AIRPORT DEVELOPMENT

AIRPORT DEVELOPMENT

INTRODUCTION

Remote camps and communities in Alaska have been served by general transport aircraft since the late 1950's. Since that time, air service provided by general transport aircraft in Alaska has primarily included mail and cargo delivery, passenger transportation, medical evacuations, as well as the transport of construction materials and equipment.

One general transport aircraft which has proven successful in the transport of construction materials and equipment, general cargo, and passengers to remote camps and communities in Alaska is the Lockheed Hercules. This aircraft was initially designed by Lockheed during the early 1950's for use by the U.S. Air Force and U.S. Army as a cargo/troop carrier (C-130) (Lockheed-Georgia Company, 1980). The Lockheed Hercules was initially intended to provide straight-in rear loading for palletized cargo, and a ramp which would allow trucks, howitzers, jeeps, and bulldozers to drive on. In addition, it was intended that this aircraft be capable of delivering men and supplies to remote or short-field situations (Dabney, 1981). Since its first delivery of the Hercules to the U.S. military in 1956, Lockheed has delivered approximately 1,000 of these aircraft to the U.S. military and an additional 600 Hercules to numerous international and commercial operators. Alaska International Airways in Fairbanks currently maintains a fleet of 5 Hercules and is the only operator in Alaska which uses the aircraft on a commerical basis.

In the following paragraphs, concepts for the development of a general transport airport capable of handling Lockheed Hercules, and other smaller aircraft within the project area, are presented and analyzed in terms of a recommended design approach and general concept; required facilities and general design criteria; O/M labor and heavy equipment requirements; and estimated mobilization, construction, and O/M costs.

RECOMMENDED DESIGN APPROACH AND GENERAL CONCEPT

Because of the dependency on general aviation for the support of many remote camps and communities in Alaska, a sizeable number of local building contractors, Federal Aviation Administration (FAA) and local government officials, as well as commercial and recreational pilots, are well acquainted with common O/M problems and practical construction solutions associated with airfield development in the Alaskan Bush. Complementing this local expertise is the availability of extensive FAA design criteria and requirements which provide excellent predesign guidance to airport designers and building contractors. Information available from both of these general sources should be carefully evaluated during the design phase of the proposed airport. However, design guidance from these sources must be combined with a detailed review and analysis of existing soil, hydrology, and climatic conditions which will provide the primary basis for detailed airport design.

Even though no substantive field investigations or resource analyses were made in conjunction with this planning effort, a cursory field reconnaissance of the project area and gross review of general soils data suggest that the project area is probably characterized by a significant amount of saturated soils and swampy muskeg areas. Consequently, design of the airport runway and support facilities must recognize the potentially damaging mechanisms of frost heave and progressive frost jacking of objects within the freezing zone, as well as the settlement or softening (loss of bearing capacity) of the soil upon thawing (Smith, Reed, et al, 1979).

Figure 5 presents a conceptual airport plan for the development of a general transport airport in the project area. The airport would provide adequate runway area, air control, lighting, storage, and ancilliary facilities necessary to accommodate the use of a Lockheed Hercules aircraft during prevailing and crosswind conditions.

REQUIRED FACILITIES AND GENERAL DESIGN CRITERIA

Introduction

The following paragraphs provide more specific discussion concerning the relationship, size, and orientation of facilities required for airport development. It is intended that these brief descriptions will serve as conceptual design parameters during the ultimate design of the airport.

Runways

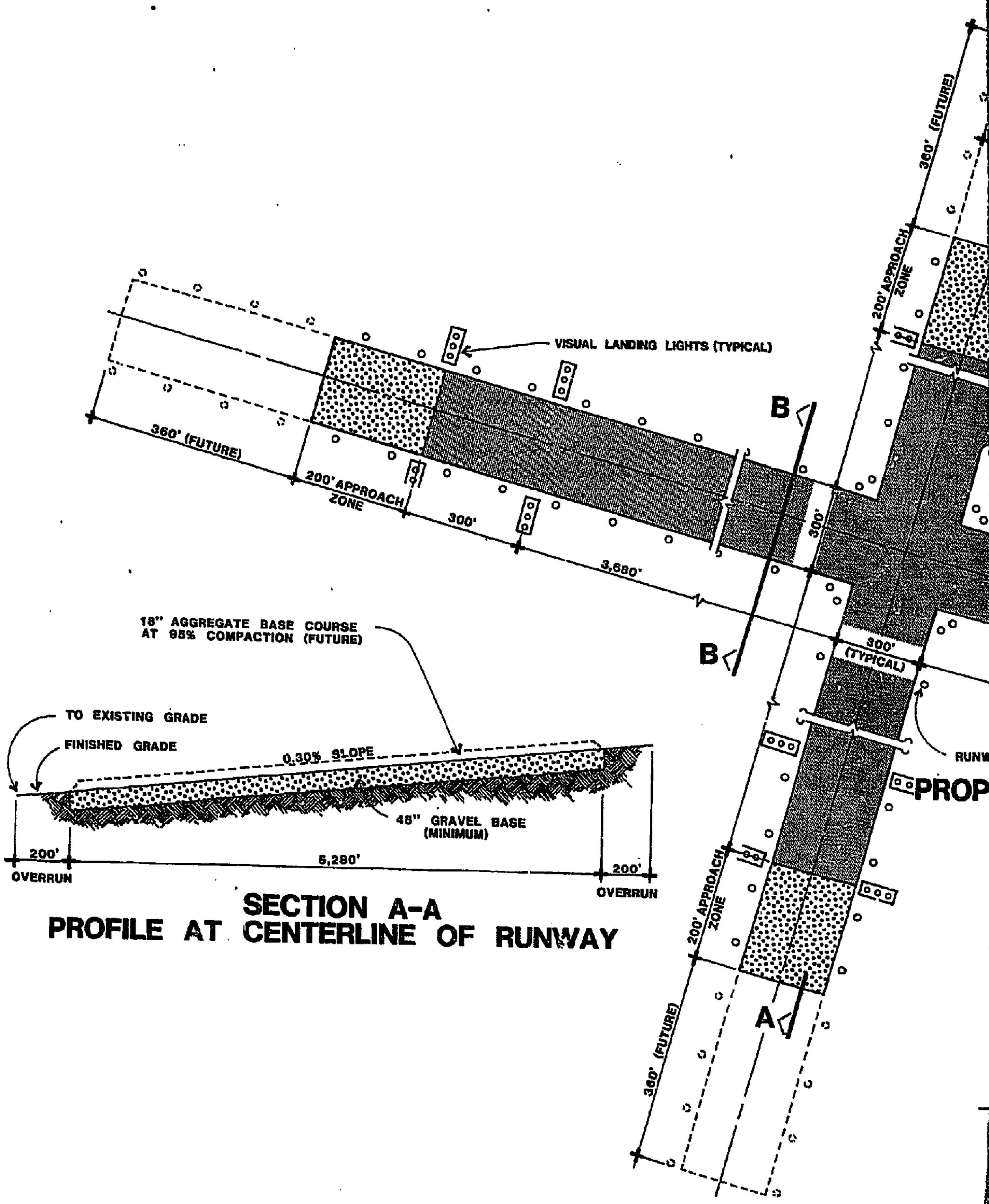
Adequate wind information is not available for the project area at this time. However, discussions with local pilots, who make frequent flights over the project area (Konrad, 1981) indicate that the prevailing wind in the project area is generally from the north (360° Magnetic) while localized storms, via Turnagain Arm (Figure 2), generate occasional gusty winds from the east (90° Magnetic). Consequently, a primary north-south and alternative crosswind (east-west) runway configuration is required for airport development. However, the initial construction of the primary north-south runway should be sufficient to handle air traffic during the construction phase of the Beluga Methanol Project.

The runway length required for a Lockheed Hercules aircraft is approximately 1 mile while the runway width should be approximately 100 feet (Figure 5). FAA criteria for a general transport, nonprescision runway, requires a basic runway safety area width of 300 feet (Federal Aviation Administration, 1969). However, an additional 200-foot clear zone will also be provided in order that sufficient protection from potential obstructions is available.

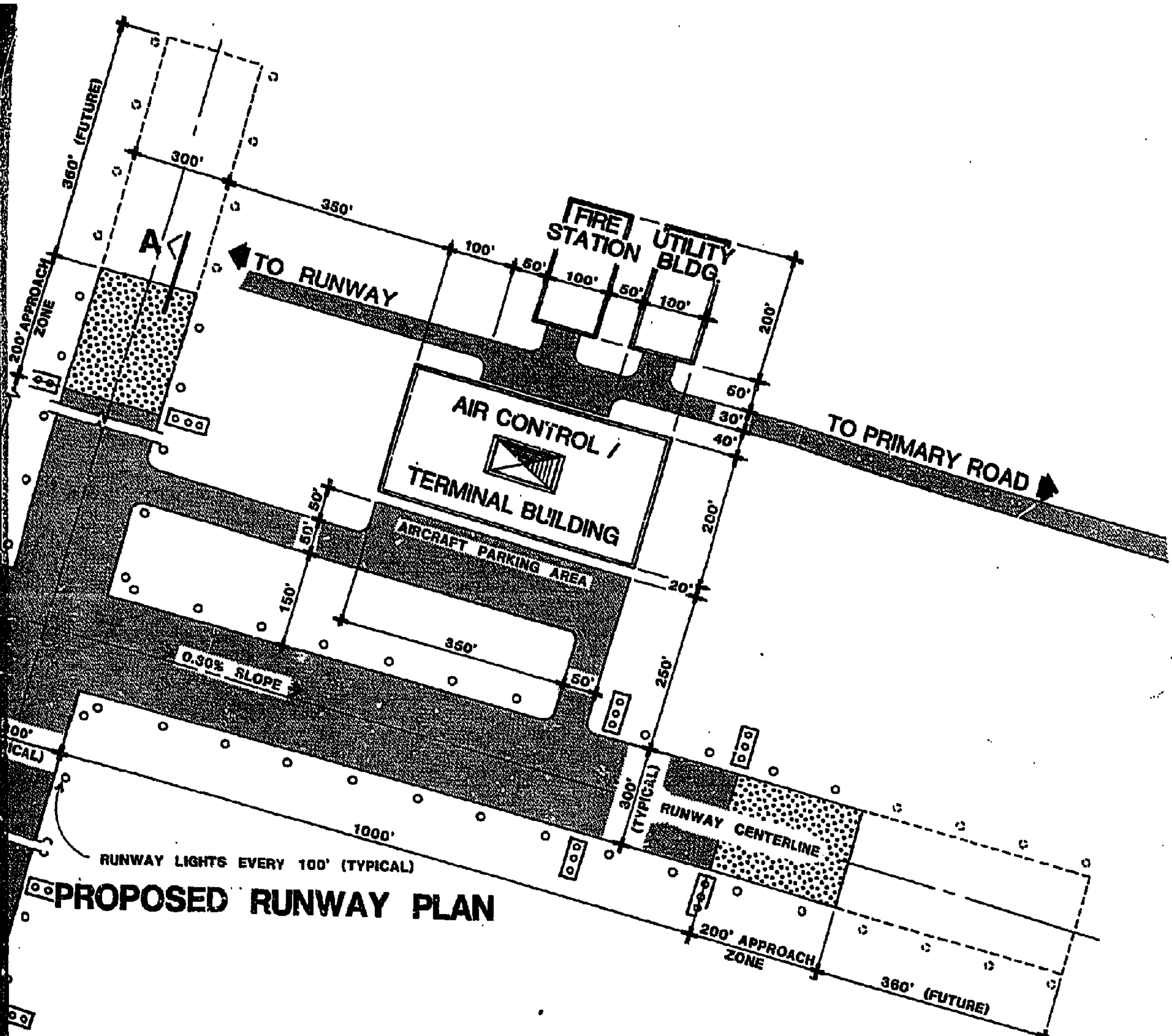
Should Boeing 737 air service be desired at some future date, an approximate 6,000-foot runway length will be required. In addition, the runway safety area width will probably have to increase to an overall width of approximately 500 feet.

The likely presence of saturated soils, potential frost heave, and ground settlement within the project area will necessitate the use of a minimum 4-foot gravel base for the runways which would be covered by a minimum 18-inch aggregate base course at 95 percent compaction (Figure 5). With the use of gravel, the runway base will also be built above the surrounding ground elevations in order that the runways will usually blow free of snow, thereby reducing snow removal efforts and costs (Smith, Reed, et al, 1979). Proper drainage of the runway will be provided through the construction of a crowned runway surface at a slope of approximately 1 to 2 percent.

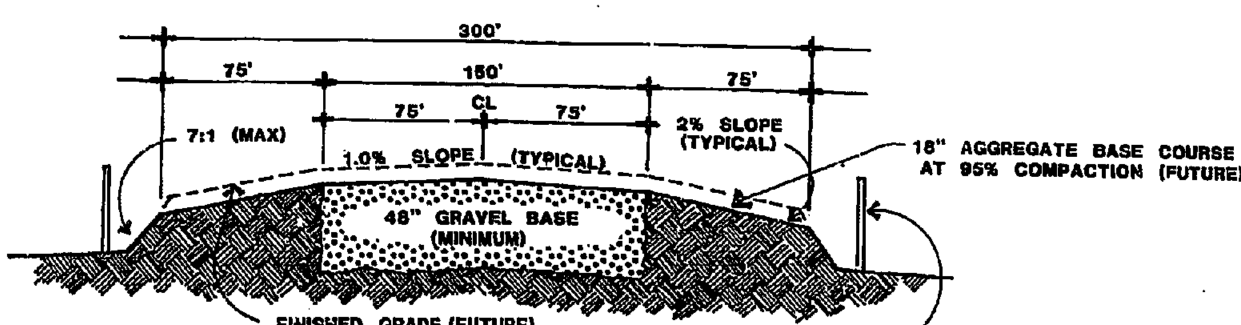
Approach-zone clearance criteria established by FAA for a noninstrument runway requires a 40:1 slope while instrument or precision runways require a slope of 50:1. FAA recommends that prescision runway clearances be used for design purposes if a full conventional instrument landing system, with a glide slope, is desired. In light of the permanent nature of this facility and the likely eventual requirement for regular air



