the access between Development Area 2

and 3 could be considered; but there will likely be a high point in that access that would likely require another lift station, which might offset any savings of not up-sizing the existing sewer mains.

7. Infrastructure Costs

Costs estimates were developed for the four road ways to access the tracts in Development Areas 1, 2 and 3. The roadways would be similar to the roadways shown in Figures 11, 12 and 13. Costs are depicted in Table 2, below.

Table 2. Development Costs					
Development Area	Costs for Streets, Sewer & Water Mains, Phone, Cable, & Illumination	Costs for Sanitary Sewer Lift Station & Water Pressure Booster Station	Construction Costs	Dwelling Units	Cost per Dwelling Unit
1A	\$1,160,000	\$400,000	\$1,560,000	43	\$36,279
1B	\$2,180,000	\$800,000	\$2,980,000	68	\$43,824
Remainder of Development Area 1	Possible Future School Site with Existing Trails				NA
2A	\$419,000	\$0	\$419,000	32	\$13,094
2B	\$524,000	\$400,000	\$924,000	14	\$66,000
2A & 2B	\$943,000	\$400,000	\$1,343,000	46	\$29,196
3A (1)	\$2,240,000	\$800,000	\$3,040,000	50	\$60,800
3B (2)	\$950,000	\$0	\$950,000	50	\$19,000
3C (3)	\$9,380,000	\$400,000	\$9,780,000	143	\$68,392
Footnotes: (1) The Cost per Dwelling for Development Area 3A is based on an assumption that 50 units would be built in this initial phase. (2) The Cost per Dwelling for Development Area 3B is based on road construction for 100 units, which according to section d-106 of the Fire Code is the number of units allowed before the fire department would require a second access. The costs assume 3A is constructed and only includes the cost to add an additional 50 units in 3B. (3) The Cost per Dwelling for Development Area 3 based on road construction for ultimate build out, including a connector from Development Area 2A to Development Area 3. The costs assume 3A and 3B are constructed and includes the cost to build addition roads in DA3; the costs to construct a link to DA2 and the costs for another sewage lift station, which may be required.					

3A, 3B, and 3C were done for conceptual estimation. The sequence of 3A, 3B, and 3C could be determined in a subsequent planning project and costs may change as a result.

In an effort to provide numbers that can be compared to the Pederson Hill Study, the costs above do not have any contingency. With the level of design and the use of LIDAR contours, we would suggest minimum contingency of 15%. Surveying, geotechnical, design, permitting, inspection, construction administration, nor the CBJ's internal costs for design are included in the costs above.

8. Phasing

8.1 First Phase

Development Area 2A would be the least expensive to develop and offers the lowest cost per dwelling unit. It is a very short piece of road being constructed and utility costs are minimal. It is zoned D-15, which would allow up to 48 units; but the cost per dwelling unit is based on a more conservative 32 units. There are some wetlands near Renninger Street that would require permitting; but these are not high-functioning wetlands; and they may be able to be avoided. The existing Switzer Trail that connects DZMS and neighborhoods off Alaska and Lund Street is used by students coming to and from school. The Juneau Safe Routes to Schools Plan (March 2012 public review draft) recommends adding lights and improving the narrow bridges on this trail through area 2A. Design of housing in this area should improve or relocate and improve this non-motorized route to and from school as well as Renninger Street.

8.2 Phase 2

Development Area 3 would have a high initial cost for access; but offers a lower cost per dwelling unit than development area 2B. Development Area 3A has higher development cost per dwelling unit than 1A or 1B; however, if you combine 3A and 3B, you get a development cost of \$3,990,000 and \$39,900 per dwelling unit, which makes 3A and 3B more attractive per dwelling unit than 1B, and close to the same cost as 1A. The soils are assumed to be better in Development Area 3 than Development Area 1, although this should be verified at some point in the future. Also, the road grades should be more accommodating to 3A and 3B than they would be to 1A.

Per the current Fire Code, Development Area 3C will need to be connected to Development Area 2. This would allow improved traffic circulation; possibly allow a bus route between Mountain Avenue and Renninger Street; provide a looped water system; and would be the best opportunity to develop area 2B.

8.3 Third Phase

Development Area 2B would be the second least expensive to develop and the second lowest cost per dwelling unit. If developed in conjunction with Development Area 2A, it would benefit from economy of scale and eliminate the costs associated with developing two cul-de-sacs and the cost of removing the first cul-de-sac.

Development Area 2B is zoned D-15 which would allow up to 21 units; but the cost per dwelling is based on a more conservative 14 units. However:

1. The soils for area 2B are suspect and may have higher site development and foundation costs.
2. Also, the cost per dwelling unit in Development Area 3 is not significantly higher and creates opportunity for additional housing units.

For the two reasons above, we recommend Area 2B as the third phase.

8.4 Fourth Phase

Development Area 1 has two areas with relatively high cost per dwelling unit. Area 1A and 1B have some steep and difficult access issues. Area 1B also has a very difficult access with multiple stream crossings and an anadromous stream crossing. Area 1B may have more merit if the access costs could be shared with a future school site development.

9. Conclusion

The CBJ needs more affordable housing. By developing the Switzer Creek area the CBJ will increase the number of dwellings available for Juneau residents and hopefully lower the cost of housing. Development areas are identified in the study area with consideration given to steep terrain, wetlands, creeks, waters of the United States, flood zones, anadromous fish habitat, and eagle nesting areas. Development costs are calculated to provide access, and sewer and water utilities to the sites.

Phasing is discussed, and Development Area 2A is recommended for the first phase because it is the easiest and least expensive to develop and offers the lowest cost per dwelling unit ratio. Developing Development Areas 2A and 2B at the same time may have merit for a first phase. However, we recommend that Development Area 3 be the second phase as area 2B would be best developed in the future if Development Areas 2 and 3 are ever connected.

Development area 3 would have a high initial cost for access; but 3A and 3B offers a lower cost per dwelling unit than Development Areas 2B, or 1B. It has a per dwelling cost slightly higher than 1A; but offers better soils (an assumption to be verified) and better road grades than 1A. We recommend that 3A and 3B be developed after Development Area 2A.

Pederson Hill Access Study



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July 22, 2010

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Pederson Hill Access Study

1. Introduction

The City and Borough of Juneau (CBJ) is facing a significant housing shortage. The 2008 CBJ Comprehensive Plan documents the insufficient supply of housing to provide residents adequate choice in housing size, location and price. According to the comprehensive plan, many households are paying more than 30% of their household income for shelter, and many live in overcrowded and/or unsafe and unsanitary conditions. Therefore, providing affordable housing is a major goal of the CBJ.

The CBJ and University of Alaska (UA) own several parcels of land on Hill 560 (referred to generally as Pederson Hill) between Auke Lake and the Mendenhall Valley in Juneau (Figure 1). This access study was performed to evaluate potential development areas, potential development densities, and transportation access for future residential development of the area. The specific areas addressed in this access study were areas A (20 acres), B (18 acres) and C (23 acres) along the southern boundary of the hill, north of Glacier Highway and west of Montana Creek and the Mendenhall River (Figure 2).

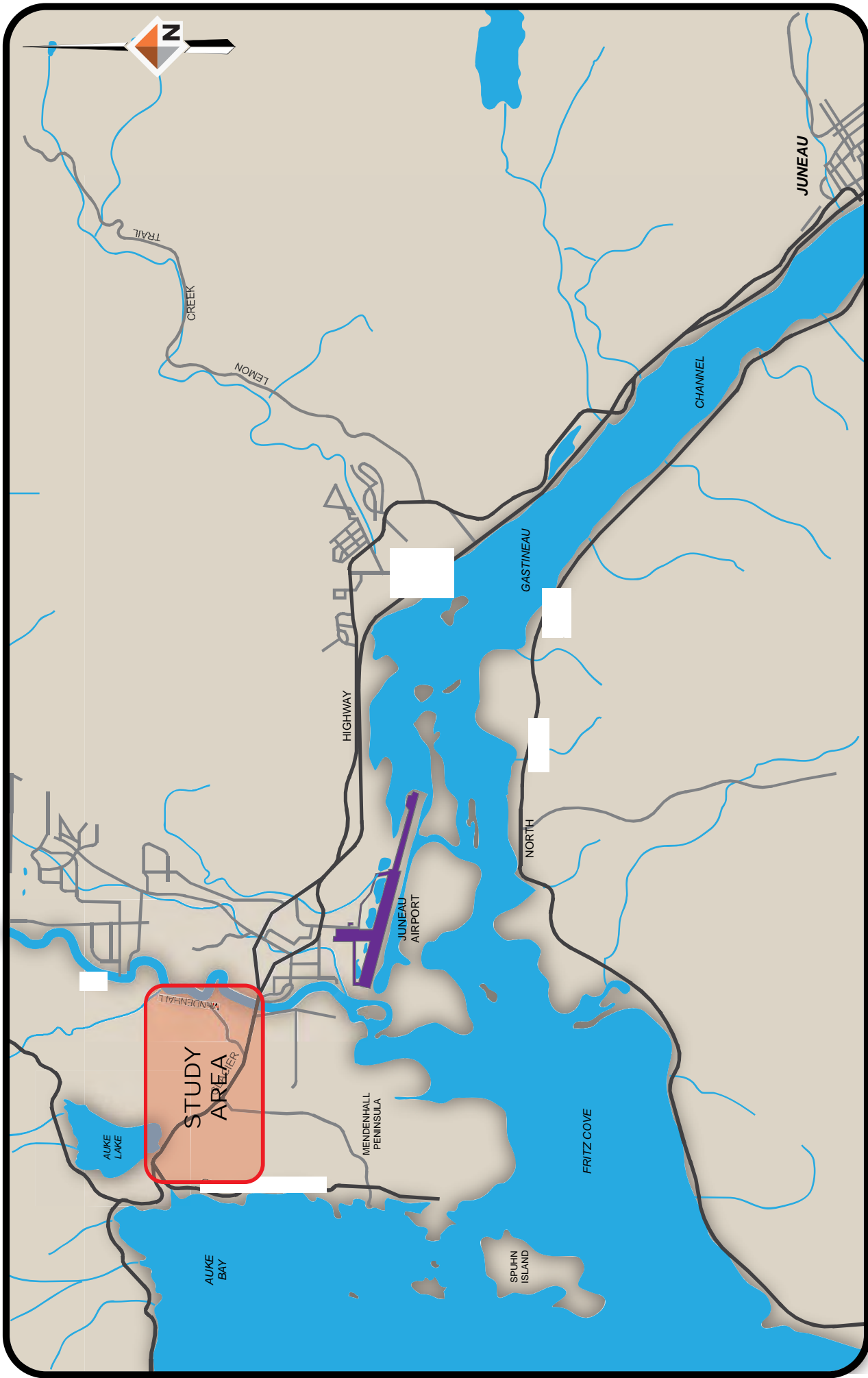
This study also addresses in a very conceptual manner, access to potential future development areas located to the north of the development areas evaluated in this study, both on top of the hill and along the north side of the hill.

