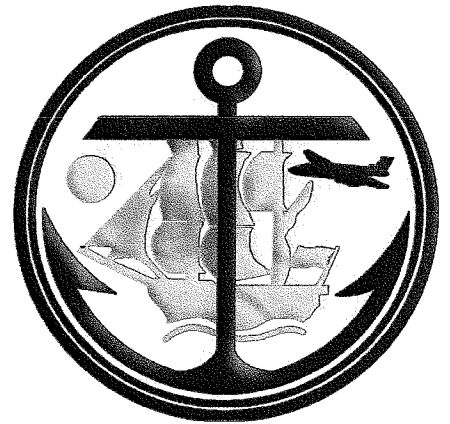


Draft Design Study Report

**MUNICIPALITY OF ANCHORAGE
PROJECT MANAGEMENT AND
ENGINEERING DEPARTMENT**

**100th AVENUE EXTENSION
MINNESOTA DRIVE TO KING STREET**



PM&E Project No. 01-009

April 2005

**Prepared by:
USKH, Inc.
2515 A Street
Anchorage, Alaska 99503**

**MUNICIPALITY OF ANCHORAGE
PROJECT MANAGEMENT AND ENGINEERING
Draft Design Study Report**

for

100th Avenue Extension
Minnesota Drive to King Street



Prepared By:

Steven M. Kari, P.E. Date
Project Manager
USKH, Inc.

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Project Management and Engineering

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Director of PM&E
Municipality of Anchorage
Project Management and Engineering

**100th AVENUE EXTENSION PROJECT
MINNESOTA DRIVE TO KING STREET
PM&E Project No. 01-009**

NOTICE TO USERS

This report reflects the opinions and design decisions as of April 2005. Changes frequently occur during the evolution of the design process, so persons who may rely on the information contained in this document should check with the Municipality of Anchorage, Project Management and Engineering Department for the most current design. Please contact Mr. John Smith, Project Manager, at 343-8422 for this information.

PLANNING CONSISTENCY

This report has been prepared by USKH, Inc. (USKH), in accordance with current design standards and federal regulations, and with the input offered by local government and public. The Project Management and Engineering Department has reviewed and approved this document as being consistent with the present community planning.

PUBLIC WORKSHOP

We hereby certify that the Municipality of Anchorage Project Management and Engineering Department held a Public Open House on Tuesday February 25, 2003 at the Klatt Elementary School. A copy of the sign-in sheet and comments are included in Appendix J.

The Municipality has considered the project's social and economic effects upon the community, its impacts on the environment, and its consistency with planning goals and objectives as approved by the local community. All records are on file at the Municipality of Anchorage, Project Management and Engineering Department, 4700 South Bragaw Street, Anchorage, Alaska.

Howard Holtan, P.E., L.S. Date
Director of PM&E
Municipality of Anchorage
Project Management and Engineering

John Smith, P.E. Date
Project Manager
Municipality of Anchorage
Project Management and Engineering

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ACRONYMS

AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans With Disabilities Act
ADAAG	ADA Accessibility Guidelines
ADEC.....	State of Alaska Department of Environmental Conservation
AMATS.....	Anchorage Metropolitan Area Transportation Solutions
ATM.....	Alaska Traffic Manual
BOP	Beginning of Project
CMP	corrugated metal pipe
DCM	Design Criteria Manual
ADOT&PF	State of Alaska Department of Transportation and Public Facilities
DSR.....	Design Study Report
IGRL	Information Guide for Roadway Lighting
ML&P	Municipal Light & Power
MOA	Municipality of Anchorage
NEC.....	National Electrical Code
NPDES	National Pollutant Discharge Elimination System
PCM	Preconstruction Manual
PS&E.....	Plans, Specifications and Estimates
ROW	Right-of-Way
SMA	Stone Mastic Asphalt
TFDG	Transit Department Transit Facilities Design Guidelines
TIP.....	Transportation Improvement Plan
USKH.....	USKH, Inc.

EXECUTIVE SUMMARY

This document is a narrative summarizing the investigation and design process used to evaluate the existing conditions and the extent of construction required to extend 100th Avenue approximately 1 mile from Minnesota Drive to King Street in Anchorage, Alaska. Important design issues have been identified by comparing existing conditions to current design criteria. Alternative solutions to these potential issues have been developed, and recommendations have been made as to which alternatives should be implemented.