SECTION A-A
PROFILE AT CENTERLINE OF RUNWAY



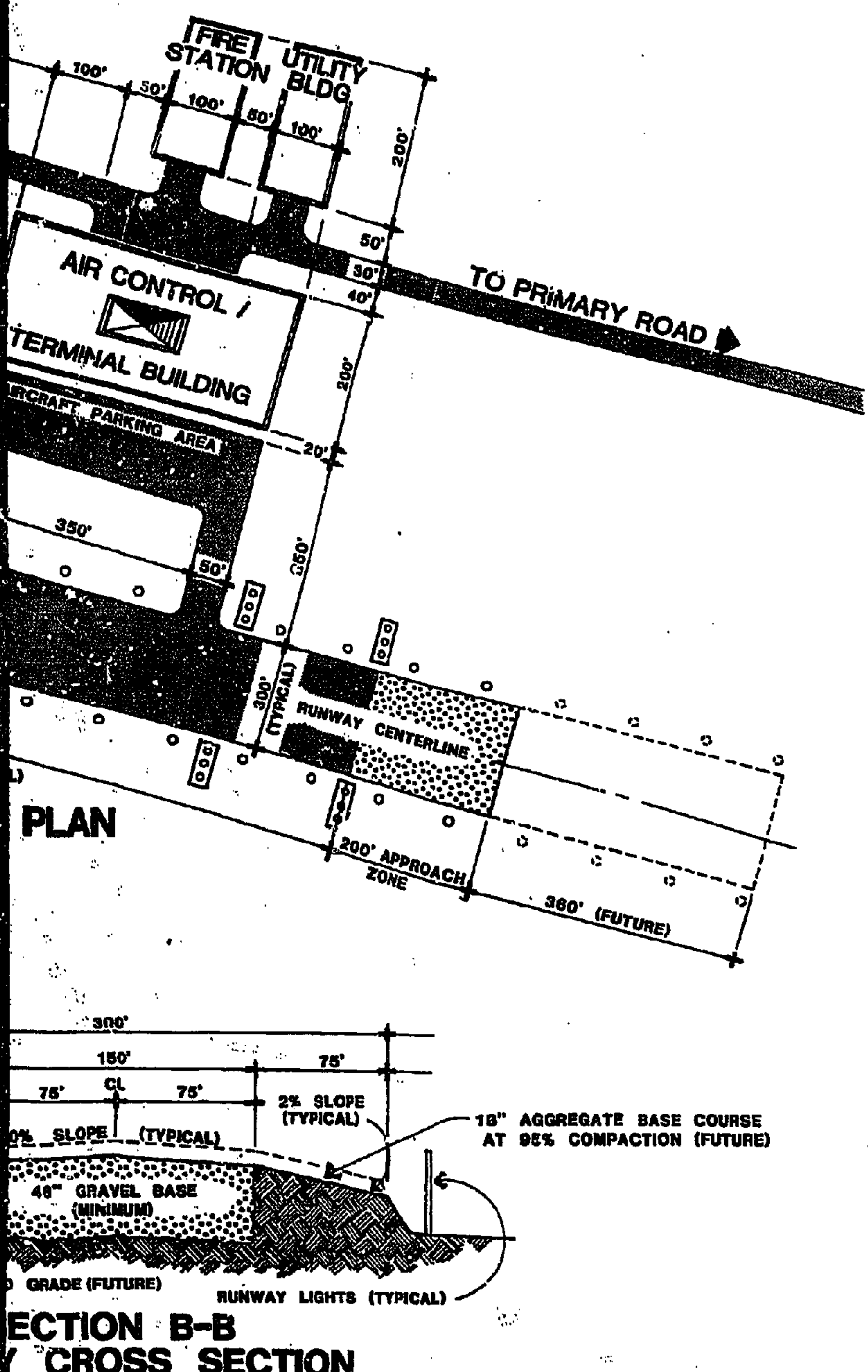
PROPOSED RUNWAY PLAN



SECTION B-B
RUNWAY CROSS SECTION

NORTH

NOT TO SCALE



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CONCEPTUAL CAMP, AIRPORT, and TOWNSITE DEVELOPMENT PLAN

BELUGA METHANOL PROJECT

AIRPORT PLAN
FIGURE 5

service between Anchorage and the project area, it is recommended that required approach zone clearances for precision runways be used for design purposes.

Air Control/Terminal Building

The air control/terminal building will be a two-story structure containing air control facilities and communication facilities on the second floor, as well as a small pilots' lounge, office space, and passenger waiting area at ground level. Adjoining this building will be an enclosed warehouse storage area which will serve as a staging facility for incoming and outgoing air freight.

Fire Station

A fire station facility will be situated adjacent to the air control/terminal building and will house the emergency vehicles and equipment necessary for airport crash rescue activities and fire suppression within nearby camp facilities.

Utilities

Airport Lighting

Airport lighting will generally consist of medium-intensity runway lights, runway identification strobe lights, a rotating beacon, and a lighted wind indicator.

Initial identification of the runway by pilots will be aided through the installation of runway identification strobe lights. The runway edge lighting system will be a configuration of medium-intensity lights which will define the entire lateral and longitudinal limits of the usable aircraft landing area (Figure 5). The rotating beacon will consist of two strobe lights which will be provided to assist pilots in the location of the airport during nighttime hours or inclement conditions. A lighted wind indicator will aid the pilot in his determination of surface wind direction prior to landing or takeoff from the airport.

Water Supply, Treatment, and Distribution

The airport water supply will require a limited potable water supply to serve approximately 10 or less airport O/M and fire station personnel, and a small number of waiting passengers. Potable water demand is expected to be limited as restroom facilities will constitute the primary use of the water supply. Assuming a potential water consumption rate of approximately 25 gallons per person per day, the anticipated domestic water demand will be approximately 250 gallons per day.

Consideration for fire flow has not been included within the potable water requirements for the airport since fire suppression within the airport area will be handled primarily through the use of dry chemicals. However, a fire truck/pumper with a full tank of water will also be stored at the airport fire station to supplement the use of dry chemicals. In addition, a domestic water truck serving the airport will also be stored at the fire station and will act as a back-up during any fire emergency.

Given the limited quantity of potable water required, potable water and fire department supply can be trucked on a weekly basis from the townsite water treatment and storage facility to the airport. Upon arrival, the potable water can be pumped into a small water storage tank located in th airport utility building, or insulated water tank which could be stored outside on skids. A second option would be to develop a small groundwater supply and install a small storage tank inside the airport utility building.

Sewage Collection, Treatment, and Effluent Disposal

Sewage flows generated by persons operating, maintaining, and using airport facilities will be at a rate of approximately 30 gallons per person per day, or a total sewage generation of approximately 300 gallons per day. Collector lines will transport the sewage to a 500-gallon package treatment facility for primary treatment. Subsequently, primary sewage effluent will be discharged into a small subsurface soil absorption system.

Power Supply and Distribution

Airport power requirements will probably be provided through the exclusive use of electric power in light of the limited total power requirement for the airport and the uncertain availability of natural gas from nearby Cook Inlet production facilities. The minimum total power requirement estimated for the airport facility is approximately 251 kilowatts (kW). However, should more detailed engineering studies during Phase IIA of the project indicate that sufficient quantities of natural gas are available for project use, approximately 206 kW could possibly be deleted from the total electrical power requirements.

The total electrical power requirement is based on the use of the following equation and a general facility analysis of the airport plan (Figure 5).

$$P = \begin{matrix}\text{Total Air-}\\ \text{port Power}\\ \text{Requirement}\\ \text{(kilowatts)}\end{matrix} = \frac{I\ (873\ \text{amps}) \times E(208\ \text{volts}) \times 1.73 \times 0.8\ (\text{power factor})}{10^3\ (\text{conversion factor})}$$

Rough calculation of the connected loads generated by the use of the airport facilities is estimated to be approximately 1,455 amps at 208 volts on a 3-phase, 4-wire system. The demand load is assumed to be 100 percent of the connected load for the runway, strobe and wind indicator lights. However, the demand load for all other airport facilities is assumed to be 60 percent of the connected load.

Similar to the construction camp, power for the airport will be obtained through the use of electrical power from Chugach Electric's Beluga Power Plant, and/or on-site diesel engine generators. In either case, the design of a power source for the airport must be integrated with the power requirements for the other major facility proposals such as the methanol plant, coal mines, townsite, and camp, which are associated with the project (Figure 2).

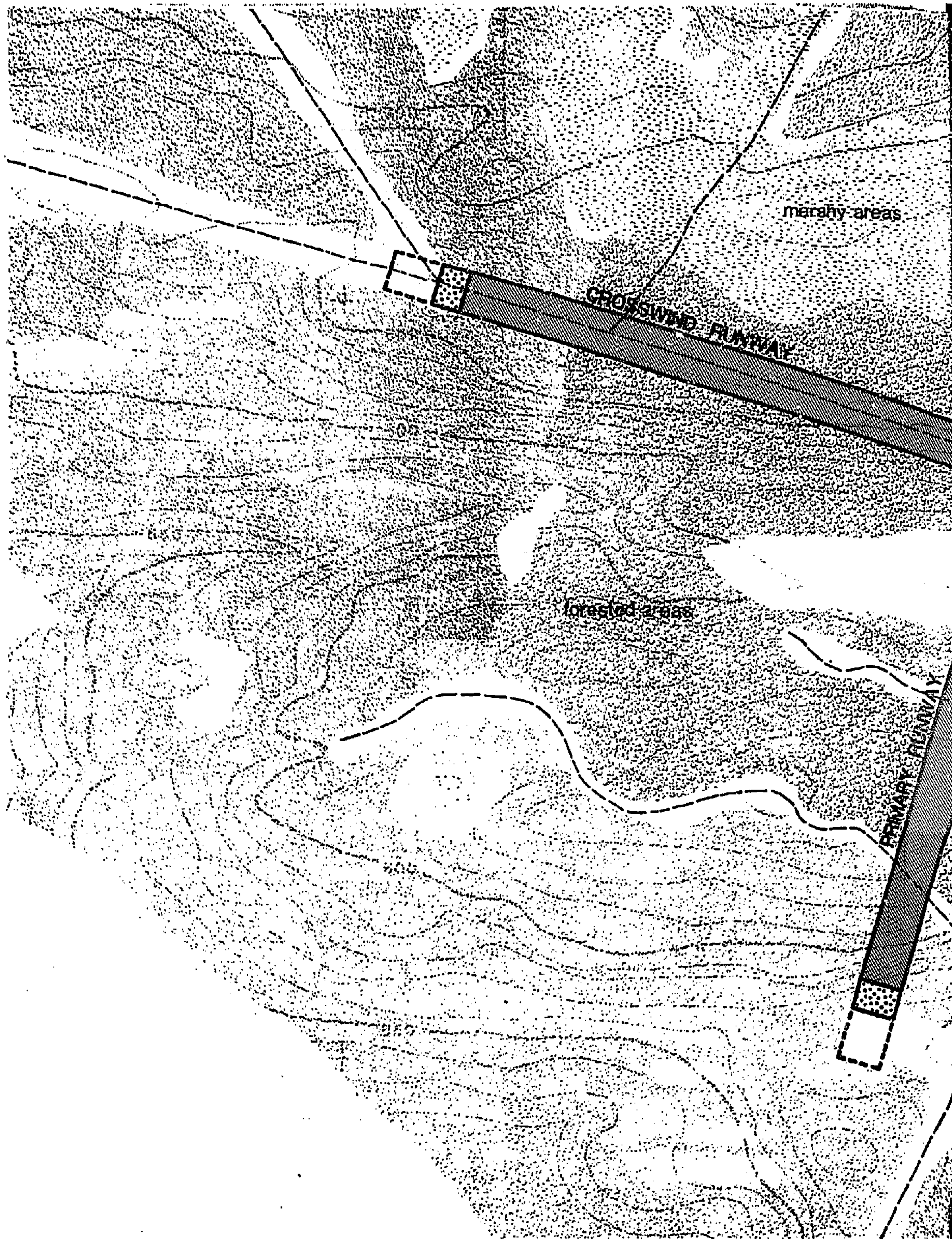
Power to the airport will preferably be supplied through the installation of a 14.4/24.9 kV overhead transmission line from the Tyonek Lumber facility, or Beluga Power Plant, along the potential transportation and utility corridor. From the corridor, a 14.4/24.9 kV, 3-phase, primary line will further distribute electrical power to airport facilities via a pad-mounted transformer which will be situated within a strategic airport location (Figure 6).

Prior to the installation of transmission lines along the transportation and utility corridor, two 275 kW diesel engine generators, with automatic transfer switches, will be used alternately to provide power to airport facilities. Once electric power is available from transmission line along the corridor, the two generators can be used to provide emergency or stand-by power for the airport complex.

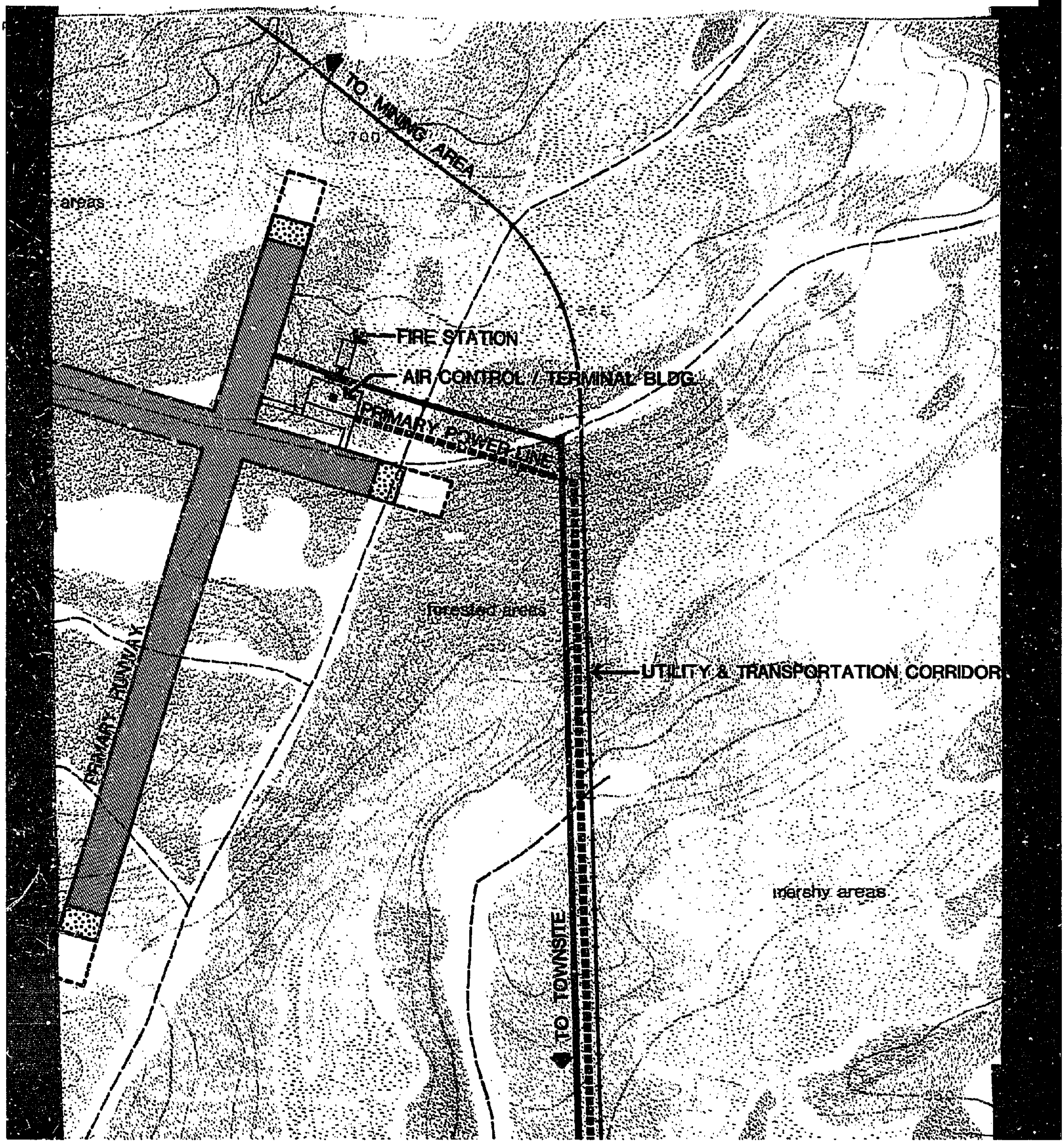
Solid Waste Collection, Reduction, and Disposal

A dumpster receptacle will be provided in a location central to the airport complex. Solid waste material stored in an airport dumpster receptacle will be collected on a regular basis by a dumpster truck which will also service the campsite and townsite areas.