2. Development Constraints

The CBJ and UA parcels pose several challenges for development, including steep slopes, wetlands, numerous creeks and drainages, anadromous fish habitat, challenging access, and eagle nests. Figure 3 illustrates the development constraints for Areas A, B and C. Constraints include steep slopes along the perimeter of the proposed development areas as well as wetlands and drainages throughout the areas. Although the forested wetlands in the study area were classified as B wetlands, this study assumes that the CBJ can obtain a permit from the Corps of Engineers for developing needed housing in the forested wetlands. The shrub/skunk cabbage fen, classified as A wetlands, was not included in the development area.

Existing data from the USFWS indicates that there are several eagle nests in the vicinity of the project. CBJ personnel report that one nest was identified directly north of the north end of Wildmeadow Lane. Anadromous streams are also common in the vicinity but are mostly south of Glacier Highway. According to the Catalog of Waters Important for the Spawning, Rearing or Migration of Anadromous Fishes, there are five streams designated as being anadromous in the vicinity of the development areas. These streams provide rearing habitat for Dolly Varden and coho salmon. Most of the anadromous reaches are south or downstream of Glacier Highway. North of Glacier Highway, two stream reaches through Brotherhood Meadow, west of Wildmeadow Lane, are listed as anadromous.

The lower two miles of Casa Del Sol Creek, also called Pederson Creek, has been listed as an impaired water body by the Alaska Department of Environmental Conservation for fecal coliform levels. The fecal coliform levels are thought to be primarily related to septic systems within the watershed. The on-going



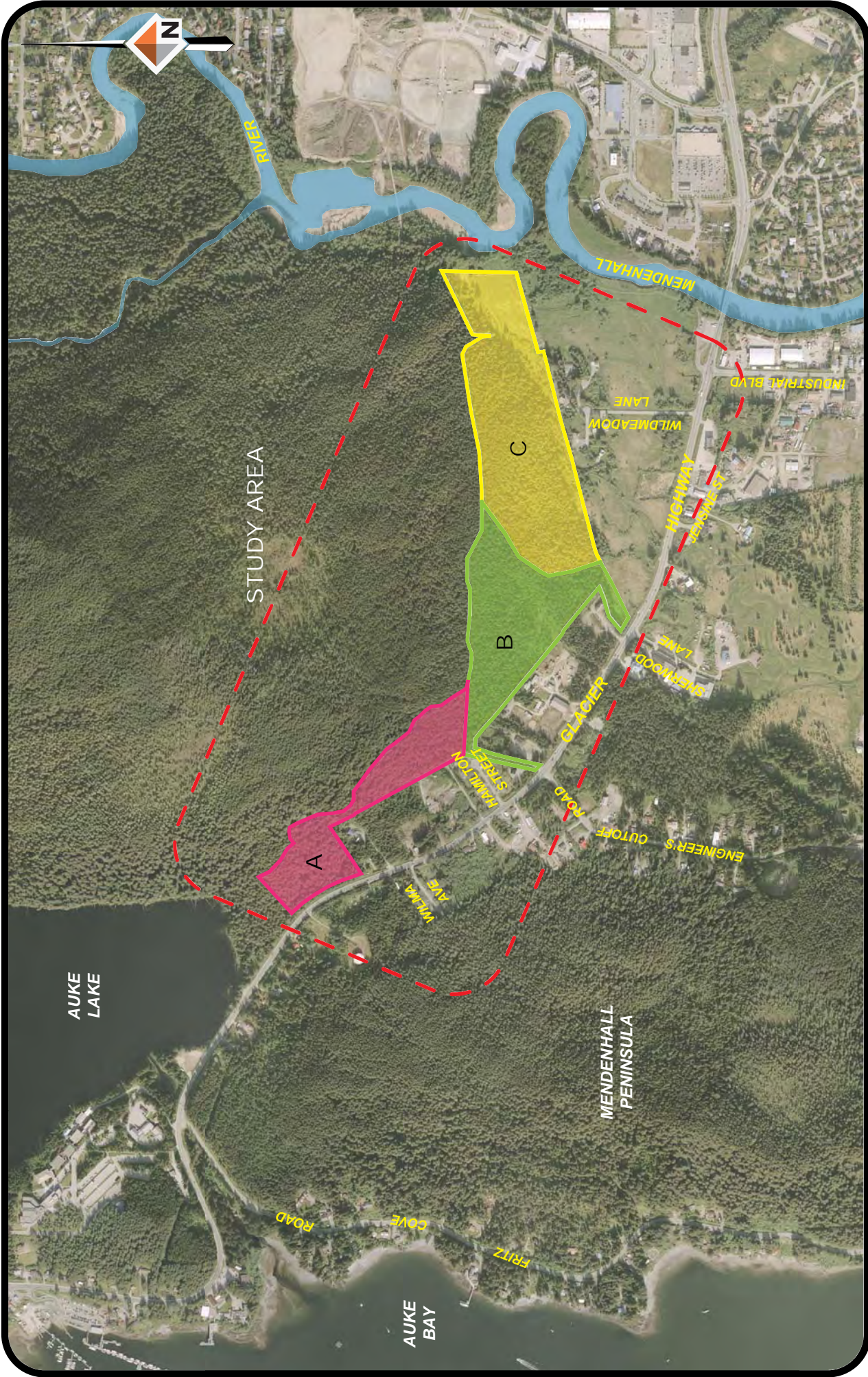
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VICINITY MAP
 PEDERSON HILL ACCESS STUDY
 JUNEAU, ALASKA