A geotechnical investigation identified highly frost-susceptible soils and high subgrade moisture contents, the combination of which can create frost-heave induced problems in pavement. Significant deposits of peat were also identified on the west half of the project within the North Klatt Bog. Various treatments of existing peat were studied with the recommended treatment utilizing the surcharge fill method of construction.

The 100th Avenue alignment is located on a ¼ section line. The limits of the bog are such that altering the alignment of the roadway will not significantly reduce the impact to the bog. For discussion purposes, the roadway centerline is stationed from 10+00 at Minnesota Drive to station 59+00 at King Street.

The project is being designed to Class I Collector standards with a 45 mph design speed and an estimated ADT of 8,820 in design year 2023.

The current estimate for the cost of roadway construction and ROW acquisition is \$4,500,000. This cost estimate does not include design engineering, construction engineering, or costs associated with potential wetland mitigation.

A two-lane urban typical section alternative, including curb and gutter, pathway, sidewalk, and insulation board, was developed to provide full protection against freezing of the subgrade. An alternative rural section was developed and is recommended for the area crossing the existing bog, extending from station 21+00 to station 45+00. Both typical sections include a pathway on

the south side of the roadway from station 10+00 to 59+00 and a sidewalk on the north side from station 48+00 (C Street) to station 59+00.

The intersection of the newly construction C Street and 100th Avenue will include the installation of a traffic signal. The 100th Avenue project will utilize signal pole foundations, junction boxes, conduit runs, and load centers constructed with the C Street project to support both the proposed traffic signal and lighting improvements.

The existing ground along the 100th Avenue alignment slopes downward to the west with a drop of approximately 40' occurring between King Street and Minnesota Drive. The proposed drainage utilizes a combination of new storm drains in the curb and gutter areas and sheet flow off of the roadway side slopes directing runoff into the bog in the rural section. The proposed storm drain system running between station 45+00 and station 55+00 will be routed west and flow into the existing bog.

A dedicated 70-foot Right-of-Way (ROW) exists from station 22+00 to station 36+00. The project will require an 80-foot minimum ROW over the project length. The necessary property acquisitions are not expected to severely impact private property since much of the existing land, where acquisitions are required, is essentially undeveloped.

The following permits will be required on the project:

- Department of the Army Permit
- Alaska Coastal Management Program Consistency Determination
- Water Quality Certification
- National Pollutant Discharge Elimination System General Permit for Storm Water Discharges from Construction Activities
- Municipality of Anchorage Right-of-Way Permit

Illumination is recommended for the entire project length to maintain a safe roadway and trail system for motorists and trail users.

1.0 INTRODUCTION

1.1 Project Location and Description

100th Avenue is located in south Anchorage between Dimond Boulevard and O'Malley Road. This project extends 100th Avenue from Minnesota Drive to King Street, crossing the North Klatt Bog near its west end. Primary improvements include embankment construction, asphalt concrete pavement, curb and gutter, drainage, street lighting, pedestrian facilities, and landscaping, and a traffic signal. Figures 1 and 2 present the location and vicinity maps, respectively.

1.2 Purpose of Project

The Municipality of Anchorage (MOA) Project Management and Engineering (PM&E) initiated this project to improve traffic circulation and reduce overall vehicle miles traveled (VMT) in south Anchorage. Existing travel corridors such as Minnesota Drive, Dimond Boulevard, Old Seward Highway, and O'Malley Road are becoming highly congested during peak hours of travel. The extension of 100th Avenue will reduce congestion by providing a new, year-round multi-modal access route between transit stations, schools, shops, employment centers, and park and recreational facilities. It will increase the safety of people and property by reducing response times for both fire and emergency medical treatment services and the addition of sidewalks and pathways will provide safe and convenient access for pedestrians and bicyclists.

The 100th Avenue extension is considered a short-term priority and it is currently ranked third in the MOA 2006-2009 Capital Improvement Budget. This important roadway connection is expected to provide the highest congestion relief value of any new collector roadway in Anchorage.

The purpose of this design study is to identify and evaluate proposals for street improvements. This Design Study Report (DSR) presents the various alternatives considered in the development of the project. The alternatives are analyzed and design recommendations are presented.