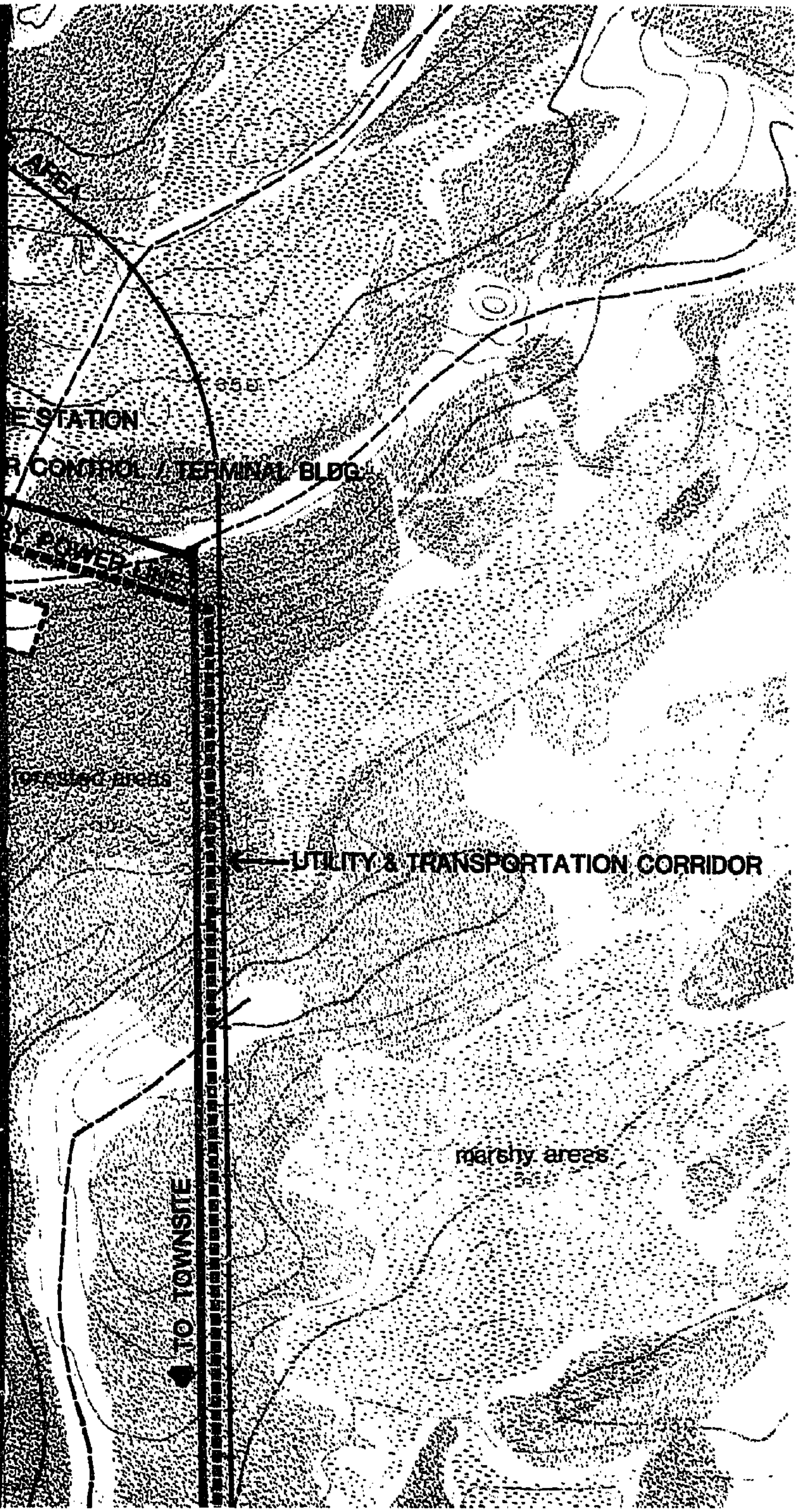
Upon collection, the solid waste material will be transported to the townsite solid waste management facilities for incineration and compaction. Reduced solid waste quantities will eventually be landfilled in an area situated near the townsite.

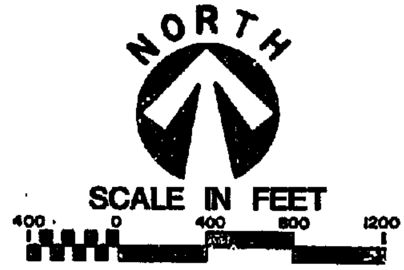


marshy areas
CROSSWIND RUNWAY
forested areas
PRIMARY RUNWAY



TO MINING AREA
areas
FIRE STATION
AIR CONTROL / TERMINAL BLDG.
PRIMARY POWER LINE
forested areas
UTILITY & TRANSPORTATION CORRIDOR
PRIMARY RUNWAY
marshy areas
TO TOWNSITE





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CONCEPTUAL CAMP, AIRPORT, and TOWNSITE DEVELOPMENT PLAN

BELUGA METHANOL PROJECT

AIRPORT SITING CONSIDERATIONS
FIGURE 6

AIRPORT O/M CONSIDERATIONS

Operation and maintenance of the airport generally will primarily consist of providing air traffic control, runway maintenance, air cargo handling, passenger processing, emergency fire suppression capability, and utility system O/M. Refueling of aircraft will only be performed on an emergency basis.

Labor and heavy requirements for these O/M activities have been incorporated within anticipated O/M requirements for variable camp populations in light of the fact that camp and airport O/M activities can be effectively combined (Tables 2 and 3). For example, road clearing operators maintaining the road between the camp and the airport also can be used to clear the airport runway. Utility system operators at camp can also operate and maintain the smaller utility systems at the airport. It should be noted, however, that union rules may somewhat restrict the use of O/M workers on a combination basis. Assuming that some degree of combined use can occur, the costly duplication of labor and heavy equipment requirements can be significantly reduced.

AIRPORT CONSTRUCTION AND O/M COSTS

Introduction

Based on conceptual requirements for airport facilities and equipment, general design criteria, and related O/M considerations, CIRI/H&N has developed general order-of-magnitude estimates for airport construction and O&M (Table 8). These estimates are primarily derived from previous experience in the design and construction of similar airports, as well as estimates and price quotations received from appropriate manufacturers and suppliers in Alaska and the lower 48 states.

Anticipated construction costs reflect the use of all inclusive unit and lump sum estimates for site development, facility construction and utility installation. Estimated airport O/M costs have been combined with estimates for camp O/M (Table 7) light of the potential cost savings which may be derived from the combined use of O/M labor and heavy equipment.

TABLE 8

PRELIMINARY CONSTRUCTION ESTIMATE
CONCEPTUAL AIRPORT DEVELOPMENT PLAN
SITE DEVELOPMENT, FACILITY CONSTRUCTION, AND UTILITY INSTALLATION

FACILITY	QUANTITY	UNIT/LUMP SUM COSTS	TOTAL COST
Gravel Road (Townsite to Airport)	126,700 ft^2	\$ 2.85/ft^2	\$ 361,095
Gravel Runways	2	2,300,000/runway	4,600,000
Air Control/Terminal Building	8,000 ft^2	45.00/ft^2	360,000
Fire Station	5,000 ft^2	47.00/ft^2	235,000
Utility Building	5,000 ft^2	47.00/ft^2	235,000
Runway Lights (medium intensity)	530	155 ea	82,150
Landing Lights	16	210 ea	3,360
Airport Beacon and Wind Sock Lights	—	10,000 LS	10,000
Runway Strobe Lights	2	450 ea	900
Power Transmission	1.5 miles	35,000/mile	52,500
Power Distribution (within site)	--	30,528 LS	30,528

TABLE 8 (Continued)

FACILITY	QUANTITY	UNIT/LUMP SUM COSTS	TOTAL COST
Temporary Power (motor generators)	2	34,835 ea.	69,670
Sewage Treatment Plant and Soil Absorption System	1	4,100 LS	4,100
Groundwater Well	1	6,200 LS	6,200
60,000-Gallon Fuel Storage Tank	1	35,300 LS	35,300
1,000-Gallon Storage Tank	1	1,200 ea.	1,200
		TOTAL	$ 6,087,003

Price assumes local availability of gravel

TABLE 9

ANTICIPATED ANNUAL O/M COSTS
TOWNSITE, AIRPORT, AND 50-PERSON CAMP

	Total Cost (1981 Dollars)
LABOR	
Project Management	$ 252,007
Administration	2,114,620
Facilities	3,718,576
Logistics	5,130,002
Community Services	2,457,943
	$13,673,148
HEAVY EQUIPMENT	
Rehabilitation	200,000
Replacement	300,000
	$500,000
OUTSIDE CONSULTANT FEES AND SERVICES	$100,000
TOTAL	$14,273,148

TOWNSITE DEVELOPMENT

TOWNSITE DEVELOPMENT

INTRODUCTION

Aside from Anchorage and Fairbanks, approximately 28 percent of Alaska's resident population resides in small communities of three thousand or less persons. Many of these settlements were established long before municipal services were ever present in Alaska. Their location and haphazard layouts were based on survival and personal preferences (Smith, Reed, et al, 1979). More recently, many of Alaska's rural communities have begun to demand increased public services and amenities. The construction or installation of desired community improvements in these more remote areas is, at the outset, an extremely costly proposition in light of increased mobilization, material and labor costs. However, the spread-out, low-density nature of these settlements further aggravates the cost of providing expanded public facilities in these communities.

Centralization of essential services such as commercial, recreational, and educational facilities is an essential consideration for rural communities in Alaska. Winter weather is not amenable to extensive vehicular travel in the winter. Consequently, pedestrian travel is desirable within small communities as long as the distance between home and essential community services is not overwhelming during the winter months, or generally discouraging to the average town resident.

The development of housing in and around essential small town community services also allows rural communities to benefit from the availability of centralized utility systems within the community. Scattered houses and cabins over a widely dispersed rural area requires each landowner to install individual utility systems such as water, power, and sewer. Unfortunately, many of the individual utility systems are less energy efficient and frequently generate localized environmental problems, such as sewage contamination of a nearby groundwater supply, which can often be avoided through the use of a communitywide utility system. However, even with the development of one or more centralized utility systems, a well-known problem in rural Alaskan communities is the limited availability of competent individuals who can operate and maintain these systems on a regular basis.

The concepts presented for development of a permanent townsite in the project area are very preliminary in nature and are described in terms of a recommended design approach and general concept; required facilities and general design criteria; O/M labor and heavy equipment requirements; and estimated mobilization construction, and O/M costs. Greater attention is devoted to the general orientation of various permanent facilities and land uses in order to provide general guidance for the eventual design of the townsite. The definition of required facilities and general design criteria is intended to clarify the basis of the general townsite development concept and estimated development costs.

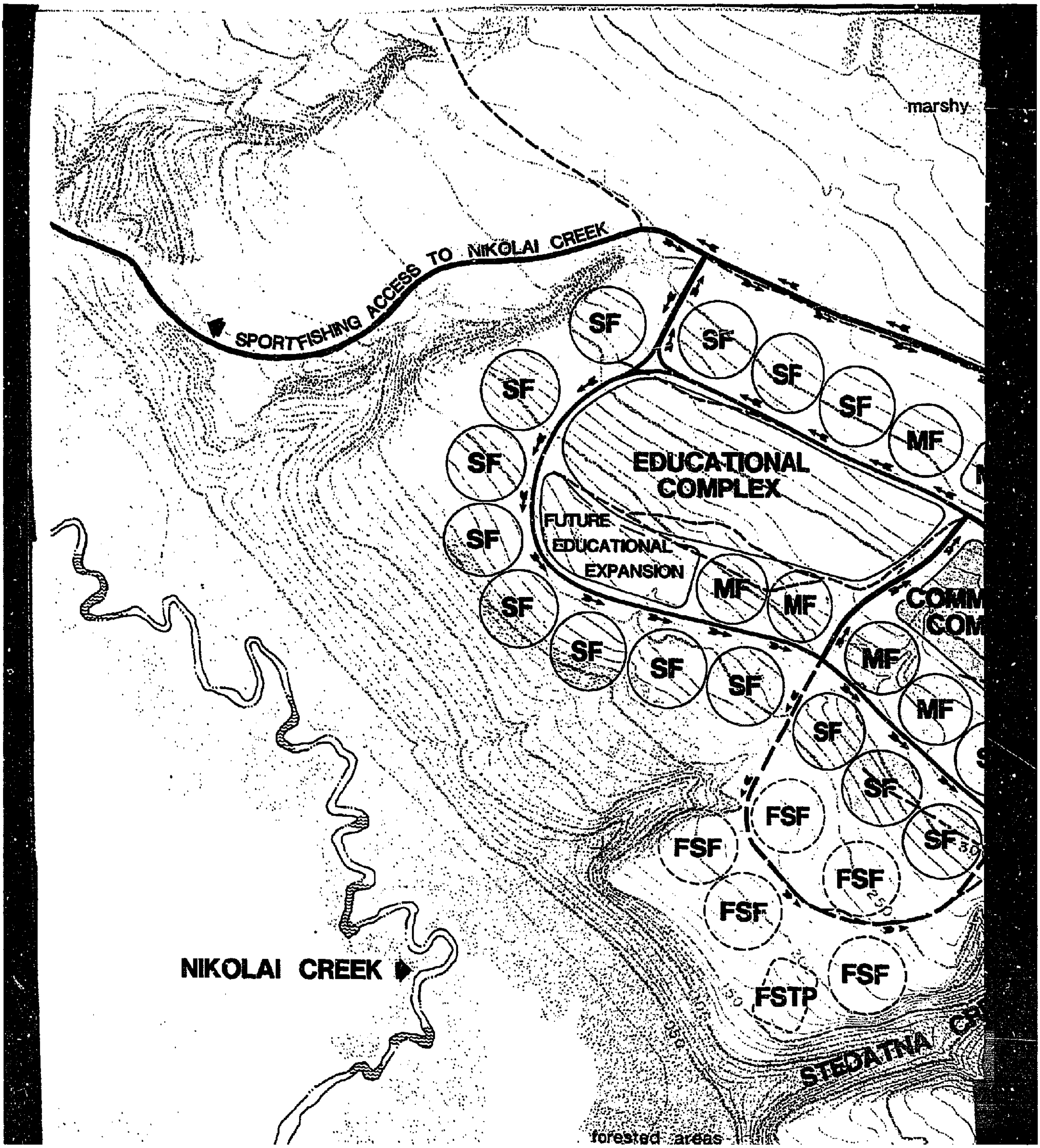
RECOMMENDED DESIGN APPROACH AND GENERAL CONCEPT

Development of a permanent townsite in the project area represents only a small segment of the anticipated development costs and related financing requirements for the Beluga Methanol Project. However, the townsite is highly significant to the overall project in terms of its potential impact on employee morale and efficiency, work force continuity, and the general perception of the project by adjacent Cook Inlet Basin communities. Consequently, it is imperative that the design and construction of the new town be responsive to project employment policies; physical resources and constraints of the project area; regional housing, education, and consumer demands; and socioeconomic characteristics of the anticipated work force.