Figure 1



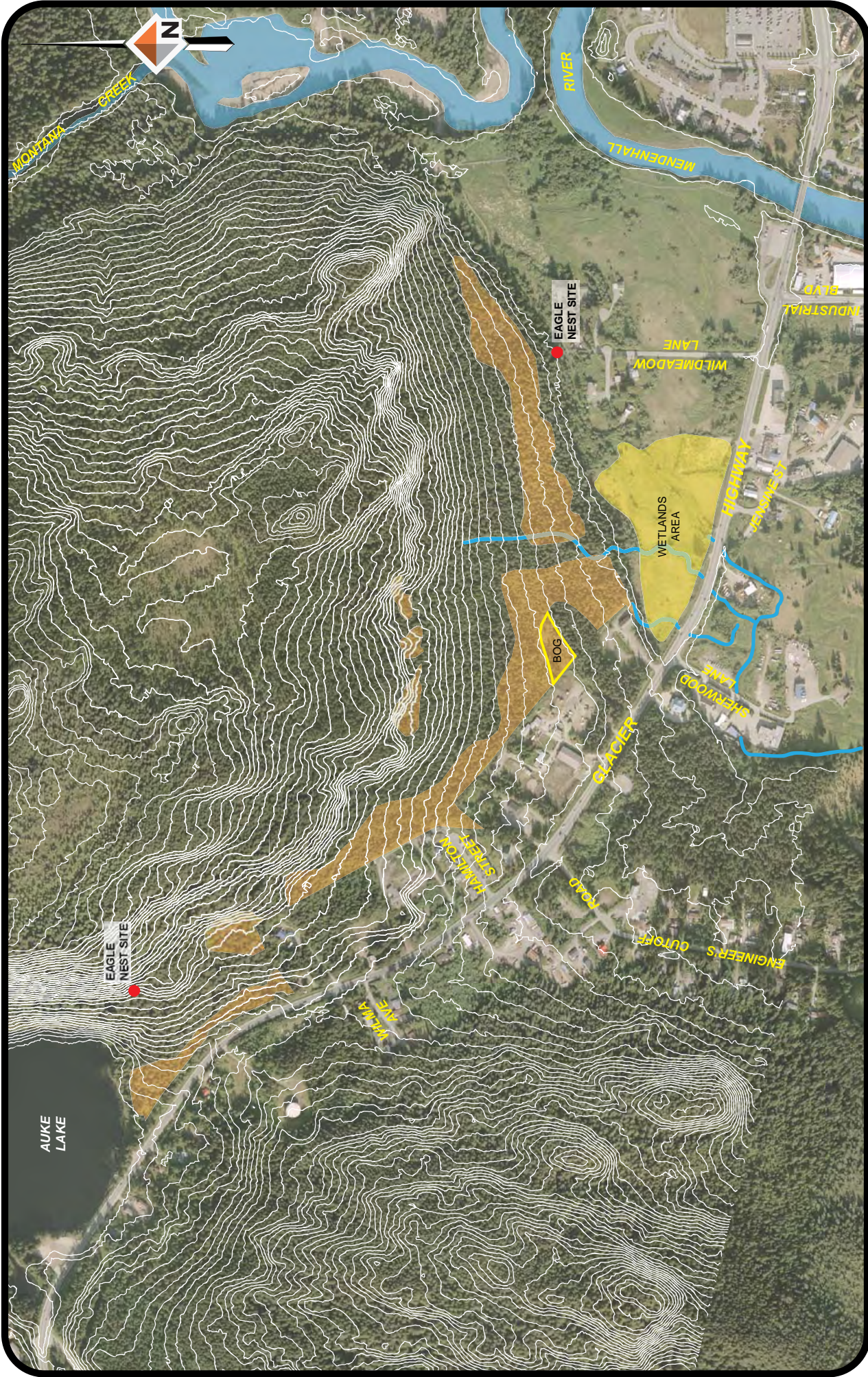
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STUDY AREA
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 JUNEAU, ALASKA

Figure 2







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ENVIRONMENTAL CONSTRAINTS MAP
 PEDERSON HILL ACCESS STUDY
 JUNEAU, ALASKA

Figure 3

-  MAPPED FORESTED WETLAND AREAS
-  GENERALIZED WETLAND AREAS
-  ANADROMOUS STREAM
-  EAGLE NEST SITES

expansion of the CBJ wastewater system in the area is expected to contribute to reduced fecal coliform levels in the future.

3. Conceptual Master Plan

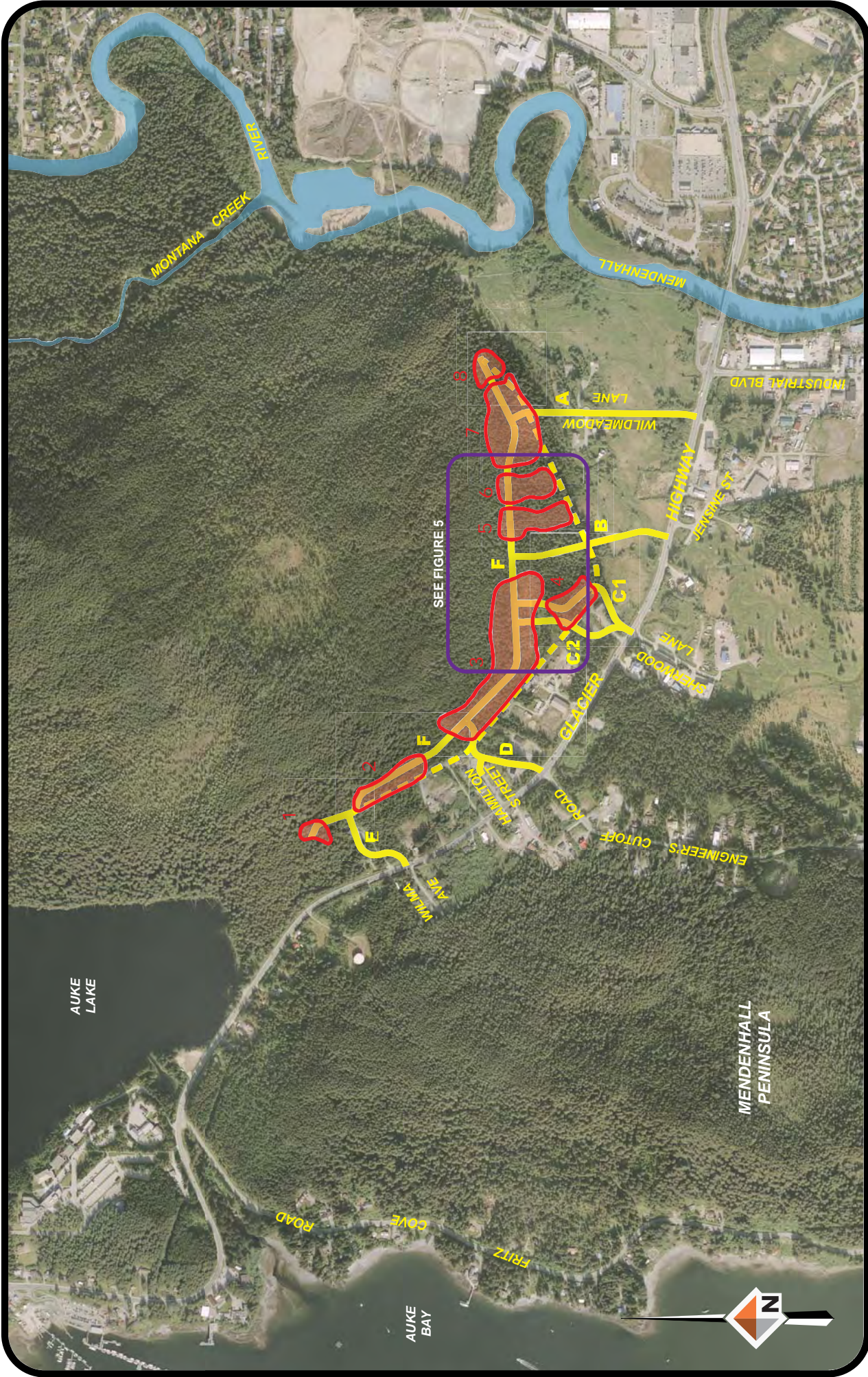
The CBJ adopted an updated comprehensive plan in 2008. One of the major issues addressed in the plan was the insufficient supply of housing for Juneau residents. As a result of this concern, the CBJ has adopted policies designed to facilitate the provision of a variety of housing sizes and types to provide more opportunities for various populations in Juneau to find affordable housing.

The study area is located in Subarea 3: Auke Bay, Mendenhall Peninsula & West Mendenhall Valley on the comprehensive plan's land use maps. The land use policies for this area call for providing medium- to high-density development on CBJ and UA lands that are served with utilities, roads and other infrastructure, where high-value wetlands, steep slopes, and hazard areas are not present, and that are outside airport hazard zones. The plan also calls for the public sanitary sewer system to be expanded in this area to accommodate higher-density, affordable student and faculty housing.

The land use designation for the study area is RDR(T)MDR or Rural Dispersed Residential (RDR) transitioning to Medium Density Residential (MDR). The RDR designation is designed for low density rural development that is not supported by utility and road infrastructure. The area is designated for medium density development once utilities and road improvements are constructed. The MDR designation allows for densities ranging from 5 to 20 units per acre. This is particularly important in areas such as Pederson Hill where economically-feasible development will require higher densities and more creative design solutions.

The area is zoned D-1(T)D-5. The D-1 residential district is intended for areas without public utility service, while the D-5 allows for higher density development once utilities are provided. Public sanitary sewer and water is available along Glacier Highway and this concept plan assumes that water and sanitary sewer will be extended to these development areas. As noted above, the new comprehensive plan calls for higher density development in this area once utilities are provided. Given the current transitional zoning, the area could be rezoned to D-5 (maximum density of 5 units per acre) through an expedited process requiring approval by the Planning Commission once utilities are in place. A rezone to a higher density (such as D-10, D-15 or D-18) would be consistent with the comprehensive plan, but would require approval by the Juneau City Assembly.

A conceptual master plan was prepared identifying developable areas and potential access and circulation routes. This concept assumes that public utilities and road improvements will be constructed prior to development and that development will occur consistent with the MDR designation. The developable areas were identified as areas with a slope under 20%, outside fen and bog wetlands, and set back approximately 50 feet from creeks and drainages. This resulted in a total developable acreage of almost 27 acres in eight development areas or pods (Figure 4 and Table 1). Assuming an average development density of 10 units per acre, these areas could potentially provide up to 273 units of housing. Figure 5 illustrates the type of high density development that could be designed to maximize housing while minimizing environmental impacts.