**THIS PROJECT
MOA PM&E
PROJECT NO. 01-009**

**100TH AVENUE EXTENTION
MINNESOTA DRIVE TO KING STREET
MOA PM&E PROJECT NO. 01-09**

APRIL 2005

USKH

ARCHITECTURE • ENGINEERING
LAND SURVEYING • PLANNING

LOCATION MAP

FIGURE 1

1.3 Description of Existing Conditions

The proposed horizontal alignment for 100th Avenue is generally located along a ¼ section line. There are no horizontal curves and only one deflection point. The topography along the route slopes downward about 40 ft from east to west.

The existing conditions over the length of the project vary from undeveloped Class B Wetlands to partially developed heavy industrial areas. On the north side of the 100th Avenue corridor, beginning approximately 400 feet east of the northbound Minnesota Drive Ramps and extending for a distance of 700 feet, a large gravel-fill pad has been placed which measures 400 feet wide. A church has been constructed on the site and is owned by Anchorage Christian Center, Inc. On the south side of 100th Avenue, the corridor traverses undeveloped bogs, with black spruce and other vegetation indicating the existence of wetlands.

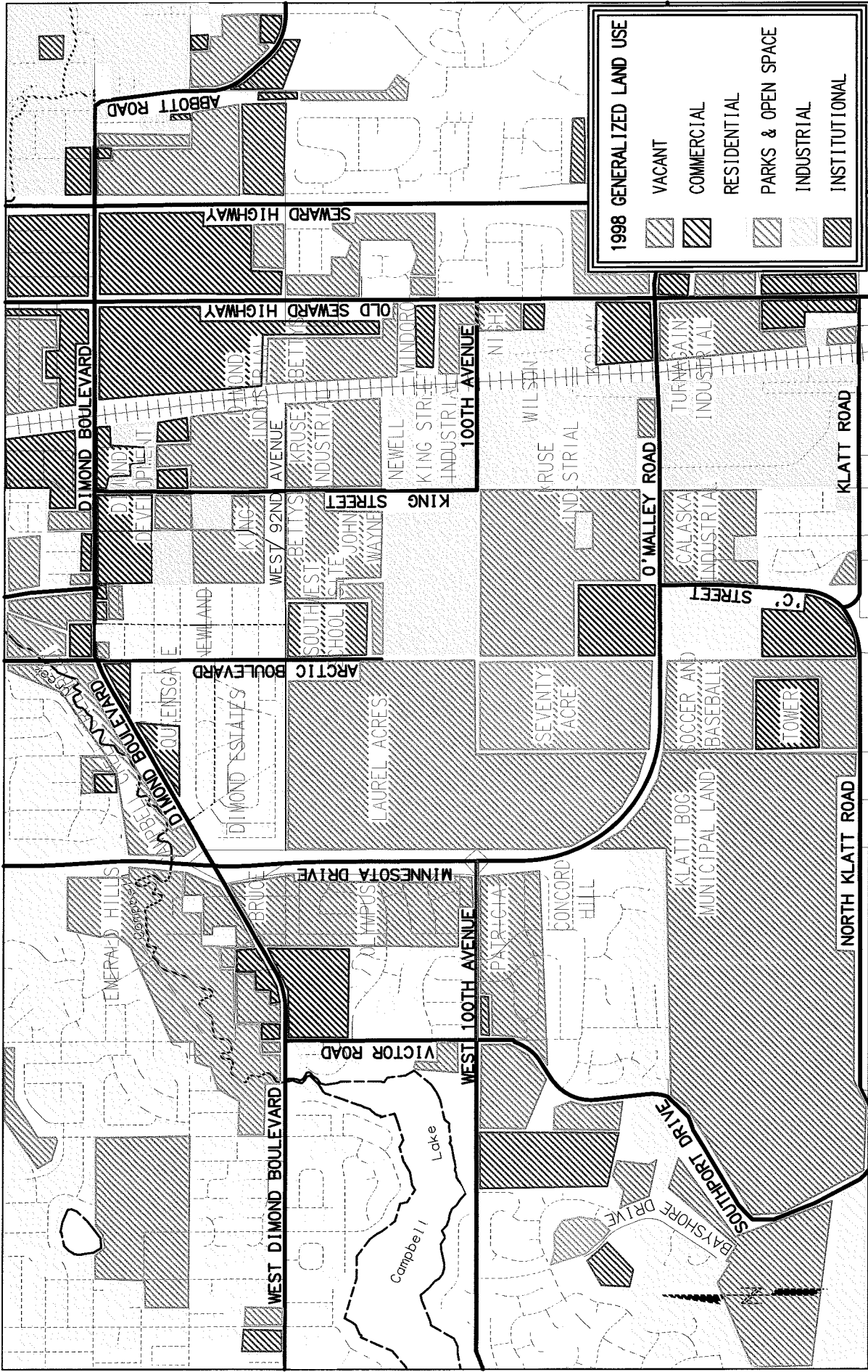
From the edge of the gravel pad east for approximately one-quarter mile to the platted Artic Boulevard ROW, bogs and wetlands are present on both sides of the planned corridor.