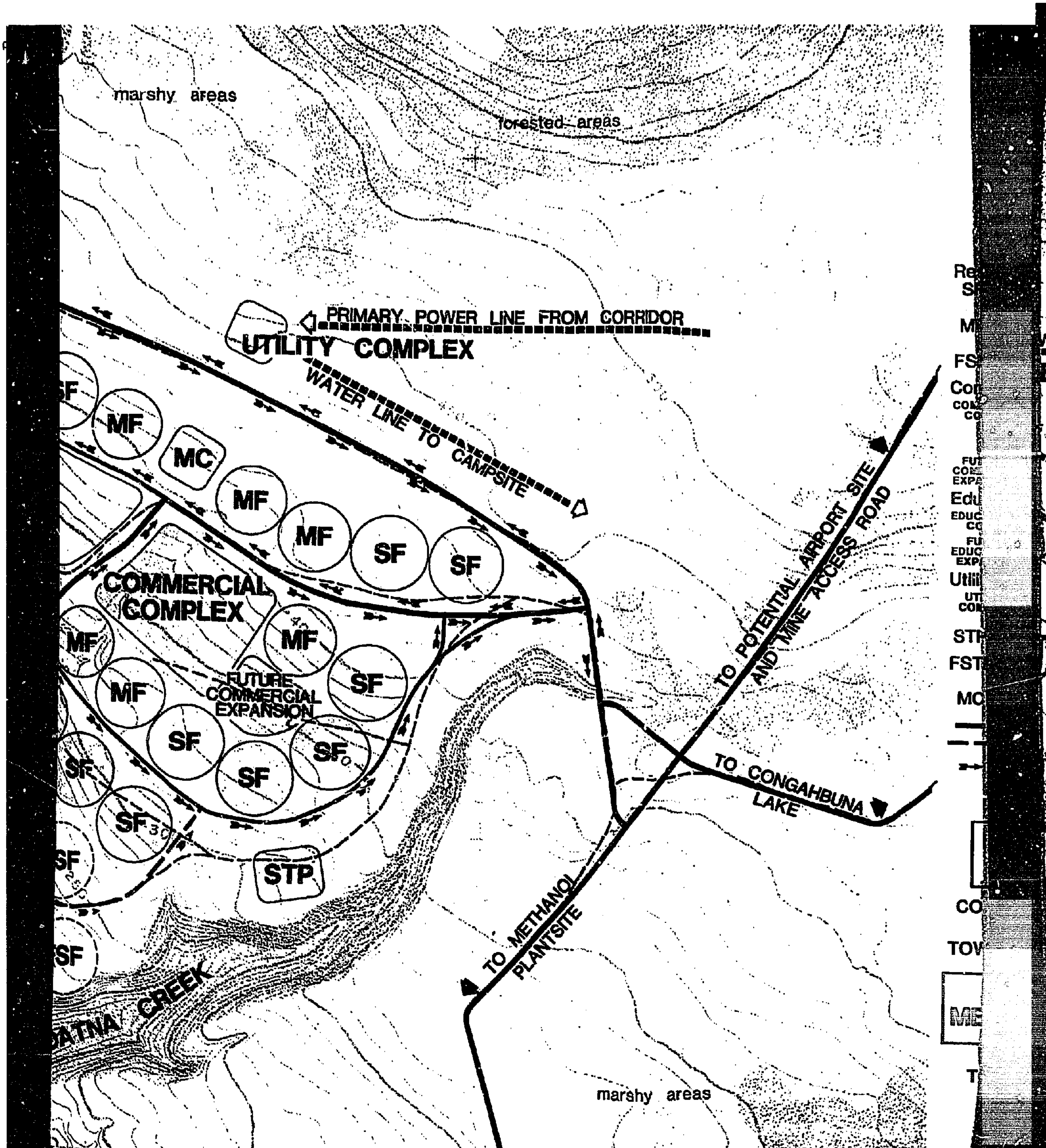
The townsite development will be innovative in the sense that its design configuration and layout will be responsive to these preceding considerations, and will address some of the general problems associated with many of Alaska's rural communities. As suggested by the conceptual townsite plan (Figure 7), the permanent townsite will centralize basic commercial, educational, and community service facilities in order to enhance provisions for these services in terms of reduced construction and O/M costs, and personal convenience to future town residents. These facilities, as well as some limited multiunit housing, will comprise the central core of the townsite which will be financed and constructed incrementally by the project and other investors. Surrounding the central core of the townsite will be the development of single-family, townhouse and multiunit residential neighborhoods. These neighborhoods will be developed and financed by other investors. Individual housing units will be marketed by a local real estate sales organization.

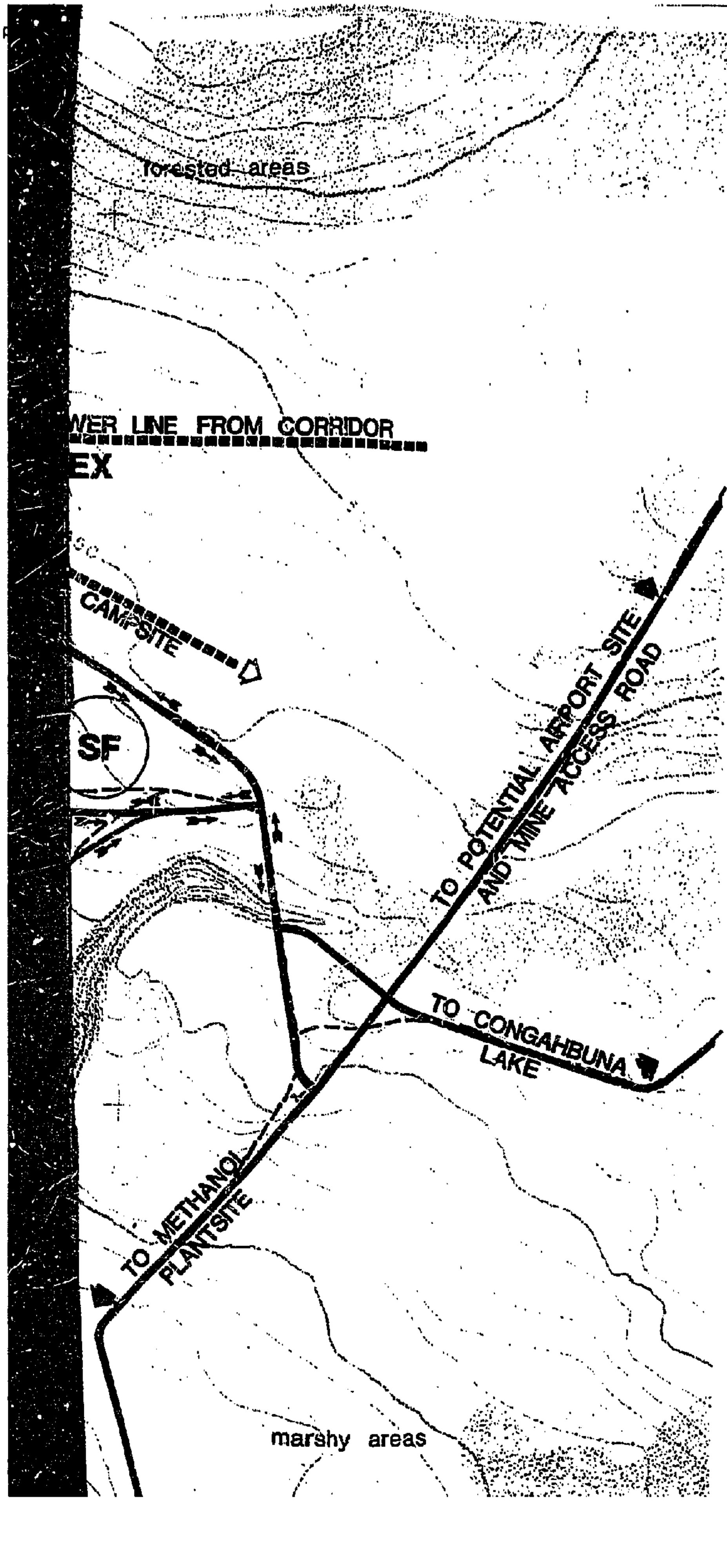
Circulation within the townsite will be accomplished primarily through the use of small 20 and 45 passenger buses, as well as pedestrian and combination bicycle/cross-country ski trails throughout the town. However, vehicular parking may eventually be planned in conjunction with the potential future use of private automobiles. Similar to other rural Alaskan communities, school facilities will serve as a community center for both community education, as well as indoor and outdoor recreation. Access to other nearby recreational opportunities such as fishing, hiking, hunting, and camping would also be provided.

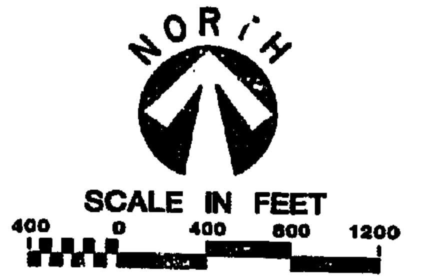
Facilities and services within the townsite will be designed for an initial population of 2,600 persons. However, these facilities and services will expand as the townsite population increases to approximately 4,200 persons in the 1990's.



marshy
SPORTFISHING ACCESS TO NIKOLAI CREEK
SF
MF
EDUCATIONAL COMPLEX
FUTURE EDUCATIONAL EXPANSION
FSF
FSTP
NIKOLAI CREEK
STEDATNA
forested areas


marshy areas
forested areas
PRIMARY POWER LINE FROM CORRIDOR
UTILITY COMPLEX
WATER LINE TO CAMPSITE
MC
MF
SF
COMMERCIAL COMPLEX
FUTURE COMMERCIAL EXPANSION
STP
TO POTENTIAL AIRPORT SITE AND MINE ACCESS ROAD
TO CONGAHBUNA LAKE
TO METHANOL PLANTSITE
CREEK
marshy areas





LAND USE DESCRIPTIONS

Residential:

SF 16 to 24 single family units in six acre neighborhoods.
average density: 3.3 units/acre

MF 50 townhouse and apartment units in five acre neighborhoods.
average density: 10.0 units/acre

FSF Potential six acre expansion area for single family neighborhood development.

Commercial:

COMMERCIAL COMPLEX Combined shopping and entertainment, community services, offices, governmental administration, and residential apartment units on 30.0 acres.

FUTURE COMMERCIAL EXPANSION Potential ten acre commercial expansion area

Educational:

EDUCATIONAL COMPLEX High school and K-8 facility on sixty acres.

FUTURE EDUCATIONAL EXPANSION Potential twenty acre expansion area for additional K-8 facility

Utilities:

UTILITY COMPLEX Water treatment, solid waste management, and power substation facilities on approx. 3.7 acres.

STP Sewage treatment plant on approximately 4.6 acres.

FSTP Potential sewage treatment plant relocation with single family neighborhood expansion on approximately 4.6 acres.

MC Motor vehicle maintenance and storage complex on 3.7 acres.

Improved road

Potential improved road for single family expansion area.

Direction of vehicular circulation

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CONCEPTUAL CAMP, AIRPORT, and TOWNSITE DEVELOPMENT PLAN