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CONCEPTUAL MASTER PLAN
 PEDERSON HILL ACCESS STUDY
 JUNEAU, ALASKA

Figure 4

-  DEVELOPMENT AREAS
-  PROPOSED ROUTES
-  ALTERNATE ROUTE F

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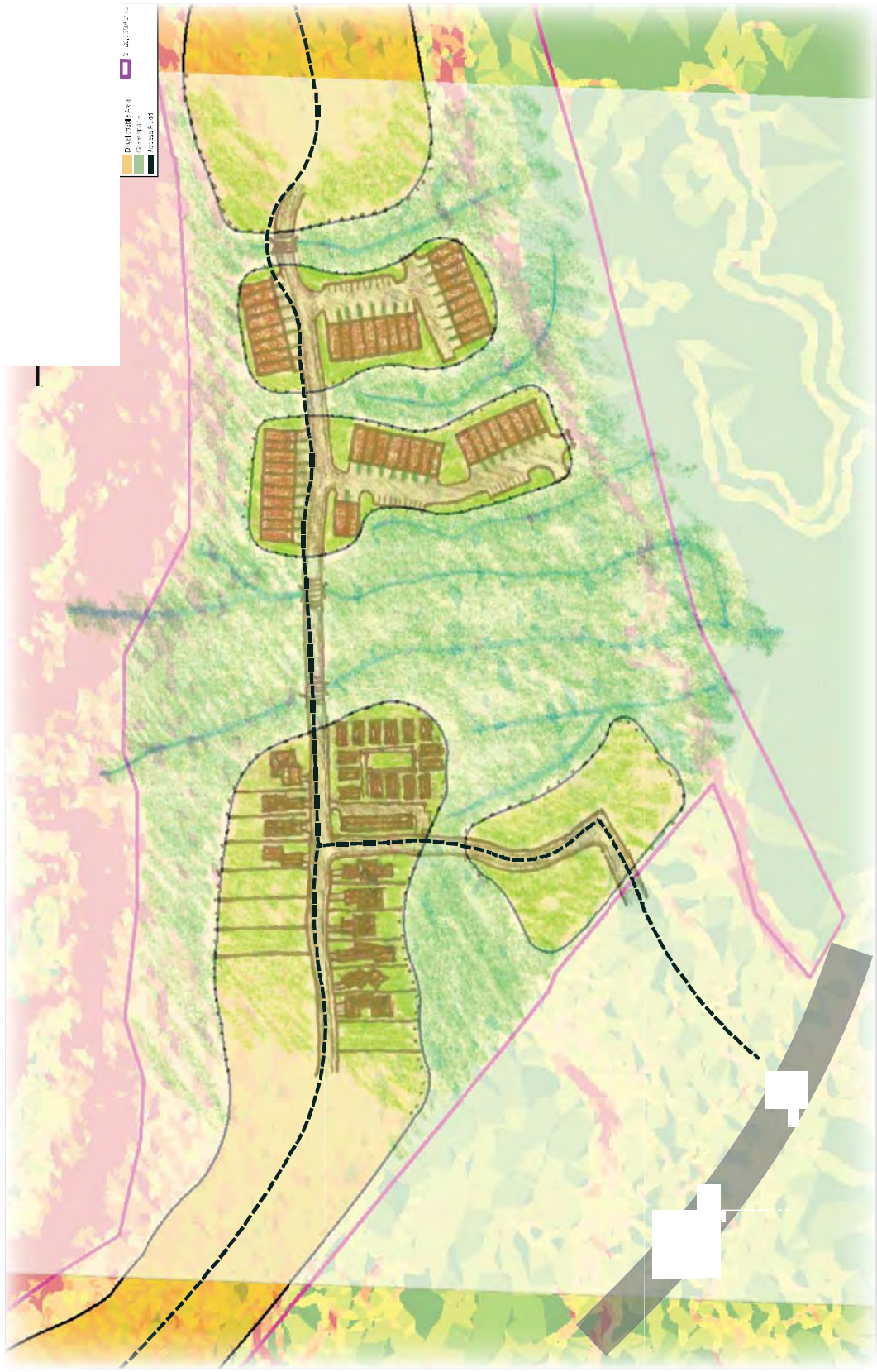


Figure 5

POTENTIAL CLUSTER DEVELOPMENT CONCEPTS
PEDERSON HILL ACCESS STUDY
JUNEAU, ALASKA

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4. Access Alignment Analysis

Given the developable areas identified in the conceptual master plan discussed above, various road access alignments were identified as shown in Figure 4. Profiles were run for each road alignment to evaluate the grade required for each option. The CBJ road design criteria call for collector road grades to remain below 12% grade. Grades below 8% are desired to allow for school and transit bus access. A planning-level traffic and safety analysis was conducted to evaluate the feasibility of each access option based on an assumed development density of 10 units per acre.

Table 1. Concept Plan Development Pods

Area ID	Acres	Units
1	0.718	8
2	2.399	24
3	10.338	104
4	1.990	20
5	2.518	26
6	2.140	22
7	5.647	57
8	1.107	12
<i>Total</i>	<i>26.857</i>	<i>273</i>

4.1 Glacier Highway

4.1.1 Wilma Avenue to Engineer's Cutoff Road

This section of the Glacier Highway is classified as a Major Arterial with an Annual Average Daily Traffic (AADT) of 8,013 vehicles per day (DOT&PF 2010). The posted speed is 50 miles per hour (mph). The cross section consists of two 12-foot lanes with 8-foot shoulders. No dedicated pedestrian facilities, roadway lighting, or turn lanes exist along this section.

4.1.2 Engineer's Cutoff Road to Wildmeadow Lane

This section of the Glacier Highway is classified as a Major Arterial and has an AADT of 11,481 vehicles per day (DOT&PF 2010). The posted speed is 50 mph. The cross section consists of two 12-foot lanes, a 15-foot center two-way left-turn lane, and 8-foot paved shoulders. Dedicated left-turn lanes and intersection illumination are present at several major intersections along the corridor. No dedicated pedestrian facilities exist.

4.2 Transit and Pedestrian Facilities

Capital Transit provides public transit service in the study area. Three routes provide service along Glacier Highway: Route 3, Route 4 and an express route to downtown Juneau. Routes 3 and 4 provide access along the Mendenhall Loop. Service is provided seven days per week. Buses run every half-hour, from 7:45 a.m. to 11:45 p.m., except for Sunday service which runs from 8:45 a.m. to 6:45 p.m. Bus stop shelters are located along Glacier Highway near Wildmeadow Lane, Sherwood Lane and Engineer’s Cutoff Road (Figure 6).

No formal pedestrian facilities currently exist on Glacier Highway between Wilma Avenue and Wildmeadow Lane. A new 10-foot wide separated multi-use trail facility has been designed along the north side of Glacier Highway and is expected to be constructed in the near future (Figure 6).

4.3 Trip Generation

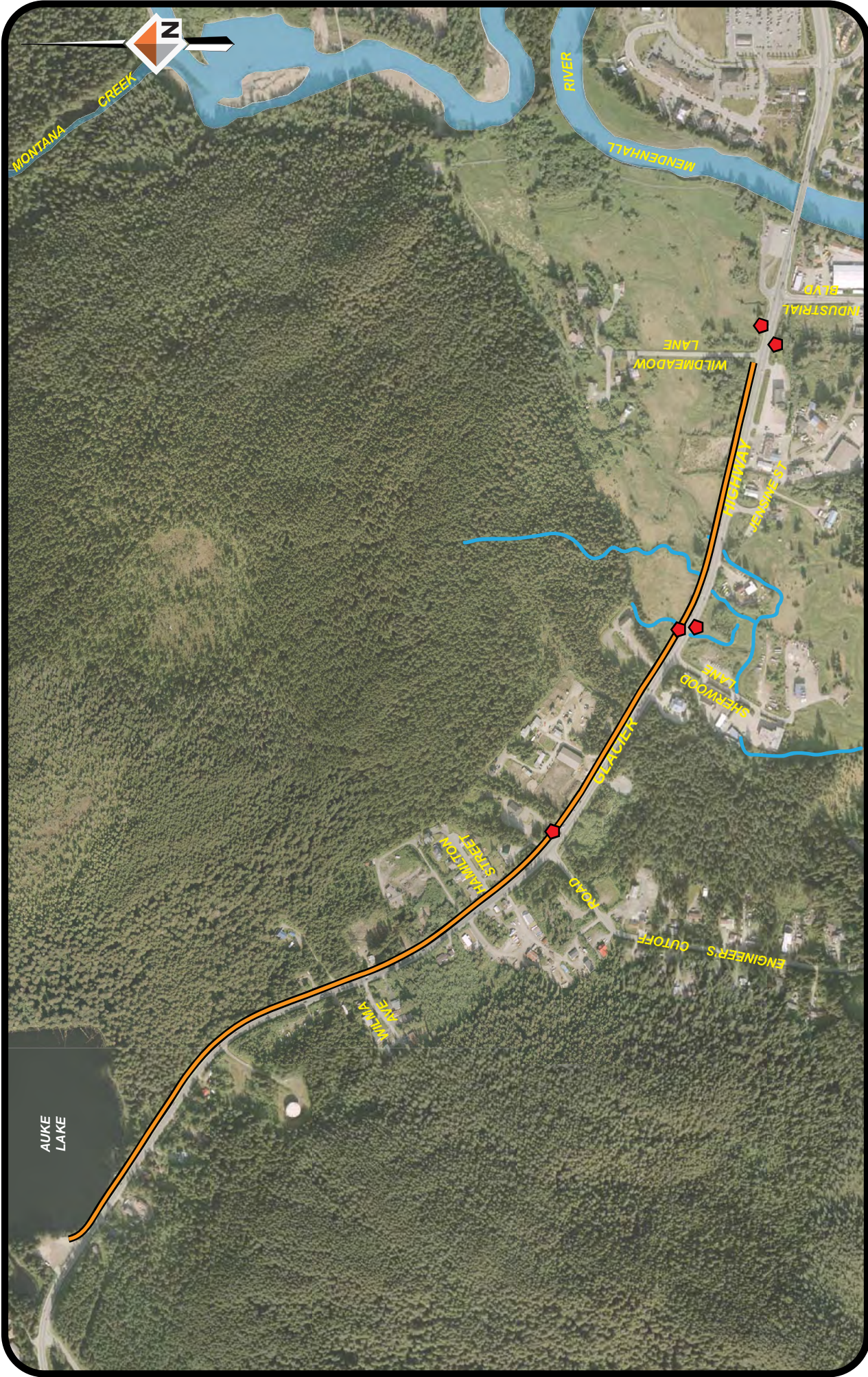
Future traffic projections were generated using the Institute of Traffic Engineers (ITE) Trip Generation Handbook 8th Edition. The trip generation was based on a land use of Residential Condominium/Townhouse (ITE Land Use Code 230), and approximately 10 units per acre. Estimated trips for each development area are given in Table 2.