At the platted Artic boulevard ROW, a municipal snow dump and sedimentation basin is located to the north side of the 100th Avenue corridor, extending east for a distance of 800 feet, where the planned C Street Extension project will intersect 100th Avenue. The south side of this section is undeveloped.

From the future C Street intersection east to King Street, the 100th Avenue corridor traverses a construction yard along the north side, and a gravel and machinery storage area along the south side.

1.4 Land Status and Zoning

Figure 3 depicts the zoning in the project vicinity according to the Anchorage Zoning Atlas. The land surrounding the project has been divided into three zoning categories. Lots to the north of the planned 100th Avenue alignment, between Minnesota Drive and the Artic Boulevard ROW, and south of the alignment to Station 23+20, are zoned single family residential (R-1). The



1998 GENERALIZED LAND USE

	VACANT
	COMMERCIAL
	RESIDENTIAL
	PARKS & OPEN SPACE
	INDUSTRIAL
	INSTITUTIONAL

APRIL 2005

100th AVENUE EXTENSION STUDY
1998 LAND USE MAP
 MINNESOTA DRIVE TO KING STREET
 MOA PM&E PROJECT NO. 01-09



FIGURE 3

MOA Parks, Cultural, and Recreation Services Land south of the alignment are zoned Public Lands and Institutions (PLI). All lots east of the Arctic Boulevard ROW are zoned Heavy Industrial (I-2).

1.5 Right-of-Way

The 100th Avenue Extension project will require ROW acquisition over its entire length. Except for the area between Rovenna Street and Arctic Boulevard, where a 70-foot ROW has been dedicated, no dedicated ROW exists for this section. A minimum 80-foot ROW will be necessary for construction of this collector roadway.

1.6 Utilities

Water and Wastewater

Anchorage Water and Wastewater Utility (AWWU) serves the areas adjacent to the project with a network of distribution pipes extending the entire length of King Street and East 100th Ave, with laterals branching off most of the side streets in the area. AWWU has no plans to expand into the project area at this time.

Sanitary sewer mains serve the south end of King Street and the entire length of East 100th Avenue. The Sewer mains along King Street consist of 8- and 12- inch ductile iron pipe installed at grades of approximately 0.4 to 1.2 percent with cover ranging from 6 to 10 ft. The sewer mains along East 100th Avenue are 8-, 10- and 16-inch ductile iron pipe. AWWU has no plans to expand into the project area at this time.

Anchorage Christian Center Inc. has proposed water and sewer to be installed along the Minnesota Drive frontage road into the northeast corner of the property.

Electric

Chugach Electric Association (CEA) has constructed a large overhead transmission line within the project limits. This facility consists of steel towers founded on pipe piles, which were installed approximately 40 feet south of the quarter-section line.

Natural Gas

Anchorage Christian Center, Inc. is served by Enstar Natural Gas Company. A three-inch plastic distribution line runs along the north edge of East 100th Avenue between Old Seward Highway and King Street. Enstar has no plans to extend their facilities into the project area at this time.

Telephone/Cable Television

There are no telephone or cable television lines present in the project area at this time.

1.7 Future Development

Construction of 100th Avenue would result in the loss of 3.41 acres of wetlands. In addition, the potential for collection of the wetland water supply within the roadway material could increase the rate of drainage from the wetland. Historically, low shrubs and herbaceous vegetation scattered with ponds, low lying flooded areas and higher shrub areas are typical of the area. These have dried due to increased drainage, or loss of inflow, or both. The construction of 100th Avenue could continue to exacerbate this effect.