BELUGA METHANOL PROJECT

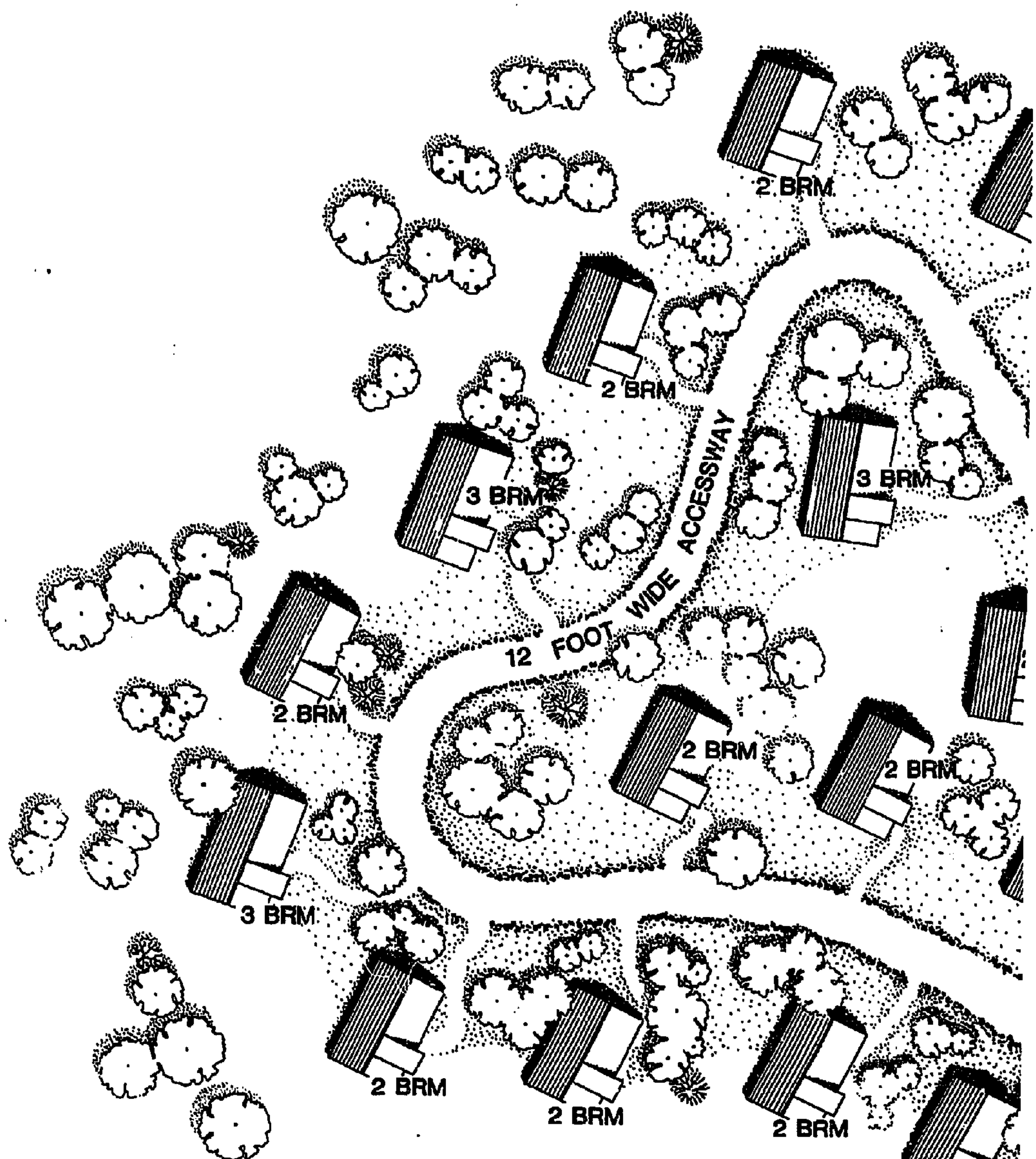
TOWNSITE LAND USE PLAN
FIGURE 7

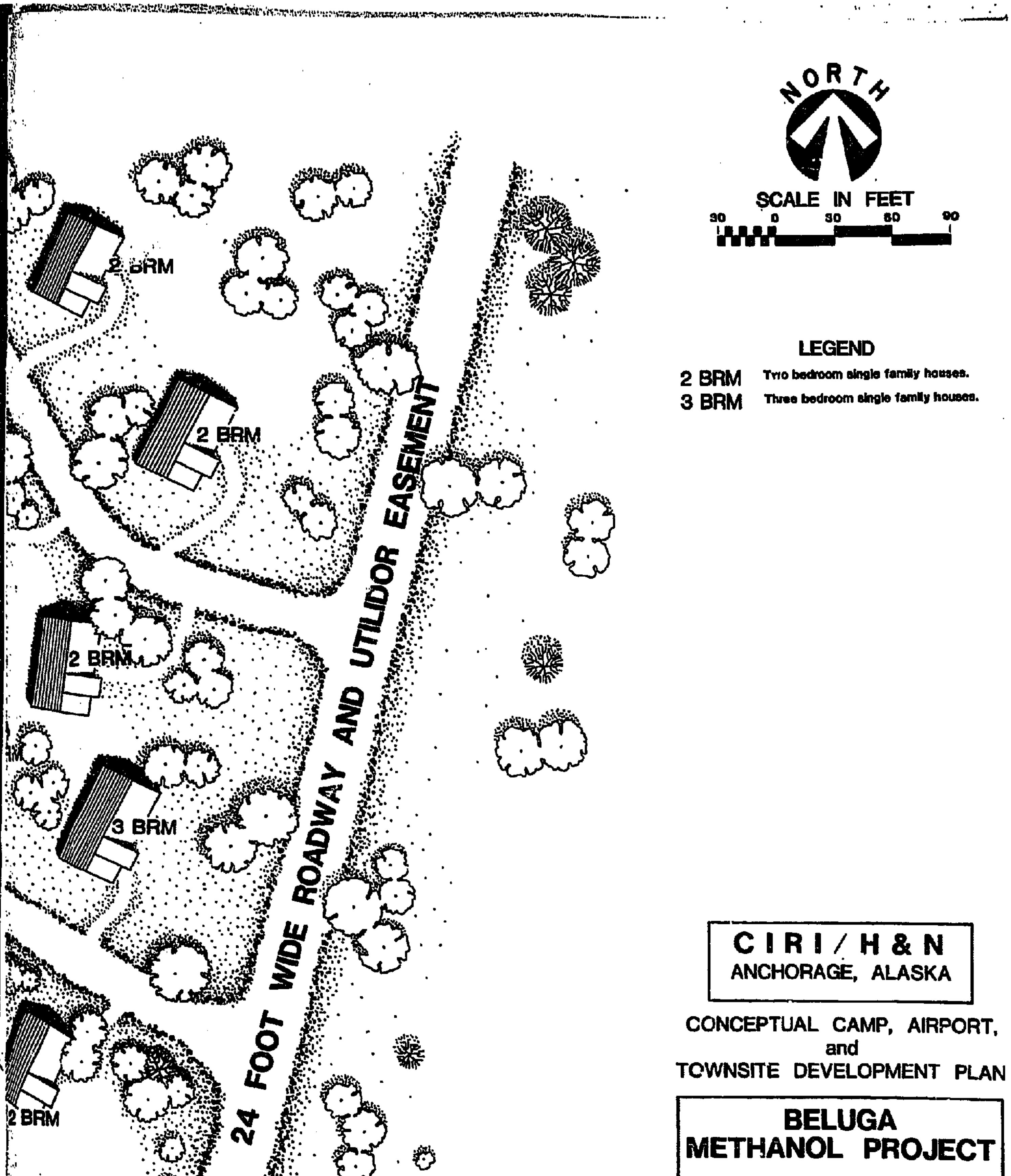
REQUIRED FACILITIES AND GENERAL DESIGN CRITERIA

Housing

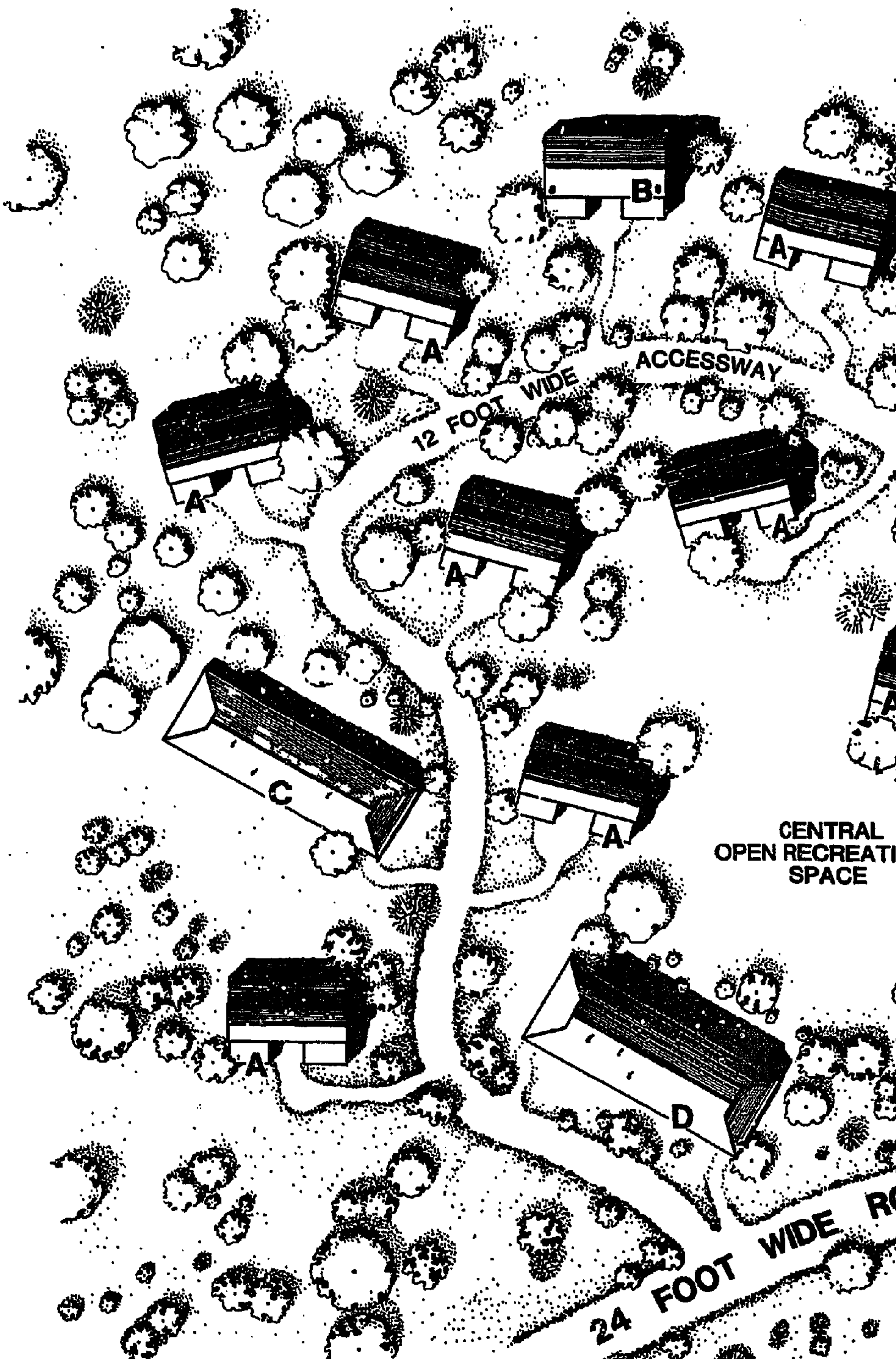
Workers and their families will reside in stick-built homes which will be developed and marketed to the work force by a local housing builder and an associated real estate sales organization. Residential construction and marketing by the builder will follow general design criteria and marketing procedures established by the project. Consequently, the project will not need to bear the substantive cost of financing and erecting permanent housing structures.

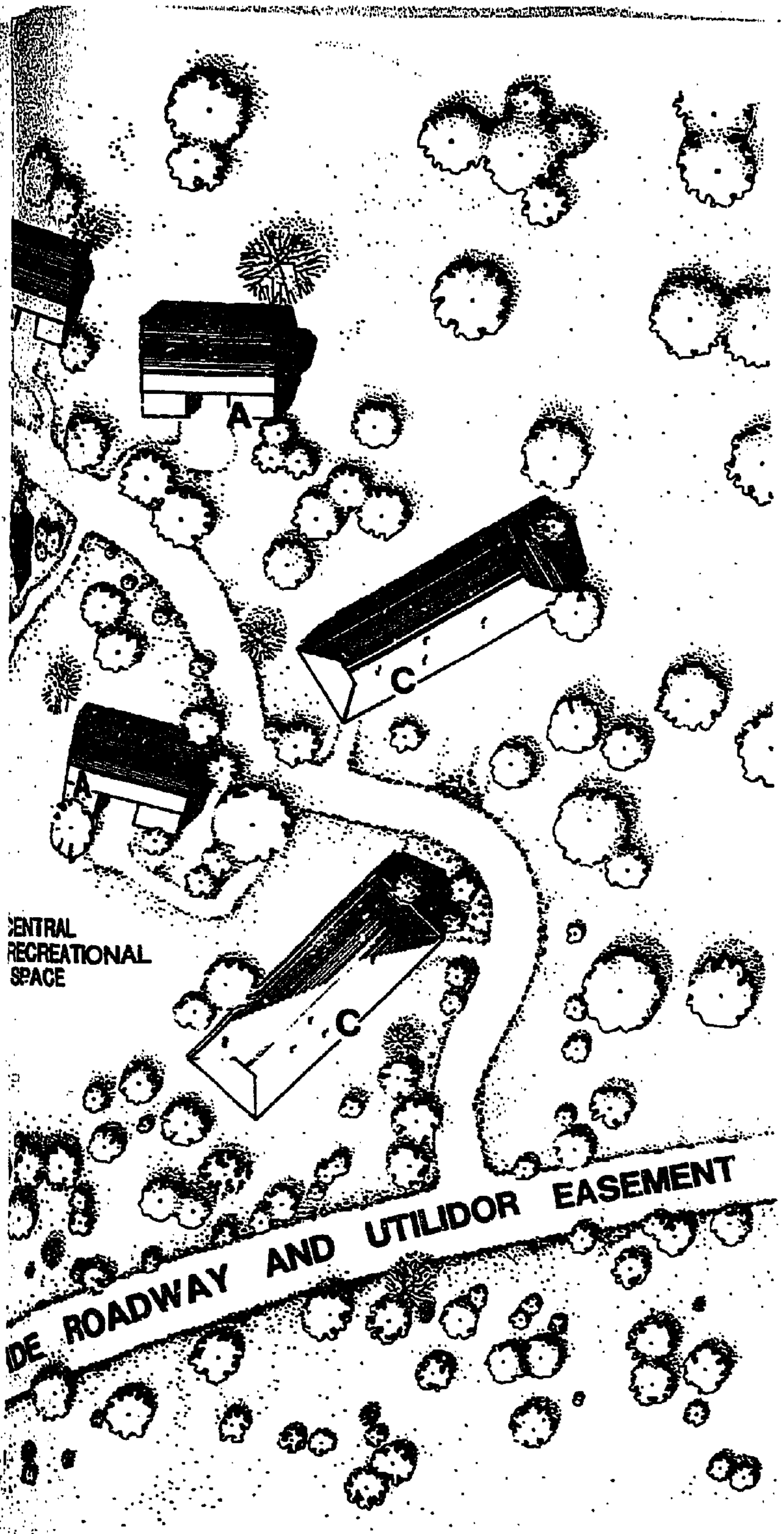
Single-family neighborhoods (Figure 8) will be comprised of 16 to 24, two and three-bedroom houses on approximately 6 acres of land, or an average density of approximately 3.3 units per acre. Townhouse/multifamily neighborhoods (Figure 9) will be characterized by approximately 50 townhouses and apartments consisting of one-, two-, and three-bedroom units on approximately 5 acres of land. Within the commercial complex, some 250 studio and two-bedroom units will be provided above and adjacent to commercial shops and community services to enliven and enhance activity within the town center.

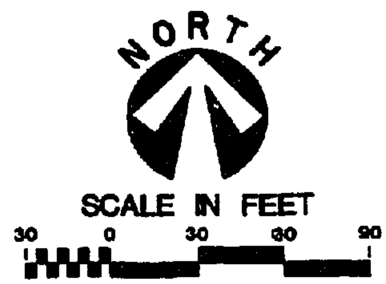

2 BRM
2 BRM
3 BRM
3 BRM
12 FOOT WIDE ACCESSWAY
2 BRM
2 BRM
2 BRM
3 BRM
2 BRM
2 BRM
2 BRM
2 BRM
2 BRM



SINGLE FAMILY NEIGHBORHOOD
FIGURE 8


12 FOOT WIDE ACCESSWAY
A
B
A
A
A
A
A
A
C
A
CENTRAL
OPEN RECREATIC
SPACE
A
D
24 FOOT WIDE RC





LEGEND

- **A** Two, two bedroom townhouses.
- **B** Two, three bedroom townhouses.
- **C** Apartment blocks with four, one bedroom units and four, two bedroom units each.
- **D** Apartment block with two, three bedroom units, four, two bedroom units, and two, one bedroom units.