Table 2. Trip Generation

Area ID	Acres	Units	Trips (per day)
1	0.718	8	47
2	2.399	24	140
3	10.338	104	605
4	1.99	20	117
5	2.518	26	152
6	2.14	22	128
7	5.647	57	332
8	1.107	12	70
<i>Total</i>	<i>26.857</i>	<i>273</i>	<i>1,591</i>

4.4 Access Alternatives

Five potential access routes to the development areas were evaluated. Each route is evaluated as an independent access alternative, but the effect of having additional access points is also addressed. Each of these alternatives assumes that Route F is constructed as a collector road that connects all of the various development pods. Plan and profile sheets for each access route alignment are included in Appendix A.



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PEDESTRIAN AND TRANSIT IMPROVEMENTS
 PEDERSON HILL ACCESS STUDY
 JUNEAU, ALASKA

Figure 6

-  BUS STOP / SHELTER
-  GLACIER HIGHWAY MULTI-USE TRAIL

4.4.1 Access Route A

Access Route A would connect the northern end of Wildmeadow Lane to Route F and use the existing roadway to connect to Glacier Highway. If this was the sole access for development throughout the eight development areas, this access would need to serve approximately 1,600 vehicles per day or approximately 180 vehicles during the peak hour. An intersection with this level of operations would potentially require auxiliary (turn) lanes and an evaluation of signalization warrants. If Access Route A was constructed in conjunction with another access road to the west (options B through E), so that Access Route A served only the traffic from development areas 5 through 8, it would be expected to serve approximately 680 vehicles per day or approximately 70 vehicles during the peak hour. This diffusion of traffic volumes would likely enable Wildmeadow Lane to remain unsignalized with no additional lanes needed.

Wildmeadow Lane is an existing local street, serving seven single-family homes. The roadway is approximately 24 feet wide with a strip paved surface and swales on each side. Wildmeadow Lane is stop-controlled at the Glacier Highway intersection. The existing intersection layout is less than 90-degree angle. Previous comments from the Southeast Region DOT&PF requested the roadways be realigned to intersect perpendicular to Glacier Highway. DOT&PF has obtained the right-of-way for this improvement in conjunction with relocating access to a neighboring trailhead to a frontage road along Glacier Highway. These improvements are expected to be complete before the housing project is constructed.

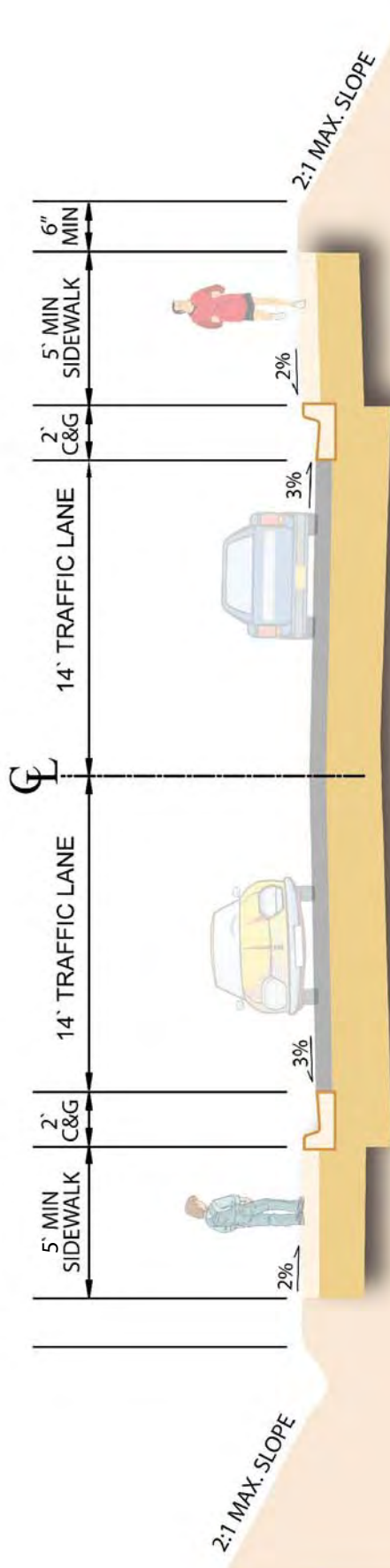
The Glacier Highway cross-section at Wildmeadow Lane consists of two 12-foot lanes, a 15-foot two-way-left-turn-lane, and 4-foot paved shoulders. An existing Capital Transit bus stop is located on Glacier Highway just east of the Wildmeadow Lane intersection. If auxiliary lanes on Glacier Highway are needed at Wildmeadow Lane, it may be feasible to convert the 15-foot center turn lane to a dedicated left-turn lane with a 4-foot median.

Under the Access Route A scenario, Wildmeadow Lane would be extended to the north/northwest at an approximate grade of 10 percent which meets the maximum allowable grade specified in the CBJ design criteria. This option also assumes that improvements to Wildmeadow Lane would be required to upgrade the existing roadway to Collector standards per CBJ Land Use Code Chapter 49.35. Specifically, the section would include two 14-foot traffic lanes, curb and gutter, and sidewalks on both sides, as shown in Figure 7. Based on this section, a 60-foot right-of-way (ROW) was assumed for each route evaluated. It is possible that the right-of-way may need to be greater based on the grade of the road. The actual right-of-way needed would be based on a final decision on the road section required for this access road, including the level of pedestrian amenities and utilities incorporated into the route.

No wetlands or anadromous streams would be affected by Access Route A; however, an eagle nest is located just north of the current terminus of Wildmeadow Lane. Construction of an access road through this area would require coordination with the U.S. Fish and Wildlife Service to ensure that the alignment and construction activities were designed to avoid or minimize disturbance of the eagle nest when actively used.

4.4.2 Access Route B

Access Route B would provide access from the development areas to the Glacier Highway at Jensine Street. If only Access Route B were constructed to support all of the development in areas 1 through 8, it



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CONCEPTUAL ROAD SECTION
 PEDERSON HILL ACCESS STUDY
 JUNEAU, ALASKA

Figure 7

would need to serve approximately 1,600 vehicles per day or approximately 180 vehicles during the peak hour. Again, an intersection with this level of operations would potentially require auxiliary (turn) lanes and an evaluation of signalization warrants.

Volumes served would drop to approximately 1,556 vehicles per day or 170 vehicles per peak hour if this route only provided access for areas 3 through 8 and another road to the west (option E) provided access for areas 1 and 2. Alternatively, if Access Route D was constructed in addition to Access Route B, Route D could also draw some of area 3 away from Route B, decreasing the volume on B to approximately 1,350 vehicles per day or 140 vehicles during the peak hour. The Glacier Highway at this location consists of two 12-foot lanes, a 15-foot center two-way left-turn lane, and 8-foot paved shoulders. If auxiliary lanes are needed on the Glacier Highway, it may be feasible to convert the 15-foot center left-turn lane to a dedicated left-turn lane with a median.

The maximum grade of this alternative is approximately 9 percent. This meets the design criteria and is close to the desired grade of 8%.

Access Route B would bisect the Brotherhood Meadow wetland area located west of Wildmeadow Park Subdivision and could impact stream reaches listed as anadromous by the Alaska Department of Fish and Game (ADF&G). In order to acquire a wetland permit for this option, the CBJ would need to demonstrate that there are no other feasible alternatives to provide access that have less impact to wetlands; this standard may be difficult to demonstrate. In addition, the CBJ would need to look at alternatives to minimize the impact of the road, such as elevating the roadway on pilings to minimize fill in the wetland. Finally, if a permit were issued, the CBJ would be required to mitigate the wetland impact. A permit would also be required from the ADF&G for the anadromous stream crossing. The streams in this area provide rearing habitat for Dolly Varden and coho salmon and any final design and construction would need to minimize potential impacts on these resources. Due to the concentration of sensitive resources in this area, this alignment may be the most difficult to permit.