The effect of development induced by the construction of 100th Avenue would probably be greater than the impact of the roadway. The land bordering the proposed alignment is zoned for light industrial use, which allows for a wide range of development types, including residential, commercial, industrial, and office uses. Ongoing development along the 100th Avenue corridor between Minnesota and King Street would continue if 100th avenue is extended. The rate of development would likely increase because access would improve from both the west and east. A majority of the undeveloped land is wetlands. The degree of wetland loss due to changes in the water regimes that might result from development is unknown.

2.0 PROJECT DESIGN CRITERIA

2.1 Street Design Criteria

100th Avenue is classified in the Official Streets and Highways Plan (OS&HP) as a Class I Residential collector between Minnesota Drive and C Street and as an industrial/commercial Class IA Collector between C Street and Old Seward Highway. These designations are base upon usage and ADT. The recommended design ADT for the 100th Avenue extension is 2,000

to 10,000. Construction of the 100th Avenue Extension will be completed according to the criteria established by the DCM, and Title 21 of the Anchorage Municipal Code of Regulations. Design criteria for the project is included in Appendix A. References are listed in the order of precedence.

2.2 Trail Design Criteria

The January 1996 Anchorage Trails Plan Update (ATPU) shows a multi-use paved trail on the south side of East 100th Avenue from the Old Seward Highway west to Bayshore Drive. In conformance with the requirements of this plan, an 8-foot-wide paved pathway is proposed for the south side of East 100th Avenue. Construction of the multi-use trail will be completed according to the criteria established by the DCM, the Areawide Trails Plan, and Guide for the Development of Bicycled Facilities, published by AASHTO. Applicable criteria are presented in Appendix A.

3.0 GEOTECHNICAL INVESTIGATIONS

3.1 Soil Investigation

On April 22 and 23, 2002, Golder Associates Inc. (GAI), conducted subsurface explorations within the project limits. A total of 9 boreholes were drilled to depths ranging from 16 to 26 feet. The test hole locations were chosen based upon a review of the available data and an inspection of conditions along the route.

3.2 Existing Conditions

Subsurface conditions along the alignment can be subdivided into partially developed and undeveloped segments. GAI's boring logs indicate 0 ft to 14 ft of fill material, underlain by 5 ft to 11 ft of peat, which overlies various layers of clay, silt, and sand in the partially developed areas. In the undeveloped areas between the Arctic Boulevard and Rovenna Street, wetland soils consist of up to 19 feet of peat, the average depth being 10 feet. Below the peat, and clay layers vary in thickness from 2 feet to 7 feet. Slotted PVC piping was installed in several boreholes to allow for monitoring of the water table. Ground water levels range from near the surface (0 ft) in the bog areas, to 14.9 ft below ground surface, where fill has been placed.

3.3 Recommendations

To fit the variety of existing conditions and the variability of possible improvements, several distinct approaches to the structural section could be used. Road embankments constructed over peat will settle and will require maintenance or reconstruction at more frequent intervals than desired unless measures are taken to limit the potential settlement. Golder Associates recommends a combination of surcharge fill techniques and full excavation of poor quality fill materials. Due to the combination of frost susceptible soils and shallow ground water, insulation should be used to limit frost penetration.

A report entitled *Geotechnical Design Criteria 100th Avenue Extension Minnesota Drive to King Street* is included as Appendix E, *Geotechnical Report*. The report provides detailed information on the investigation, soil test results, measurements of the water table, and design recommendations.

4.0 DRAINAGE AND HYDROLOGY

A hydrologic and hydraulic analysis is included in Appendix F. The analysis describes drainage characteristics in the project area and discusses several alternative solutions.

4.1 Existing Conditions

The topography along the alignment slopes from east to west at an average rate of 0.6%. The eastern side of the study area has developed areas including a snow storage area, a dirt road forming the future alignment of the C Street Extension, and industrial land use on either side of the proposed 100th Avenue alignment. The industrial land on either side of the alignment between the proposed C Street and King Street (approximately 5 acres) will drain towards the road and should be included in the drainage collection design.

A small area on the western side of the study area has recently been developed by Anchorage Christian Center, Inc. Besides the church area, the west half of the proposed road alignment is located within an extensive wetland area, North Klatt Bog. The bog extends north and south of the proposed alignment.