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CONCEPTUAL CAMP, AIRPORT, and TOWNSITE DEVELOPMENT PLAN

BELUGA METHANOL PROJECT

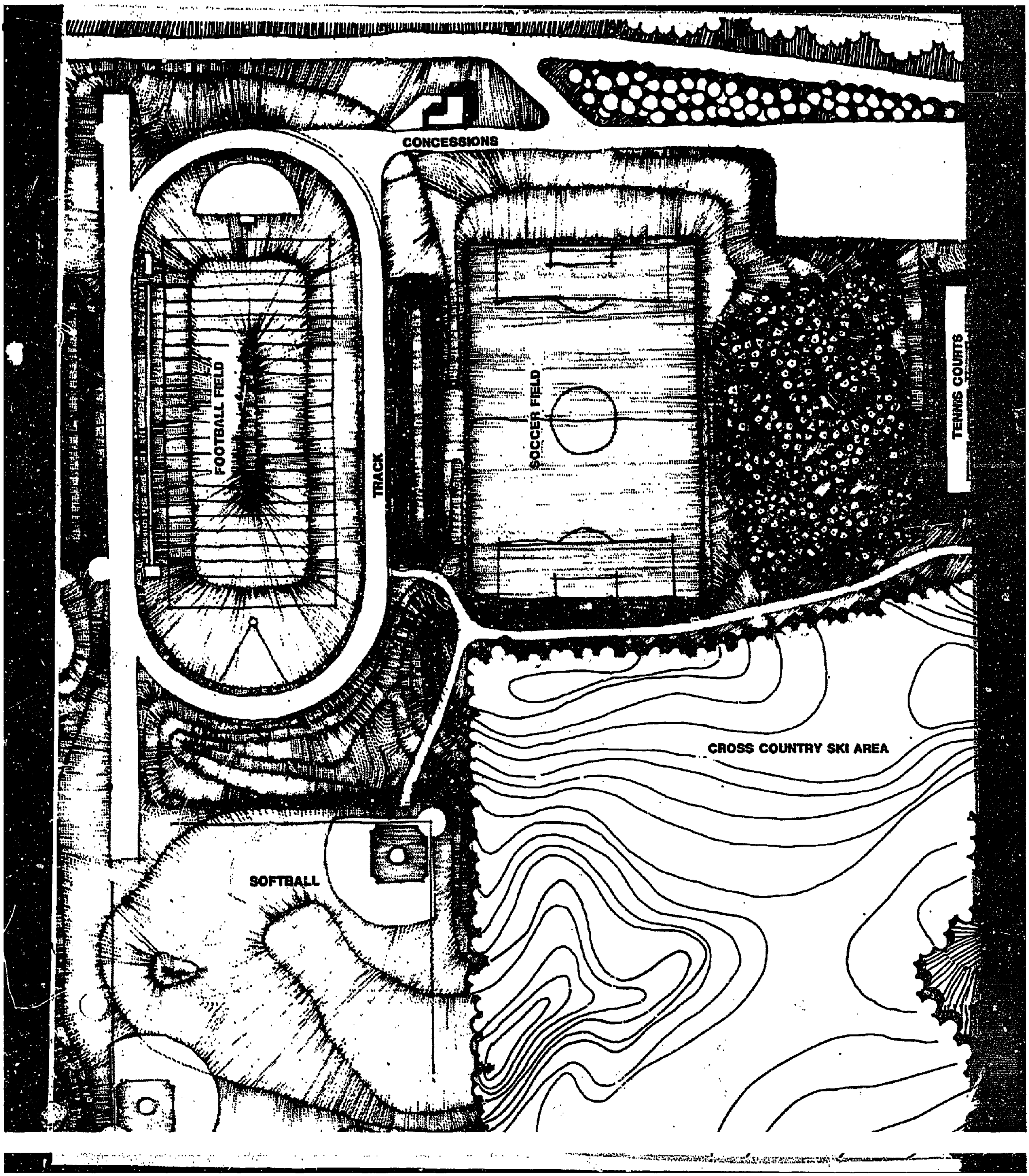
TOWNHOUSE/MULTI-FAMILY NEIGHBORHOOD
FIGURE 9

Utility distribution to residential neighborhoods will be accomplished through the use of an underground utilidor which will be located along the 12-foot wide loop access route within each neighborhood. The loop road will also provide access to 20 passenger buses; small delivery and home repair trucks; as well as emergency vehicles for fire suppression, medical, and law enforcement emergencies. Otherwise, the access will be used for pedestrian/bicycle traffic and cross-country skiing activity.

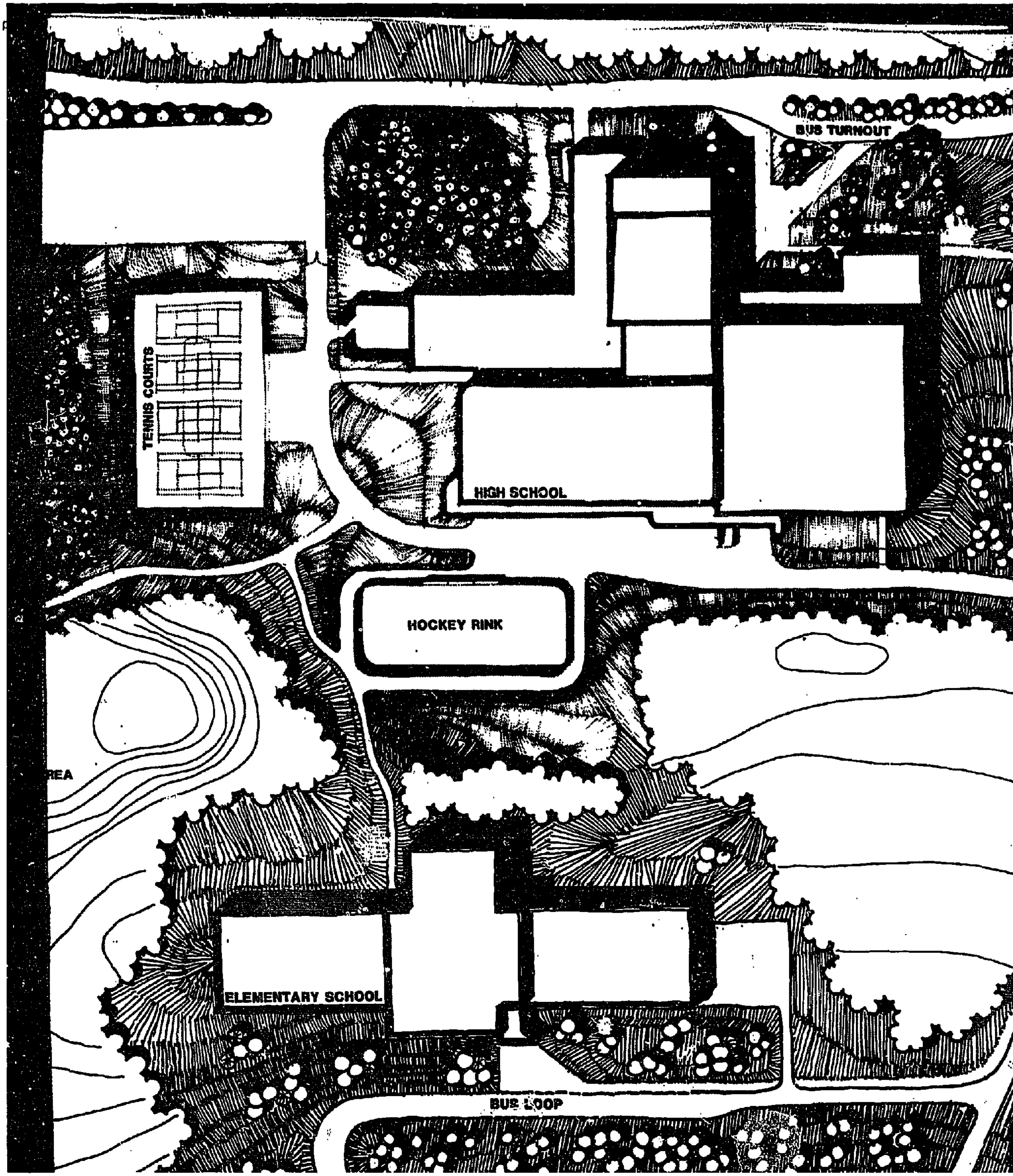
Educational Complex

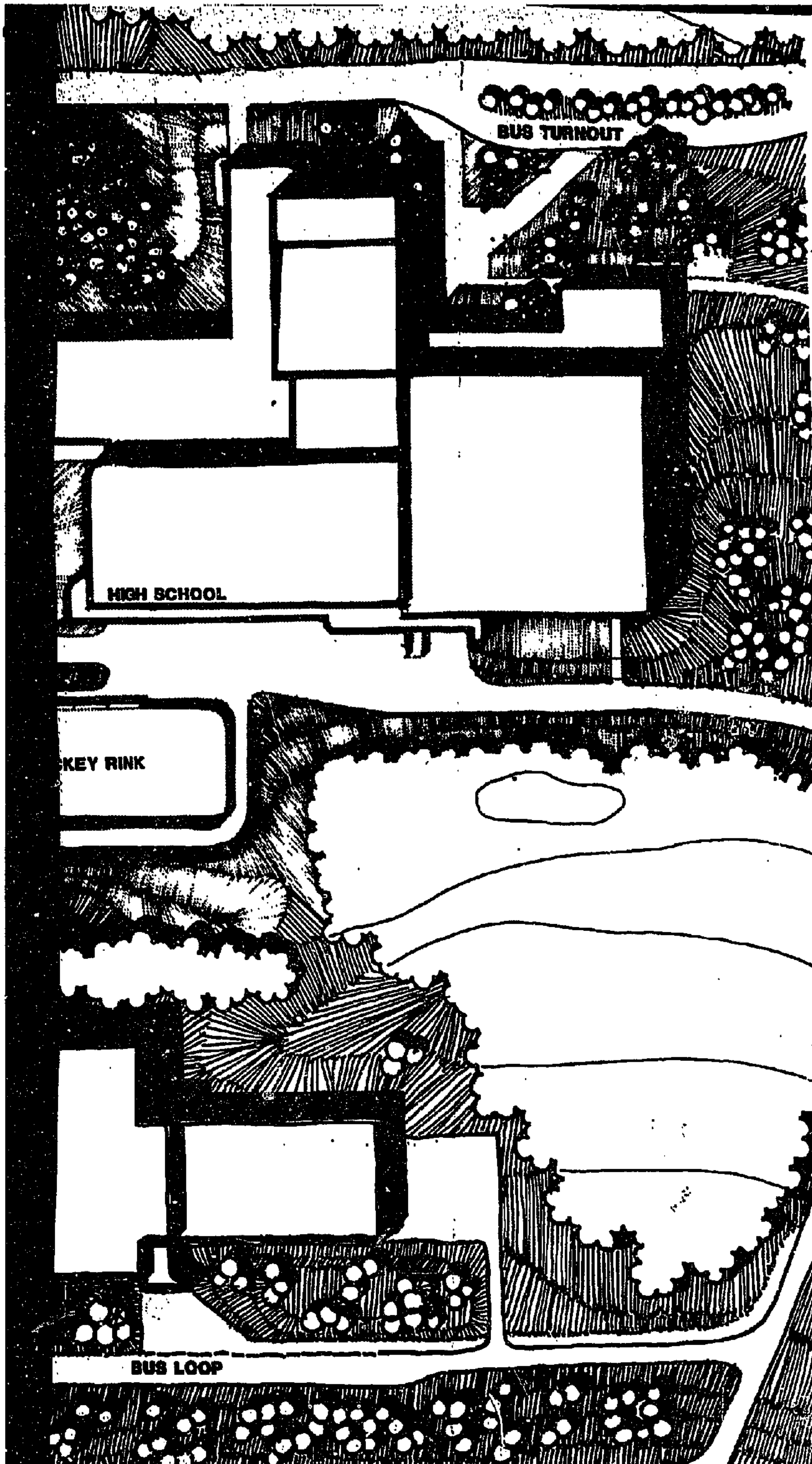
An ultimate town population of approximately 2,600 to 4,200 persons in the project area is expected to generate a K-12 school population of 800 (Harrison, 1981) to 1,600 students (Ward, 1981). Preliminary discussion with the Kenai Peninsula Borough School District (Ward, 1981) suggest the need for a high school facility capable of accomodating up to 800 students, as well as a K-8 school for a maximum of 500 students. With the development of a new educational complex in the townsite (Figure 10), the Tyonek community and/or the Kenai Peninsula Borough School District (KPBSD) may eventually wish to bus some 85 students from Bartlett Elementary/High School in Tyonek to the new educational facilities within the townsite.

Within most rural Alaskan communities, local elementary and high school facilities are utilized for classroom space during the day. However, during night-time hours and weekends, rural schools serve as a major focal point for numerous indoor and outdoor community activities such as public meetings, community school programs, and winter sport festivals. It is envisioned that school facilities within the new town will operate in a similar fashion. With this assumption, eventual



CONCESSIONS
FOOTBALL FIELD
TRACK
SOCCER FIELD
TENNIS COURTS
CROSS COUNTRY SKI AREA
SOFTBALL


BUS TURNOUT
TENNIS COURTS
HIGH SCHOOL
HOCKEY RINK
REA
ELEMENTARY SCHOOL
BUS LOOP



Adapted from design by:

Harold Wirum & Associates, Architects
Anchorage, Alaska

CIRI / H & N
ANCHORAGE, ALASKA

CONCEPTUAL CAMP, AIRPORT, and TOWNSITE DEVELOPMENT PLAN

BELUGA METHANOL PROJECT

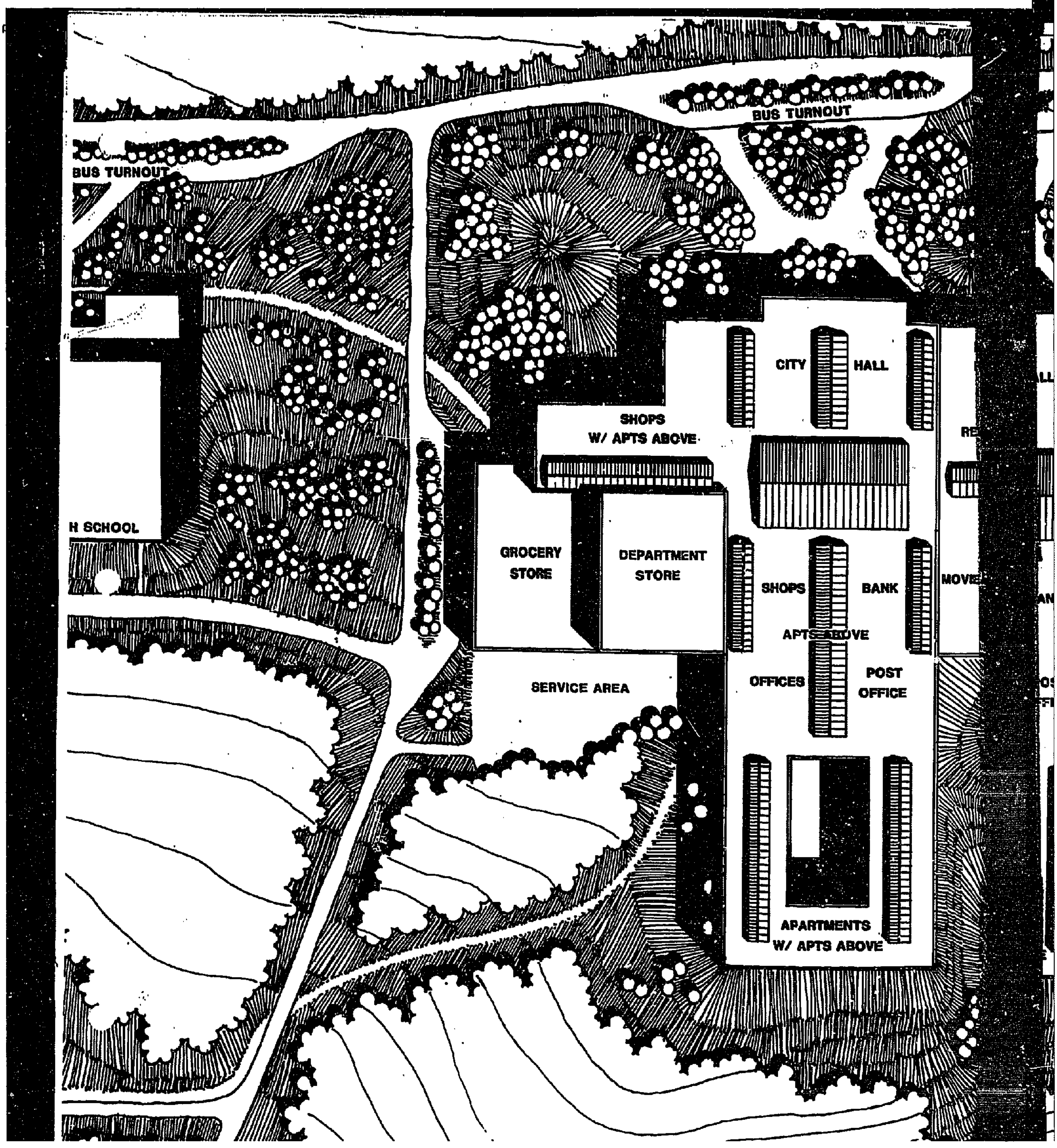
EDUCATIONAL COMPLEX
FIGURE 10

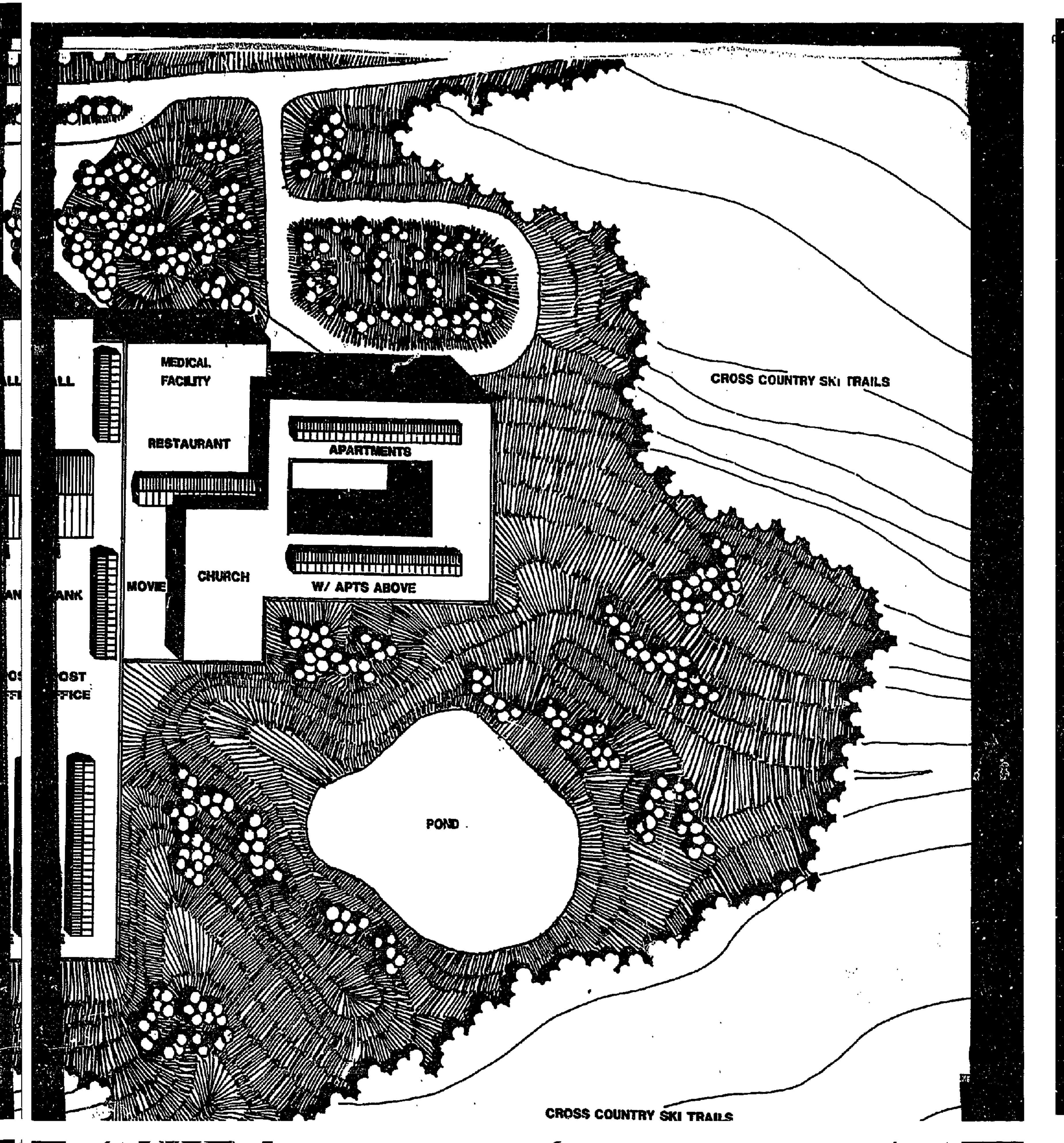
school facility designs will need to reflect supplemental provisions for activities such as swimming; community theatre and musical presentations in the school auditoriums; photography, painting, and ceramic studios; and a library collection suitable for community wide use. Outdoor facilities will include facilities for, at least, ice hockey and skating, cross-country skiing, football, track and field events, and baseball/softball.

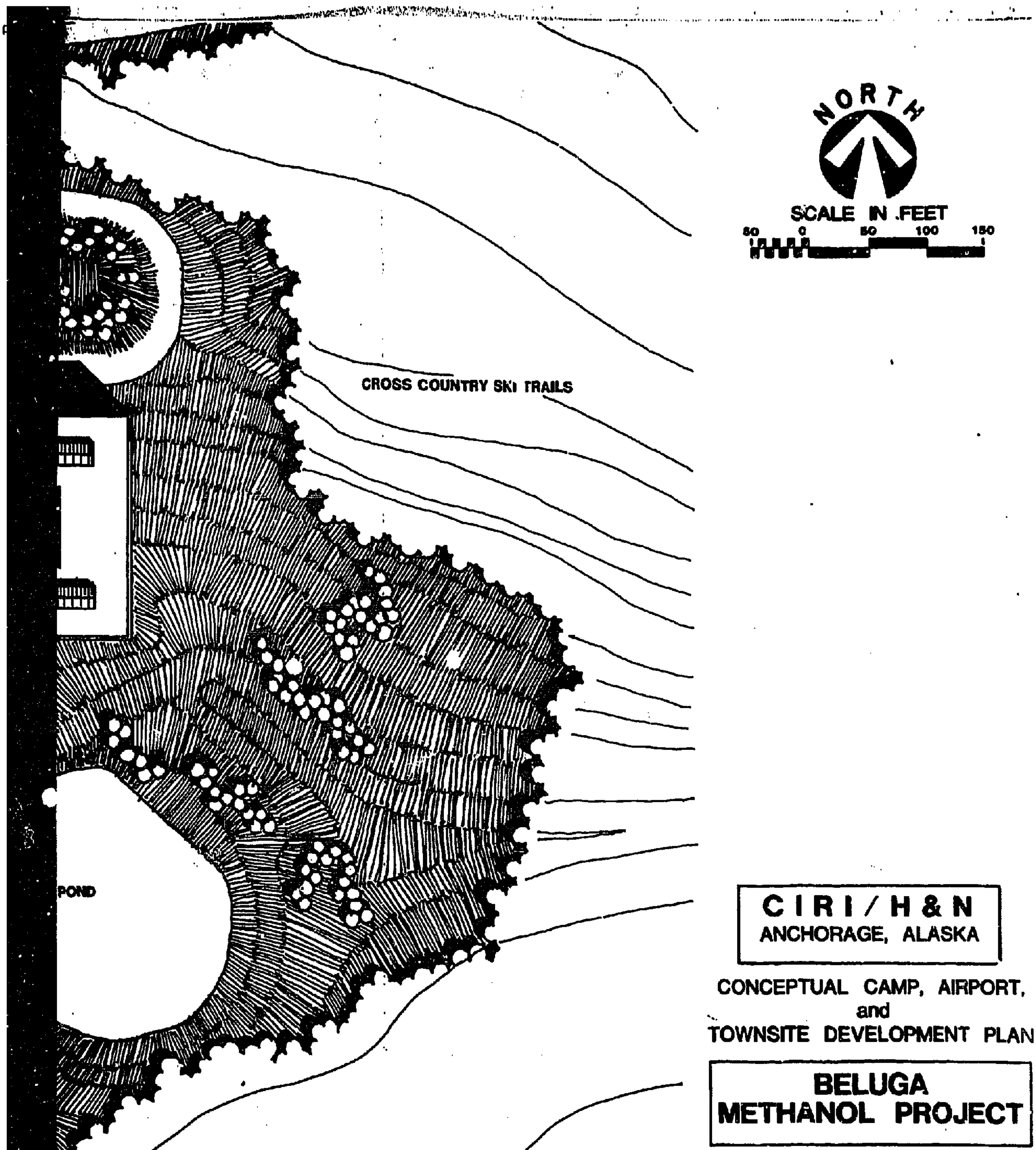
All educational facilities will be developed within one educational complex (Figure 7) with adequate separation being given between the high school and K-8 facilities. This can be accomplished through the use of forested buffer areas and commonly used outdoor recreational facility areas, such as football and baseball fields (Figure 10). Another advantage of the centralized educational complex is the potential for curriculum sharing of school programs, such as music and health services (Ward, 1981), which could aid in decreasing the annual cost of the town's educational program. Assuming use of the centralized educational complex, the Kenai Peninsula Borough School District estimates that approximately 40 acres would be required for a high school site while some 20 acres would be needed for a K-8 facility (Ward, 1981).

Commercial Complex

The other major component of the town center is the commercial complex (Figure 11). This area will provide essential and desirable community facilities for consumer purchases and services. Commercial space for retail grocery and department stores, a church, medical facilities, bank, offices, movie theatre, restaurants, and future governmental administration


BUS TURNOUT
BUS TURNOUT
CITY
HALL
SHOPS
W/ APTS ABOVE
GROCERY
STORE
DEPARTMENT
STORE
SHOPS
BANK
MOVIE
APTS ABOVE
OFFICES
POST
OFFICE
SERVICE AREA
APARTMENTS
W/ APTS ABOVE


MEDICAL FACILITY
RESTAURANT
APARTMENTS
MOVIE
CHURCH
W/ APTS ABOVE
BANK
POST OFFICE
CROSS COUNTRY SKI TRAILS
POND
CROSS COUNTRY SKI TRAILS



COMMERCIAL COMPLEX.
FIGURE 11

will be situated within an enclosed, two-story mall structure. In order to enhance the commercial and social viability of the complex, studio apartments and two-bedroom condominiums will also be developed in selected ground-level and second-floor areas adjacent to shops and community service facilities. The enclosed mall, which connects all commercial and residential space, will also be characterized by a double-insulated glass roof (Figure 11) which will provide natural light to the complex during the spring and summer months.

Access to the commercial complex will be primarily by bus and pedestrian traffic. In the winter, some residents will choose to use cross-country skiis in coming to the town while, in the summer, a sizeable number of residents will utilize bicycles. Commercial goods will be transported into the complex by truck via designated vehicular service areas (Figure 11). Special vehicular access will also be provided for emergency vehicles such as ambulance and fire trucks, as well as utility and service vehicles which require access into the commercial complex to accomplish necessary repair work or local commercial deliveries.

Utility distribution lines within the commercial area will be buried in an underground utilidor serving the complex.

<u>Transportation</u>

The work force will be provided regular public bus service for daily commuting to work areas within and outside the townsite. It is envisioned that transportation of workers to work areas out of town, for example, airport, mine, and plant, will require the use of 45 passenger buses while bus routes inside of town will use 20 passenger buses and/or 9 passenger vans.

Forty-five passenger buses will also be utilized to accommodate school-aged children commuting to the educational complex from townsite residential areas. Throughout the year, variable sized buses will also be used to provide bus transportation to nearby recreational areas such as Congahbuna Lake and Nikolai Creek.

Within the townsite, vehicular circulation for required buses, utility and service trucks, and emergency vehicles will be accommodated primarily through the use of a 24-foot wide, one-way, loop circulation system (Figure 7). Two-way traffic will occur along this roadway from the town's main entrance to the motor vehicle maintenance and storage complex in order to minimize larger bus traffic within the primary loop access system.

Secondary roads, approximately 12 feet wide, will provide vehicular access to buses and utility/service vehicles within residential areas, as well as the commercial and educational complexes.

Automobiles for private use will initially not be permitted within the townsite since adequate transportation and access will be provided through an efficient bus service, and an extensive communitywide trail system for pedestrians, bicycling, and cross-country skiing. However, the use of private automobiles may eventually be allowed. If so, parking area for these vehicles may also be provided.

All buses, heavy equipment, and utility/service vehicles serving the townsite will be stored and maintained at the motor vehicle maintenance and storage complex. This facility, approximately 4 acres in size, will be situated near the town center in order to enhance the efficiency of vehicular circulation within the townsite.

Recreation

Both indoor and outdoor recreational opportunities will be afforded to new town residents. Indoor recreational and social activities such as movie-going, informal art fairs, and restauranting will occur primarily within the town commercial complex while activities such as basketball, swimming, badminton, gymnastics, community theatre, art studios, and community clubs will function through the use of available elementary and high school facilities. Outdoor recreation will probably include the formal organization of various community leagues for hockey, football, and baseball which will use facilities located within the educational complex. Activities such as cross-country skiing, skating, and fishing will be carried out informally at various locations throughout and adjacent to the new town.

It is envisioned that new town residents who enjoy hiking, cross-country skiing, fishing, and hunting will also be attracted to other nearby recreational sites within the project area such as Congahbuna Lake and Nikolai Creek (Figure 7). With the presence of existing logging roads, access to these areas can be provided by small 9-passenger vans available from the town's public bus service.

Utilities

Water Supply, Treatment, and Distribution

No specific design criteria has been established by the State of Alaska for rural community water supplies. However, it is assumed that an ultimate town population of approximately 2,600 to 4,200 residents would consume approximately 120 gallons per person per day. Consequently, the new town's domestic water consumption will be approximately 504,000 gallons per day. Given this requirement, the well and booster pumps associated with a groundwater supply will need to be sized to accommodate an approximate 875 gpm flow. This flow rate includes a peak factor of approximately 2.5 times the average daily flow to allow for maximum peak day requirements.

Fire flow is the quantity of water in gallons per minute that is required for a specified duration of time to give effective control of a major fire or fires at any designated point within a community. Fire flow criteria by the National Board of Fire Underwriters suggest that the townsite should be provided with a fire flow of approximately 2,050 gpm for two hours, or 246,000 gallons.

The water supply for the townsite would desirably be obtained from the existing aquifier in the vicinity of the townsite. Every effort should be made to construct the well within or adjacent to the townsite utility complex which will be situated upslope of town residential neighborhoods, and commercial/educational complexes. Whether or not adequate groundwater potential is available in the vicinity of the utility complex or townsite cannot be assessed until test well investigations are undertaken within specific alternate townsite locations.

As stated earlier, the townsite water supply should be developed early in the overall construction program in order that the initial potable requirements of the temporary camp can be provided to the camp without developing a separate temporary water supply. It is recommended that the well pump size be originally constructed for the ultimate townsite demand to further reduce construction costs associated with water source development.

The storage requirements for the town's potable water system will be based on the sum of the fire demand and one-half the daily domestic demand, or a total of approximately 498,000 gallons. This storage will either be a ground storage tank located upslope of the town, or an elevated storage tank in the vicinity of the well pump site. While in storage, domestic supplies will undergo some degree of treatment to enhance the acceptability of the potable water by camp residents, and maintain potable water quality at levels which are in keeping with the water quality standards of the State Department of Environmental Conservation. Such treatment may include the use of sediment filters; charcoal filters for taste, odor and color removal; water softeners for iron or manganese removal; and iodinators for bacterial disinfection.

Depending on the outcome of test well investigations, a booster pump station may be required to provide the water pressure necessary for potable water storage and distribution. However, every effort will be made to take advantage of gravity flow from the storage tank to the town neighborhoods and facility complexes. Otherwise, a single distribution system is presently envisioned to provide domestic and fire requirements for the town. This system will consist of a main transmission line which will be installed within an underground utilidor along the town's primary loop access. Smaller diameter pipe will be installed within the utilidors providing distribution within the residential neighborhoods, as well as the commercial, educational, and vehicle maintenance/storage complexes.