4.4.3 Access Routes C

Access Route C would provide a collector road from the Glacier Highway at Sherwood Lane to Route F. Again, it would need to serve approximately 1,600 vehicles per day or approximately 180 vehicles during the peak hour if it was the only access road for development areas 1 through 8. An intersection with this level of operations would potentially require auxiliary (turn) lanes and an evaluation of signalization warrants. If this route was used only to access development areas 3 and 4, traffic levels would be estimated at 722 vehicles per day, or 80 vehicles during the peak hour. If Route C and Route A were constructed, volumes on C would decrease to approximately 682 vehicles per day or 75 vehicles during the peak hour. Alternatively, if Routes C and E were constructed, volumes on C would be approximately 1,400 vehicles per day, with 155 in the peak hour. Peak hour volumes greater than 80 vehicles will likely require analysis of auxiliary lanes and intersection controls on the Glacier Highway.

Access Route C has a maximum grade of 9 percent, which meets the design criteria and is close to the desired grade. This route would require the purchase of ROW, and would be proposed to wrap around to the southeast of the existing church. Due to the proximity of the driveways, the existing church access would be removed and a new church access would be constructed to the northeast to connect with Route C. An alternative that may reduce the impact on the church is shown as Route C2. Access Route C would be designed to create a perpendicular connection at Glacier Highway, which aligns with

the existing Sherwood Lane. Glacier Highway at this location has two 12-foot lanes, a 15-foot two-way-left-turn-lane east of Sherwood Lane, and a hatched transition area of varying width to the west. Due to the existing widened pavement section on Glacier Highway, turn-lanes could be installed at this location with minimal work.

This route does not cross any anadromous streams or wetlands. This route is close to an existing church and any final alignment would need to be coordinated with the affected land owners and designed to minimize or mitigate impacts on this existing use.

4.4.4 Access Route D

Access Route D would start at the Glacier Highway and Engineer's Cutoff Road and travel north to Route F. Access Route D would need to serve approximately 1,600 vehicles per day or approximately 180 vehicles during the peak hour if it was the only access road for development areas 1 through 8. An intersection with this level of operations would potentially require auxiliary (turn) lanes and an evaluation of signalization warrants. If this route were combined with an access road along Route A (for areas 5 to 8) and Route D provided access only for development areas 1 through 4, volumes would be reduced to approximately 900 vehicles per day or about 95 vehicles during the evening peak hour.

The maximum grade along Access Route D would be 9 percent. This access would tie into the Glacier Highway at a 90-degree angle southeast of the church at Engineer's Cutoff Road. Engineer's Cutoff Road is a minor north-south arterial with a 2008 AADT of 1657 that connects Glacier Highway to the south end of Fritz Cove Road. Glacier Highway at Engineer's Cutoff Road currently consists of two 12-foot through lanes, 6-foot paved shoulders, and a northwest bound left-turn lane. A southeast left-turn lane could be added to the 12-foot hatched transition area of the pavement on Glacier Highway; however, some widening would be required.

In order to consolidate access to the Glacier Highway, access to the church and residences along Hamilton Street would be rerouted to the Glacier Highway along Access Route D eliminating the intersection at Hamilton Street and the Glacier Highway. These improvements would require property acquisition along the east boundary of the church property, but would conserve their parking. Several developed lots currently have access from Hamilton Street to the Glacier Highway. The changes to access along Hamilton Street might be viewed negatively by residents in this area.

Casa Del Sol Creek runs through the existing right-of-way used for this access alternative. This creek is anadromous in its lower reaches, and is also listed as an impaired water body for high levels of fecal coliform. The creek is fairly channelized within the study area and there has been some discussion of the potential to reroute a portion of the creek within the study area to avoid areas used for livestock that could contribute further to the fecal coliform levels downstream.

4.4.5 Access Route E

Access Route E connects the development areas to Glacier Highway at Wilma Avenue. Again, it would need to serve approximately 1,600 vehicles per day or approximately 180 vehicles during the peak hour if it was the only access road for development areas 1 through 8. An intersection with this level of operations would potentially require auxiliary (turn) lanes and an evaluation of signalization warrants. If this road provided access to only development areas 1 and 2, the demand would be reduced to about

200 vehicles per day or about 22 vehicles per peak hour and no dedicated turn lanes would be required. This access would tie into the Glacier Highway at 90 degrees.

The maximum grade of this alternative would be 12 percent, which is the maximum allowed under the CBJ design criteria. Private property would need to be acquired for this route, as there is no existing right-of-way to the north from the Glacier Highway at this location. Glacier Highway in this vicinity currently consists of two 12-foot lanes and 8-foot paved shoulders. If turn lanes were required on Glacier Highway, the highway would need to be widened, which would be much more difficult in this area as compared to the other routes. There are also safety concerns regarding placing another intersection on this portion of the highway due to icing concerns in this area and sight-distance limitations related to the highway geometry issues in this area.

No environmental issues were identified for this access alternative.

4.4.6 Route F

Route F connects the development areas with each other and the proposed accesses to Glacier Highway. It does not provide a connection to Glacier Highway. This road is assumed to be designed and constructed to the same collector level as the access routes. Route F has a maximum grade of 7 percent, which meets the CBJ design criteria and is below the desired maximum grade. Traffic along this road will vary depending on the construction of other access routes. As discussed above, approximately 1,600 trips per day would be expected to be generated based on the development assumptions for the conceptual master plan area. The distribution of trips along this road would depend on the location of the access to the Glacier Highway. An alternative alignment along the southern boundary of the development areas may provide an opportunity for more efficient co-location of utility services within the road corridor.

5. Utility Analysis

5.1 Existing Water

An 18-inch ductile iron pipe (DIP) water main runs along the south side of Glacier Highway through the study area (Figure 8). Two smaller mains branch off the water main and run north towards the proposed development area.

At Wildmeadow Lane, a 10-inch DIP water main line branches off the 18-inch DIP water main line and runs under Glacier Highway. At approximately 40 feet past the northern edge of Glacier Highway, the 10-inch DIP line is reduced to 6-inch DIP water main line. The 6-inch water main line runs to end of Wildmeadow Court and terminates at a cap and thrust block. A fire hydrant is located near the end of the line; static pressure at the fire hydrant was most recently measured at 76 pounds per square inch (psi) with a flow at 1,190 gallons per minute (gpm) at 58 psi residual.

At Hamilton Street, an 8-inch DIP water main line branches off the 18-inch DIP water main line and runs under Glacier Highway. This 8-inch DIP water main line runs the length of Hamilton Street and terminates at a cap. A blow-off hydrant is located near the end of the line; static pressure at the fire hydrant was most recently measured at 55 psi and with a flow at 1,160 gpm at 50 psi residual.



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UTILITIES
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Figure 8

-  WATER LINES
-  SEWER LINES & MANHOLE

5.2 Existing Sanitary Sewer

The CBJ is proposing to install an 18-inch polyvinyl chloride (PVC) sanitary sewer main line along Glacier Highway in the study area. The sanitary sewer extension along Glacier Highway has been designed but is not yet constructed. This analysis assumes that it will be constructed as currently designed prior to development of the CBJ and UA lands.

At Wildmeadow Lane, a 10-inch PVC sanitary sewer main line runs from a manhole at the north end of Wildmeadow Lane to a manhole at the intersection with Glacier Highway. The line turns east at the manhole and runs approximately 280 feet to a second manhole. The line turns south at the second manhole and crosses under Glacier Highway in a 20-inch casing and connects to the 18-inch sanitary sewer main line at a manhole on the south side of Glacier Highway. The design grade of this entire section of 10-inch sanitary sewer main line is 0.28%.

A 15-foot stub out of 8-inch PVC is located at the undeveloped right-of-way across from the intersection of Glacier Highway and Engineer's Cutoff Road. This line stubs out from a manhole on the 18-inch PVC sanitary sewer main line on the north side of Glacier Highway.

At Hamilton Street, an 8-inch PVC sanitary sewer main line runs from a manhole at the north end of the street to a second manhole mid-block of Hamilton Street, and then to a third manhole at the intersection of Hamilton Street and Glacier Highway. At this point, it connects at a manhole on the 18-inch PVC sanitary sewer main line on the north side Glacier Highway. The upper section of the Hamilton Street main has a design grade of 9.43%; the lower section has a design grade of 5.70%.

5.3 Conceptual Utility Requirements

A sanitary sewer capacity analysis (Table 3) was conducted using the housing units per acre information and the following assumptions:

- 3 residents per unit;
- Average water consumption of 100 gallons per capita per day (gpcd);
- Water consumption directly correlates to sanitary sewer effluent volume;
- Peak consumption and flow occur during the morning hours between 7 and 9 a.m.; and
- One third of the daily water consumption occurs during the peak hours.

Groundwater infiltration is not taken into account in this estimate. However, the 3 residents per unit and 100 gpcd assumptions are conservative and offset the need to account for infiltration.

Table 4 below shows the full flow characteristics of 8" PVC pipe at various slopes. Based on a total area peak flow rate of 0.502 ft³/sec, 8-inch PVC sanitary sewer pipe would be adequate.