4.2 Area Hydrology

The most significant source of water in the bog is precipitation, which is approximately 8 to 21 inches per year. North Klatt Bog contains both natural and constructed surface water conveyance systems. Surface water typically escapes ponded areas through evapotranspiration, groundwater infiltration, flow through micro-channels, and sheet flow. The general flow direction through North Klatt Bog was found to be toward the west. This flow is captured by a ditch paralleling Minnesota Drive where it enters a storm drain inlet at 100th Avenue. The final receiving body is Campbell Lake and Bayshore Lake.

4.3 Changes in Drainage Patterns

The 100th Avenue Extension may affect the drainage patterns in the bog. The following predictions have been made based on the preliminary road design: The southern side of the alignment may become wetter; while the northern side of the alignment may become drier. The localized area near the inlet and outlet of the cross drainage culverts (to be installed) may experience ponding, while the area between the culverts on the north side may become drier because the embankment may block the natural sheet flow. Design of the cross culvert system will closely maintain existing drainage patterns across the road embankment to prevent bog dehydration, meet ADEC and Environmental Protection Agency stormwater treatment requirements, and match existing stormwater management systems in the area where applicable.

4.4 Storm Drain System

To adequately address all of the design goals for the project, several types of drainage techniques will be employed along the roadway alignment.

At the beginning of the proposed extension of 100th Avenue water will be captured in curb and gutter structures that will parallel the road on both sides. Water will flow into catch basin inlets, which will lead into the existing storm drain system at the intersection of Minnesota Drive and 100th Avenue.

Across Klatt Bog the drainage goal will be to maintain bog hydrology. The drainage and treatment technique for this section is grass filter strips on the roadside slopes. Treated water

will drain from the side slopes into the natural vegetation, where existing drainage patterns can disperse the water through the bog. This technique will continue further along the south side of the alignment until the developed area is reached (station 44+00).

The next section contains the developed land north of the alignment (the snow storage property). Water in this area will be captured and channeled westward in a vegetative swale for release into the bog.

East of the C Street alignment to station 53+00 water will be conveyed along the roadway by curb and gutter. Catch basins will channel runoff into a piped storm drain system which will feed into the drainage swale described above, providing additional water for the bog.

From station 53+00 to the end of the project water will be conveyed to an existing treatment wetland via curb and gutter and an existing storm drain system on King Street.

5.0 PERMITTING

The extension of 100th Avenue from C Street westward to Minnesota Drive requires permits because the work will entail placing fill in wetlands. The Alaska Department of Transportation and Public Facilities (ADOT&PF) holds permits for the C Street Extension that allow it to fill the wetlands within its project footprint. Since C Street will be constructed before the King Street to C Street portion of 100th Avenue, that portion of 100th Avenue may be built without environmental permits. It is unknown whether the ADOT&PF has modified its permits to allow filling of additional wetlands necessary for reconstruction of the snow dump entrance.

5.1 Permitting Requirements

The following permits are needed for the 100th Avenue Extension:

- **Department of the Army Permit** – This permit is issued by the U.S. Army Corps of Engineers (COE) under authority of Section 404 of the Clean Water Act. PM&E must submit an Individual Permit application to the Corps of Engineers. The COE takes approximately 90 days to process the application, place a public notice, and issue the

permit for a routine, noncontroversial project. The COE solicits comments specifically from federal agencies, and weighs those comments, along with public input, to determine what is in the public interest and whether to issue a permit, and with what stipulations.

The permitting process does not have set timelines for resolution of issues raised by the public or agencies, so issuance of a permit for a complex process may take many months.

- **Alaska Coastal Management Program Consistency Determination** – PM&E will need to submit a Coastal Project Questionnaire to the Alaska Department of Natural Resources (DNR) and certify that the project is consistent with the Alaska and Anchorage Coastal Management Programs. DNR will conduct a project review process to seek state agency and public comment on the project regarding its consistency with standards of the coastal management programs. This program is presently in transition among state agencies but the process is not expected to change.
- **Water Quality Certification** – This certification is issued under authority of Section 401 of the Clean Water Act by the Alaska Department of Environmental Conservation. The application for the Department of the Army permit serves as PM&E's application for this authorization.
- **National Pollutant Discharge Elimination System General Permit for Storm Water Discharges from Construction Activities** – Because the area of ground to be disturbed by this project will exceed five acres, PM&E's contractor will need to comply with this General Permit. PM&E typically includes this requirement in the construction specifications.
- **Municipality of Anchorage Right-of-Way Permit** – PM&E issues this permit. When PM&E does the plan review for the road, and the contractor has been selected, the pre-construction meeting held, the Notice to Proceed issued to the contractor, and the traffic control plans developed, the Right-of-Way section will issue the permit either to the construction contractor, or to PM&E itself.