Sewage Collection, Treatment, Effluent Disposal

Sewage flows generated by the town will be a rate of approximately 80 gallons per person per day (Smith, Reed, et al, 1979), or a total camp flow of approximately 336,000 gallons per day. Variable size collector lines will transport the sewage to a tertiary treatment facility within the townsite utility complex.

The sewage treatment process will consist of the four 50,000 gallon package plants, for example, extended aeration, previously utilized for the construction camp, as well as three additional 50,000 gallon package plants necessary to accommodate the increased sewage quantities. Similar to camp development, construction and actual use of the townsite will occur on an incremental basis. Consequently, the package plants from the camp will be transported and installed incrementally at the townsite as the camp population decreases and the permanent work force is nearing relocation to the townsite.

The sewage treatment plant will be sited downslope of the townsite in order that gravity sewer collection lines can be used. The plant site will also be situated adjacent to a natural drainageway which can be utilized for the discharge of sewage effluent. Using this method, a portion of the effluent, during the spring and summer months, would be absorbed in the substation while the remaining discharge would eventually flow downslope to Nikolai Creek. During the winter, a considerable accumulation of frozen effluent would likely occur within the drainageway.

A significant salmon fishery area is present within Nikolai Creek along Cook Inlet (Arminsky, 1981). Consequently, careful planning and coordination with the State Department of Fish and Game and the Department of Environmental Conservation will be required during the design phase of the camp sewage system to ensure that fishery resources in this area will not be significantly affected by the upstream discharge of tertiary-treated effluent.

If the accumulation of frozen effluent in a downslope drainageway is considered unacceptable for aesthetic reasons, or there is ecological concern for the rate of effluent discharge into Nikolai Creek, a holding pond could be constructed adjacent to the treatment plant. Effluent would still freeze within the pond during the winter months; however, containment of frozen effluent within one central area, and/or the option of a controlled rate of discharge, may be more acceptable for the mitigation of environmental concerns.

Power Supply and Distribution

Power requirements for the townsite will probably be met through the exclusive use of electrical power in light of the uncertain availability of natural gas from nearby Cook Inlet production facilities. Based on this assumption, the minimum power requirement anticipated for the townsite is approximately 25.9 megawatts (MW). However, should more detailed engineering studies during Phase IIA of the project indicate that sufficient quantities of natural gas are readily available, approximately 21.0 MW could possibly be delected from the total electrical power requirements.

The total electrical power requirement is based on the use of the following equation and a general facility analysis of the townsite land use plan and related schematic plans for residential neighborhoods and facility complexes.

$$P = \begin{array}{c}\text{Total Town-}\\ \text{site Power}\\ \text{Requirement}\\ \text{(Megawatts)}\end{array} = \frac{I\text{ (668 amps)} \times E\text{(24.9 kilovolts)} \times 1.73 \times 0.9\text{ (power factor)}}{10^3\text{ (conversion factor)}}$$

Rough calculation of the connected loads generated by the use of the townsite facilities is estimated to be approximately 1,113 amps at 24.9 kilovolts on a 3-phase, 4-wire system. The demand load is assumed to be approximately 60 percent of the connected load as shown in the preceding equation.

A 165-MW coal-fired power plant will ultimately be included as part of the overall Beluga Methanol Project. However, construction and subsequent use of the townsite will require the availability of the minimum power requirement prior to the development of the coal-fired power plant. As a result, electrical power will initially need to be obtained from the use of a 14.4/24.9 primary voltage line which will be installed from Tyonek Lumber Company to the townsite utility complex.

However, the design of a power source for the camp must be integrated with the power requirements for the other major facility proposals such as the methanol plant, coal mines, townsite, and airport, which are associated with the project (Figure 2).

As stated earlier in this report, Chugach Electric's Beluga Power Station has a 14.4/24.9-kV overhead transmission line to Tyonek Lumber Company in Tyonek (Figure 2). Excess power is technically available on this line; however, Kodiak Lumber Company of Tokyo, Japan, owner of Tyonek Lumber Company, is 90 percent owner of the existing transmission line. Consequently, successful negotiations between the project and Kodiak Lumber will have to be initiated and completed if this transmission line extension is to occur.

Assuming installation of the 14.4/24.9 kV transmission line extension to the townsite utility complex (Figure 7), a switching station will be constructed in the utility complex in order that electrical distribution within the townsite can be installed underground. Distribution lines within the town will be accomplished through the use of pad-mounted transformers and an underground utilidor which will be situated along the town's primary and secondary roads.

Solid Waste Collection, Reduction, and Disposal

The new town will generate approximately 8 pounds of solid waste material per person per day. The wastes will be composed of approximately 14,784 pounds per day of burnable material and approximately 2,016 pounds per day of noncombustible material.

After daily collection of wastes by townsite O/M personnel, a dumpster will be used to haul garbage to a solid waste management facility situated within the townsite utility complex. Incinerators at this facility will reduce burnable material approximately 15 percent while nonburnable material will be compacted to approximately one-eighth of its original volume. Remaining solid waste material will ultimately be disposed within a sanitary landfill located on the downwind side of the townsite.

TOWNSITE O/M CONSIDERATIONS

Once the townsite is fully occupied by the project's operational work force, it is assumed that the need for a 50-person camp will still exist in order to accommodate visiting governmental officials, subcontractor representatives, and prospective project employees. Consequently, anticipated O/M labor requirements for the townsite include provisions for the O/M of a 50-person camp and the airport. Table 10 summarizes the labor requirements necessary for the operation and maintenance of the townsite, airport, and a 50-person camp facility. However, a more definitive breakdown of these requirements is presented in Appendix A.

TABLE 10

ANTICIPATED O/M LABOR REQUIREMENTS
TOWNSITE, AIRPORT, AND 50-PERSON CAMP

Type of Work	Required Number of Workers
Project Manager	2
Administration	18
Facilities	30
Logistics	45
Community Service	20
Total	115

The operation and maintenance of the new town will be accomplished most ideally through the use of single O/M organization for all facility complexes, residential neighborhoods, and utility systems. However, due to the variety of tasks required, the availability of a single contractor capable of providing such a broad range of O/M services may be limited. In either case, the townsite O/M organization will generally reflect a delegation of responsibilities similar to that previously used for camp and airport O/M.

Due to the nature and presence of the permanent townsite, O/M labor requirements will generally include ground maintenance of common areas within residential neighborhoods; the daily maintenance of the commercial and educational complexes; roadway and trail maintenance, for example, snow plowing; as well as the operation and maintenance of the townsite utility systems. Heavy equipment required for the performance of these tasks can largely be accomplished through use of heavy equipment previously used for camp O/M. However, some equipment rehabilitation and replacement should be expected.

TOWNSITE CONSTRUCTION AND O/M COSTS

Introduction

Based on conceptual facility requirements, general design criteria, and related O/M considerations, CIRI/H&N has developed general order-of-magnitude estimates for townsite construction and O/M (Tables 11, 12, 13, and 14). The estimates were primarily derived from price quotations and cost estimates obtained from transportation companies, building contractors, architects, and equipment manufacturers in Alaska. In some limited cases, it was necessary to supplement local cost data from similar sources in the lower 48 states. However, such information was generally escalated to account for regional cost variations in labor, materials, and equipment.

Construction Costs

Townsite construction estimates are segregated to enhance separate consideration of mobilization, facility construction, and utility system installation (Tables 11, 12, and 13). Facility construction costs presented in Table 11 assume the development of all townsite facilities. However, the potential financial participation by private builders in the development of the commercial complex and residential neighborhoods would significantly reduce the costs which would actually be absorbed by the project for townsite development. Another potential reduction in townsite facility costs would be generated through development of the educational complex by the Kenai Peninsula Borough School District.

Given the preliminary assumptions regarding the potential financial participation by the project and other investors

(Tables 12 and 13), it is estimated that the level of financial responsibility anticipated for facility construction and utility installation will be as follows.

Agency	Amount
The Project	$ 17,479,205
Other Investors	82,866,400
	$100,345,605

Assuming disproportionate requirements for construction mobilization (Table 11), each agency will also incur an additional $0.5 to $1.0 million for this aspect of townsite development.

TABLE 11

PRELIMINARY CONSTRUCTION ESTIMATE
CONCEPTUAL TOWNSITE DEVELOPMENT PLAN
CONSTRUCTION MOBILIZATION

Type of Transportation	Quantity	Payload Capacity (pounds)	Estimated Mobilization Period	Rate	Total Costs (1981 Dollars)
Rover Barge (Anchorage to Project Area)	2	160,000/unit	6 months	$100,000/unit/month (includes fuel)	1,200,000
Lockheed Hercules C-130 Aircraft (Anchorage to project area)	1	45,000	150 roundtrips over 8 months	$4,700/roundtrip (include fuel)	705,000
Flatbed Trucks (within project area)	2	40,000/unit	4 trips/day 5 days/week for 8 months	$320/day/truck	113,280
TOTAL					$2,018,280

TABLE 12

PRELIMINARY CONSTRUCTION ESTIMATE
CONCEPTUAL TOWNSITE DEVELOPMENT PLAN
FACILITY CONSTRUCTION

Facility	No. of Units	Floor Area Requirement	Unit Cost	Total Costs (1981 Dollars)	Anticipated Source of Financing
Studio Apartment	220	400 ft^2	$51.00/sq.ft	$ 4,488,000	The Project
One Bedroom Apartment	150	800 ft^2	59.00/sq.ft.	7,080,000	Other Investors
Two Bedroom Apartment (Townhouse/Multifamily Neighborhood)	95	1,040 ft^2	59.00/sq.ft.	5,829,200	Other Investors
(Commerical Complex)	30	1,040 ft^2	59.00/sq.ft.	1,840,800	The Project
Two Bedroom Townhouse	75	1,280 ft^2	64.00/sq.ft.	6,144,000	Other Investors
Two Bedroom Single Family	350	1,060 ft^2	69.00/sq.ft.	25,599,000	Other Investors
Three Bedroom Townhouse	50	1,490 ft^2	64.00/sq.ft.	4,768,000	Other Investors
*K-8 School, High School, Library and Supporting Facilities				18,450,000	Other Investors
Restaurant	1	8,000 ft^2	80.00/sq.ft.	640,000	Other Investors
Movie Theatre	1	9,600 ft^2	72.00/sq.ft.	691,200	Other Investors
Retail Stores	10	1,920 ft^2	65.00/sq.ft.	1,248,000	Other Investors
Church	1	10,500 ft^2	65.00/sq.ft.	682,500	Other Investors
City Hall/Police Station	1	20,500 ft^2	85.00/sq.ft.	1,742,500	Other Investors

*Information obtained from Kenai Peninsula Borough School District.

TABLE 12 (Continued)

Facility	No. of Units	Floor Area Requirement	Unit Cost	Total Costs (1981 Dollars)	Anticipated Source of Financing
Medical Facilities	1	9,500 ft^2	90.00/sq.ft.	$ 855,000	The Project
Food Store	1	18,000 ft^2	65.00/sq.ft.	1,170,000	Other Investors
Department Store	1	18,000 ft^2	60.00/sq.ft.	1,080,000	Other Investors
Bank	1	6,500 ft^2	65.00/sq.ft.	422,500	Other Investors
Offices	8	800 ft^2	60.00/sq.ft.	384,000	Other Investors
Post Office	1	10,500 ft^2	60.00/sq.ft.	630,000	The Project
Mall and Corridors Gen. Covered Circulation for Commercial Center	1	70,400 ft^2	22.00/sq.ft.	1,548,800	The Project
Fire Station	1	5,000 ft^2	40.00/sq.ft.	200,000	The Project
Maintenance Building	1	3,000 ft^2	50.00/sq.ft.	150,000	The Project
Warehouse	1	2,500 ft^2	38.00/sq.ft.	95,000	The Project
Fire Station	1	5,000 ft^2	47.00/sq.ft.	235,000	The Project
TOTAL				$90,085,900	

TABLE 13

PRELIMINARY CONSTRUCTION ESTIMATE
CONCEPTUAL TOWNSITE DEVELOPMENT PLAN
UTILITY SYSTEM INSTALLATION

Facility	No. of Units	Quantity	Unit Cost	Total Costs (1981 Dollars)	Anticipated Source of Financing
Power Transmission (from Corridor to Townsite)	1	4 MI	35,000/mile	$140,000	The Project
Power Distribution (Within Site)	1			2,310,600	Other Investors
Water Treatment Building	1	4,500 ft	$30.00/sq.ft.^{2}	140,000	The Project
Water Treatment Facility	1		Lump Sum	250,000	The Project
Primary Utility Corridor*	1	15,200 lin.ft.	$187.00/lin. ft.	2,842,000	The Project
Sewage Treatment Plant	4		$310,000/unit	1,240,000	The Project
Secondary Utility Corridor*	1	4,100 ft^2	$125.00/lin.ft.	512,500	Other Investors
Solid Waste Management Building	1	4,800 ft^2	$30.00/sq.ft.	144,000	The Project
Solid Waste Reduction Equipment	2			300,000	The Project
Gravel Road of Townsite	1	835,300 ft^2	$2.85/sq.ft.	2,380,605	The Project
TOTAL				$10,259,705	

*Includes water, fire, sewer lines and heat tape.

TABLE 14

ANTICIPATED ANNUAL O/M COSTS
TOWNSITE, AIRPORT, AND 50-PERSON CAMP

	Total Cost (1981 Dollars)
LABOR	
Project Management	$ 252,007
Administration	2,114,620
Facilities	3,718,576
Logistics	5,130,002
Community Services	2,457,943
	$13,673,148
HEAVY EQUIPMENT	
Rehabilitation	200,000
Replacement	300,000
	$500,000
OUTSIDE CONSULTANT FEES AND SERVICES	$100,000
TOTAL	

Construction Mobilization

Similar to camp and airport development, mobilization costs for the townsite (Table 11) reflect the assumption of CIRI/PLACER, or its construction manager, contracting air and barge services for the transport of heavier and more bulky equipment to the project area. It is assumed that barged material will be off-loaded at some point along Trading or Beshta Bay Shoreline (Figure 2). Subsequently, the materials will be temporarily stored at a nearby staging area until materials can be loaded onto flatbed trucks which would deliver the materials, via existing logging roads, to the townsite. Barge transportation will be supplemented through the use of Lockheed Hercules aircraft which will deliver construction materials and equipment to the proposed airport. Upon arrival, materials will be temporarily stored at a staging area at the airport until truck delivery, via existing logging roads, is available to transport the materials to the townsite.

Facility Construction and Utility System Installation

Facility construction estimates (Table 12) generally assume the use of wood frame and truss systems for residential units, concrete and steel construction for the commercial complex, and prefab steel construction for maintenance and warehouse facilities. The costs developed are based upon anticipated floor area envisioned for each townsite facility, as well as estimated unit prices for each type of facility construction.

Estimates for utility system installations primarily reflect the use of package utility systems and an underground utilidor for utility distribution. Water, sewer, and solid waste facilities have been generally priced on a lump sum basis.

However, power transmission and underground utility distribution costs are based upon appropriate unit prices.

O/M Costs

Townsite O/M costs (Table 14) include the operation and maintenance of the townsite, airport, and a 50-person camp facility. The costs associated with providing heavy equipment for O/M activities should be limited to the replacement, rehabilitation and maintenance or the same equipment previously used for both camp and airport O/M.

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