Table 3. Sanitary Sewer Analysis

Area ID	Acres	Units	Residents (3 per unit)	Usage at 100 gpcd (1000 GPD)	ft ³ /day	Estimated Peak Flow Rate 7-9 AM (ft ³ /s)
1	0.718	8	24	2.4	321	0.015
2	2.399	24	72	7.2	963	0.044
3	10.338	104	312	31.2	4171	0.191
4	1.990	20	60	6.0	802	0.037
5	2.518	26	78	7.8	1043	0.048
6	2.140	22	66	6.6	882	0.040
7	5.647	57	171	17.1	2286	0.105
8	1.107	12	36	3.6	481	0.022
<u>Total</u>	<u>27</u>	<u>273</u>	<u>819</u>	<u>82</u>	<u>10951</u>	<u>0.502</u>

Table 4. Eight Inch PVC Flow Characteristics

Pipe Size (in.)	Inside Diameter (in.)	Manning # (n)	Slope (%)	Velocity (ft/s)	Discharge (ft ³ /s)	Rate (1000 GPD)
8	7.920	0.009	0.1	1.57	0.54	347
			0.2	2.22	0.76	491
			0.3	2.72	0.93	601
			0.4	3.14	1.07	694
			0.5	3.51	1.20	776
			0.6	3.85	1.32	850
			0.7	4.16	1.42	919
			0.8	4.44	1.52	982
			0.9	4.71	1.61	1042
			1.0	4.97	1.70	1098

5.4 Access Route Alternative Utility Analysis

Utility requirements were evaluated for each route alternative, assuming that utilities would be placed in the road corridor. These utility costs do not account for any sanitary sewer infrastructure needed within the development areas. Costs within each development area will vary based on lot layout, type of development, and location within the development area. Depending on the final road alignment, it may be more cost effective to place the main sanitary sewer line in a separate easement along the southern part of each development area.

In each case, a water booster station is required to provide adequate water pressure to areas at elevations above 110 feet mean sea level (msl). Development areas 1, 2 and a portion of 3 are located at or above this elevation.

5.4.1 Access Route A

If Wildmeadow Lane was used as the only development access to all of the development areas, the following utility infrastructure would be required: approximately 6,100 linear feet (lf) of 8-inch DIP water main line, 6,100 lf of 8-inch DIP gravity sanitary sewer main line, 1,300 lf of 4-inch DIP sanitary sewer force main, two lift stations (one to serve Area 4 and another to serve Area 8 and approximately half of Area 7), and the reconstruction of 900 lf of 8-inch DIP water main line (to replace the existing 6-inch DIP water main line).

5.4.2 Access Route B

If Route B were developed as the only access to all of the development areas, the following utility infrastructure would be required: approximately 6,850 lf of 8-inch DIP water main line, 6,850 lf of 8-inch DIP gravity sanitary sewer main line, 2,500 lf of 6-inch DIP sanitary sewer force main, and two lift stations (one to serve Area 4 and another to serve Areas 8, 7, 6, and 5).

5.4.3 Access Route C

If Route C was the only access route to all of the development areas, the following utility infrastructure would be required: approximately 6,000 lf of 8-inch DIP water main line, 6,000 lf of 8-inch DIP gravity sanitary sewer main line, 2,100 lf of 6-inch DIP sanitary sewer force main, and one lift station (to serve Areas 5, 6, 7, 8, and a portion of Area 3).

5.4.4 Access Route D

If Route D (Hamilton Street) were the only access to all of the development areas, the following utility infrastructure would be required: approximately 6,200 lf of 8-inch DIP water main line, 6,200 lf of 8-inch DIP gravity sanitary sewer main line, 3,950 lf of 8-inch DIP sanitary sewer force main, and two lift stations (one to serve Area 4 and another to serve Areas 8, 7, 6, 5, and 3).

5.4.5 Access Route E

If Route E was developed as the main access road for all of the development areas, the following utility infrastructure would be required: approximately 6,300 lf of 8-inch DIP water main line, 6,300 lf 8-inch

DIP gravity sanitary sewer main line, 5,225 lf of 8-inch DIP sanitary sewer force main, and two lift stations (one to serve Area 4 and another to serve Areas 8, 7, 6, 5, 3, and 2).

6. Infrastructure Costs

Rough order of magnitude costs were developed for constructing roads and utilities for this study area. A conservative estimate of the total cost per linear foot is \$1,060. This does not include the required sanitary sewer lift station(s), the water booster station, or sanitary sewer force main. The cost of a lift station is estimated at \$100,000 and the cost of a booster station is approximately \$400,000 - \$700,000. The rough cost for each access alternative is shown in Table 5. Cost estimates could be further refined based on future decisions regarding the configuration of development parcels and other factors.

Table 5. Order of Magnitude Cost Estimates

Access Route	Linear Feet	Additional Utilities ¹ (\$000s)	Cost ² (\$M)
A	6,100	\$820-1,020	\$7.3-7.5
B	6,850	\$850-1,050	\$8.2-8.4
C	6,000	\$710-910	\$7.1-7.3
D	6,450	\$995-1,195	\$7.8-8.0
E	6,300	\$1,120-1,320	\$7.8-8.0

¹ Additional utilities include water booster station, sanitary sewer lift station(s) and force main.

² Cost does not include any ROW acquisition or needed improvements on Glacier Highway.

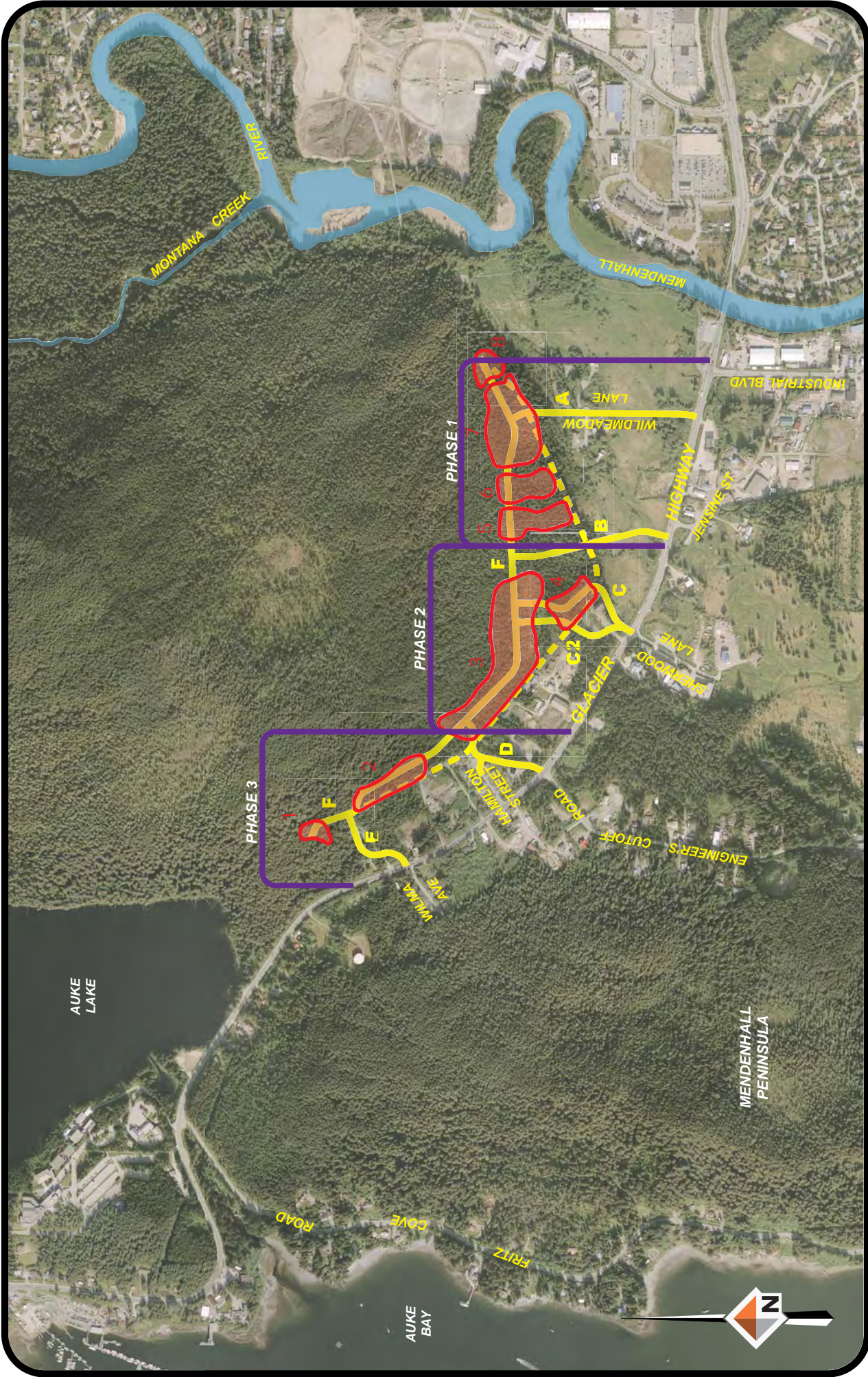
7. Phasing and Long-term Planning Issues

7.1 Phasing

The costs estimated above assumed that all development areas were served via one access road. There are several drawbacks to this assumption, including higher utility costs, poorer emergency access, and higher Glacier Highway intersection improvements required. Development phasing could also reduce costs, as some areas could be accessed and provided with utilities at a much lower cost than other areas. Potential phasing is discussed below (Figure 9).