In addition to these authorizations, the project's drainage plans must be reviewed by the Alaska Department of Environmental Conservation to ensure that drainage and water quality are handled appropriately.

Two multi-agency meetings have been held to discuss this project. These were attended by representatives of PM&E, PM&E's consultants USKH and HDR, the COE, Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service (USFWS), Alaska Division of Governmental Coordination, and the Municipality of Anchorage Planning Department. The federal agencies expressed substantial concern about the C Street to Minnesota Drive segment of this project. Their concerns are related to the direct impacts of the road on North Klatt Bog's hydrology and wildlife habitat (loss and fragmentation), and the indirect effects of the project – its potential to induce development in adjacent parts of the bog. They referred to the Section 404(b)(1) Guidelines, which require that a project subject to permitting under Section 404 undergo a sequential analysis to prove that it incorporates all practicable measures to avoid, minimize, then compensate for unavoidable wetland losses. A non-water-dependent project is presumed to have a practicable alternative located in uplands until that is proven otherwise.

The COE, under the watch of the EPA, will require that the 404(b)(1) process be rigorously implemented on this project. PM&E must, in sequence, prove that the project is presently needed, that no upland alternatives exist, and that all practicable minimization measures have been incorporated into the project planning, such as use of bridges (see Appendix G for further discussion). Then, appropriate compensation for the unavoidable wetland losses associated with the project must be determined. The COE has requested that compensation be directed at protection or enhancement of North Klatt Bog. Compensation could be in the form of permanently protecting wetlands from development by purchasing a conservation easement on them, donating funds to a third-party to effect this preservation, or rectifying past damage to the bog, for example by providing more surface water to dried portions of the bog.

During the public comment period of the Department of the Army permitting process, if the USFWS and EPA are not satisfied with the proposed project, they will likely recommend to the COE that the permit be denied. They may also deem that the affected wetlands are an Aquatic Resource of National Importance, and cite interagency agreements that grant them the right to review the Corps' permit decision prior to its issuance and to elevate any concerns to higher levels of their respective agencies prior to permit issuance.

5.2 Permitting Cost

Acquiring permits for the project is estimated to cost approximately \$90,000 in environmental consultant time, plus participation of the design team and PM&E staff time. Compensatory mitigation costs cannot be defined until compensation alternatives are developed and reviewed by the agencies. A rough estimate is that PM&E will spend \$200,000 to \$500,000 to compensate for wetland impacts.

6.0 TRAFFIC ANALYSIS

An Analysis of the present and future traffic volumes in South Anchorage indicates that construction of the 100th Avenue Extension from Minnesota Drive to King Street is necessary to meet the future transportation needs of south Anchorage. The proximity of major traffic generators to existing saturated arterial roadways, and lack of alternative routes provided by collectors, have created major intersection congestion. Traffic modeling has demonstrated the benefits to be realized in intersection LOS resulting from the construction of the 100th Avenue Extension. AADT of 8,820 vehicles is expected in the design year 2023. Reductions in intersection delay allow for reductions in CO emissions, reductions in VMT, and increased safety for the public. A full report is included in Appendix H.

7.0 LANDSCAPING AND AMENITIES

Since the streets in this project are collectors, the Planning and Zoning Commission (P&Z) is required to review and approve the project. One of the recommendations often placed on a street project by the P&Z Commission is to resolve landscaping issues with the Urban Design Commission (UDC), and sometimes the UDC requires landscaping to be installed. Municipal Code Sections 21.40.200 and 21.40.210 require landscaping for both visual enhancement and to provide buffers in areas zoned I-1 and I-2. Discussion of landscaping options is discussed in Appendix I.

8.0 DESIGN ALTERNATIVES & RECOMMENDATIONS

The purpose of the design study is to identify and evaluate different design alternatives for street improvements. To facilitate the evaluation of the various alternatives, it was recognized that different issues control the design of the roadway in the Klatt Bog versus the upland areas at either end. Construction within a class "B" wetland requires design features and construction

methods that minimize and mitigate wetland impacts. During the permitting process several different wetland mitigation measures were analyzed. For the complete analysis see *100th Alternatives Analysis* in Appendix G.