Phase 1. This phase would include development of areas 5 through 8 with Access Route A. These areas could be developed without the need for a water booster station or sanitary sewer lift station and with a minimal amount of new road construction. The lower volume of traffic associated with these areas would minimize the need for additional improvements at Glacier Highway.

Phase 2. This phase would include development of areas 3 and 4 with Access Route C. Again, most of this area could be developed without a water booster station or sanitary sewer lift station. This phase



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CONCEPTUAL MASTER PLAN PHASING
 PEDERSON HILL ACCESS STUDY
 JUNEAU, ALASKA

Figure 9

- ▭ DEVELOPMENT AREAS
- ▭ PROPOSED ROUTES
- ▭ ALTERNATE ROUTE F

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could also be constructed without Access Route C and could rely solely on Access Route A; however, that could trigger a need for a sanitary sewer lift station and additional improvements at Glacier Highway.

Phase 3. Development of areas 1 and 2 and the western portion of area 3 would be proposed as the last phase. These areas would require a water booster station to achieve an acceptable water pressure. Access Routes D or E could provide additional access for emergency services and reduce travel time for residents heading west on Glacier Highway.

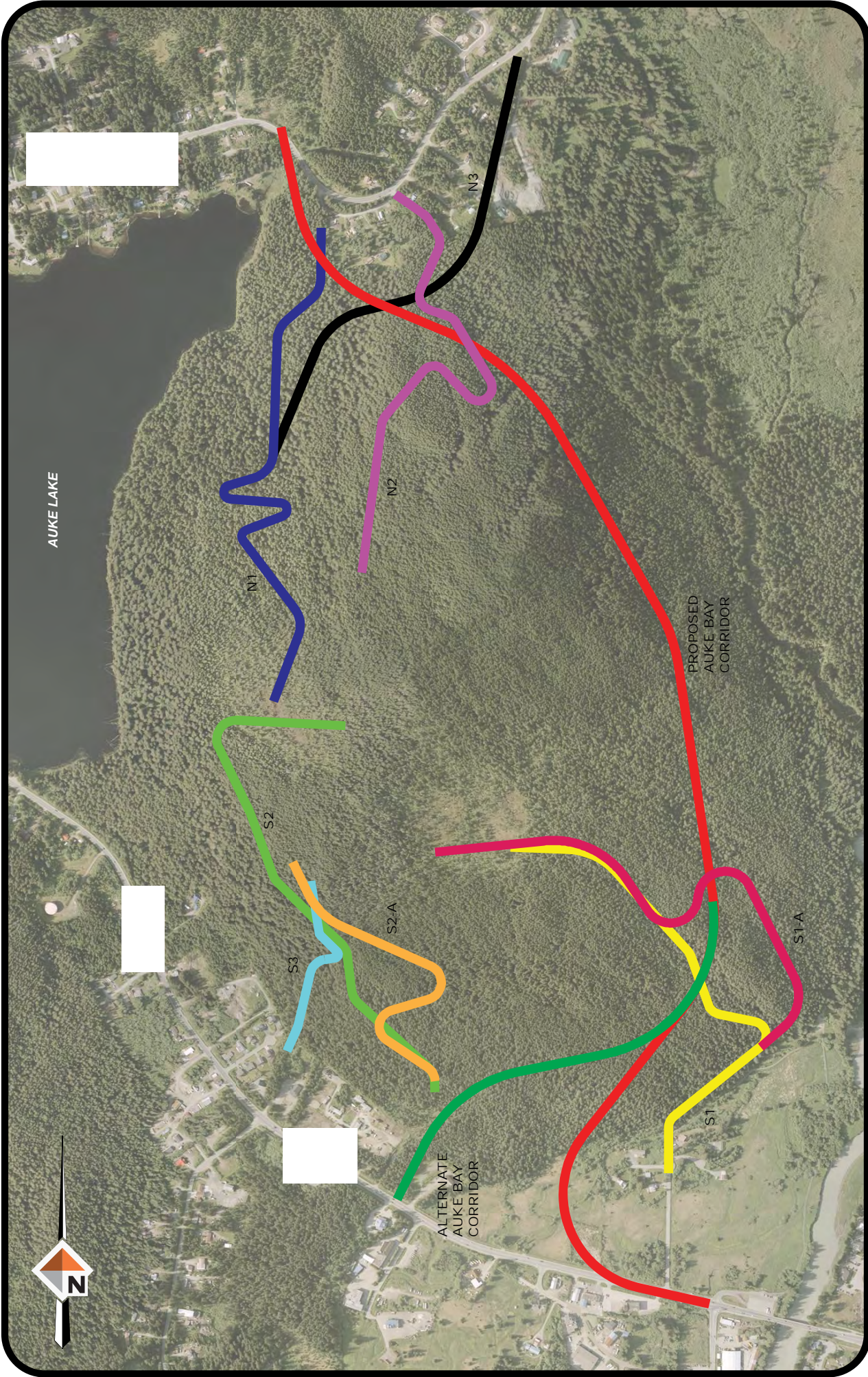
7.2 Long-term Planning Issues

The CBJ and UA also own property located north of the development areas addressed in this access study. A number of potential access routes to the top of the hill from the study area were evaluated from the south and from the north (Figure 10). Revisions to the eastern route from the south (S-1) were successful in reducing the maximum grade to under 10% (at 9.24%). The western route from the south exceeded 12%. Two potential routes from Goat Hill Road were preliminarily estimated to have maximum grades of 9-10%. These preliminary routing evaluations indicate that, by using switchbacks, acceptable road grades may be within reach but could result in longer access roads and higher construction costs.

The Alaska Department of Transportation & Public Facilities (DOT&PF) conducted an Auke Bay Corridor Reconnaissance Study in 2004. This study identified a possible bypass corridor that leaves the Glacier Highway near Industrial Boulevard and follows the east side of Pederson Hill around the hill to Goat Hill Road. This Auke Bay Corridor route has a maximum grade of just under 10%. The reconnaissance study shows this route beginning from the Brotherhood Meadow just west of Wildmeadow Lane and swinging through this wetland area, through development areas 5 through 8, and then to the north around the east side of the hill (Figure 10). This proposed corridor alignment would reduce the developable areas on the CBJ and UA properties; the extent of the impact would depend on the width of the right-of-way required. Impacts to the developable area of the properties could be minimized while maintaining a reasonable road grade if the bypass route instead headed east and then north from the north end of Wildmeadow Lane. An alternative alignment from this point is shown in Figure 10.

8. Conclusion

The CBJ is facing a significant housing shortage. In response to the need for additional housing, the CBJ is evaluating the potential to use CBJ and UA properties on Pederson Hill for medium density residential development. The properties owned by the CBJ and UA on Pederson Hill have development constraints, including wetlands, streams and drainages, steep slopes and a lack of existing access and utility infrastructure. Five access alternatives were evaluated for providing access to developable areas. Although technically feasible, providing service to all of the potential development areas with one access road to the Glacier Highway has significant drawbacks including higher utility costs, poorer emergency access, and a greater need for improvements at the intersection with Glacier Highway. Therefore, the CBJ may want to consider multiple access routes and/or phased development starting with the development areas to the east that are the closest to existing infrastructure.



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LONG-TERM ROAD ALIGNMENTS EVALUATED
 PEDERSON HILL ACCESS STUDY
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Figure 10

The chart below summarizes the advantages and disadvantages of the various access routes, if used to provide access to all 8 development areas. Access Route A has the fewest non-favorable ratings, while Access Route C has the most favorable ratings. Access Routes A and C appear to be the most favorable based on the generalized criteria considered. From a circulation and utility service perspective, constructing both Routes A and C would reduce utility costs and provide better circulation and emergency access to the development areas. Cost estimates for providing utility service using these two access routes for development areas 3 through 8 could be refined with further analysis of the development areas in terms of lot configuration, type of development and density. Given the cost of extending infrastructure to these area and the development constraints in the area, development concepts will need to achieve a fairly high density of development in smaller areas with large areas of open space to be financially feasible while being sensitive to the natural environment.

	Access Route A	Access Route B	Access Route C	Access Route D	Access Route E
 Yes/Favorable  Maybe/Moderate  No/Not Favorable					
Creates Favorable Intersection Geometry at Glacier Highway					
Maximizes Intersection Sight Distance					
Provides Better Access to Larger Development Areas					
Minimizes Construction Cost					
Minimizes ROW Acquisition Needs					
Minimizes Roadway Grades					
Decreases Number of Roads Accessing Glacier Highway					
Impacts to Private Lands/Existing Residences/Access					
Environmental Concerns (wetlands, anadromous streams, eagle nests, etc.)					

DOT&PF was asked to review and comment on a draft copy of this access study. DOT&PF's comments noted that the Access Route A (Wildmeadow Lane) was the most likely location for a future signalized

intersection, making this the best location for access to the development areas. DOT&PF also indicated that they were open to the possibility of also constructing access along Access Route C, but would need to see more analysis on the need for two access points to Glacier Highway prior to making any final decisions. Finally, DOT&PF acknowledged that although no final decision has been made on the specific routing of the proposed Auke Bay Corridor, nothing in this access study appears to be inconsistent with their future plans for this corridor.