Alternatives considered and recommendations for each aspect of the project are discussed below. The recommendations for this project will bring 100th Avenue into conformance with the DCM, the OS&HP, and other applicable standards as much as possible with consideration of economical, practical, and safety limitations.

The centerline alignment for 100th Avenue should generally match the ¼ section line on which it is platted. However, horizontal displacement of the street centerline from the ¼ section line may be required to place the selected typical section within the ROW and to minimize property acquisition. The profile should be designed to meet the 45 mph design speed required by the DCM. Horizontal alignments and profiles are shown in Appendix C, Plan and Profiles Sheets.

Two alternative profiles reasonably represent the range of options available for this project. The primary difference between the two profiles is in the grade where the alignment crosses the bog. The need to minimize the footprint of the roadway embankment across the bog requires that the height of fill be kept to a minimum. The minimum fill height is also dictated by the cover requirements of cross culverts and other utilities. The DCM dictates the minimum roadway profile grade required for an urban typical section having curb and gutter and this profile has been presented in Alternative 1. Alternative 2 offers a profile grade that is slightly flatter, relying upon the cross slope of the roadway to sheet water off of the driving surface.

Alternative 1 represents a typical section having curb and gutter for the entire length of the project. Between King Street and C Street the typical section provides a 38-foot wide paved surface with Type 1 curb and gutter. A 5-foot sidewalk and an 8-foot pathway on the north and south sides respectively are provided for pedestrians and bicyclists. This typical section is depicted in Figure A of Appendix B, Typical Sections. From C Street west to Minnesota the paved surface would taper to 36-feet. An 8-foot path on the south side with a 6.5-foot separation for snow storage would provide pedestrian and bicycle access. This alternative meets the

requirements of the ATPU, has curb and gutter and is depicted in Figures B and C of Appendix B, Typical Sections. Typical sections B and C differ in that the portion of the roadway from the BOP to Station 21+00 will make use of previously placed structural fill.

Alternative 2 considers the use of curb and gutter over the entire length, except across the bog. To minimize and mitigate the impacts to the wetlands a rural section was developed for the segments of the alignment crossing the bog. This section has a smaller footprint and requires less ROW than the urban section. The section through this area would have a 36-foot wide paved surface. An 8-foot-wide pathway on the south side with a 7-foot separation for snow storage will provide pedestrian access and meet the requirements of the Anchorage Trails plan update. This typical section is depicted in Figure D of Appendix B, Typical Sections.

In response to a request to consider providing greater separation between the roadway and the path, an alternative pathway alignment was considered. Between Stations 21+00 and 36+00 the pathway was shifted 20 feet to the south. An existing 25-foot trail easement across MOA Parks Cultural & Recreation Services Land makes this possible. Due to the increased impact to the wetlands area this alternative was discarded.

8.1 Analysis of Alternatives

Rural sections do not have curb and gutter, allowing roadway drainage to flow from the crown of the roadway toward the shoulders, and down the side slopes. Recognizing that surcharge fills have the potential to settle non-uniformly over time, the value of a rural type of section becomes more apparent. Curb and gutter is more likely to crack and have irregularities in the flow line, increasing the chance of ponding and other drainage problems. Storm drain systems that may initially function properly may be short-circuited by differential movement in the embankment. Reverse flow situations may occur and pipe joint connections may be compromised, possibly allowing fill into pipes and leading to failures in the roadway surface. The rural typical section also provides some degree of water quality improvement by mechanically filtering sediments from runoff as it passes through the grassy filter strips along the sides of the roadway. Minimizing the point discharge of storm runoff and distributing it over the bog crossing length mitigate impacts to the bog hydrology resulting from this project.

Alternative 2 offers several advantages over Alternative 1, including:

- Lower overall construction cost.
 - Less curb and gutter,
 - Less storm drain pipe,
 - Less right-of-way.
- Lower road maintenance costs.
- Less impact to bog
 - Smaller area of footprint,
 - Less fill placed,
 - Water quality mitigation improved,
 - Less impact to bog hydrology.

In summary, it is our opinion that Alternative 2, with a rural typical section constructed across the bog, is the preferred alternative.