

ASE IPPI SKI AREA

by

GEORGE DUVAL HARRIS

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SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF LANDSCAPE ARCHITECTURE

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GEORGE DUVAL HARRIS

A practicum submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

MASTER OF LANDSCAPE ARCHITECTURE

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To my colleagues in the Faculty of Architecture, I wish them well and say 'thanks'. To the professors that I have learned from over the years I am also grateful.

Sincerely,

George Duval Harris /95

ABSTRACT

Technological advances are allowing ski areas to function better with greater lift capacity and snow making ability. Ski area design however, has not progressed to take into account environmental design principles and theories. An opportunity exists to provide a better skiing experience by applying practices of landscape architecture to the design of ski trails.

This practicum demonstrates how architectural principles of visual sequence, proportion, scale, enclosure and the spatial effect of light, colour, texture and detail can enhance the alpine skiing experience. Using the proposed Asessippi ski area site north of Russell, Manitoba, the project provides a design for the ski trail system.

The design process for this project involved six phases; proposal and program definition, site selection, site inventory and analysis, development potential, the detailed design, and finally, conclusion. The project includes the conceptual

design of the overall development and the detailed design of two typical ski trails, one chairlift loading and one unloading area, and the base area surrounding the daylodge.

The project demonstrates that vegetation can be used to define spaces and effect the skier's perception of motion. A variety of spaces were carved from the existing forest to create a rhythmical experience of enclosure and exposure. Grading was used in some cases to make a trail appear longer and in others to conceal terrain from skiers views. These techniques and others were applied to the layout and design of the trails according to the metaphor of "discovery".

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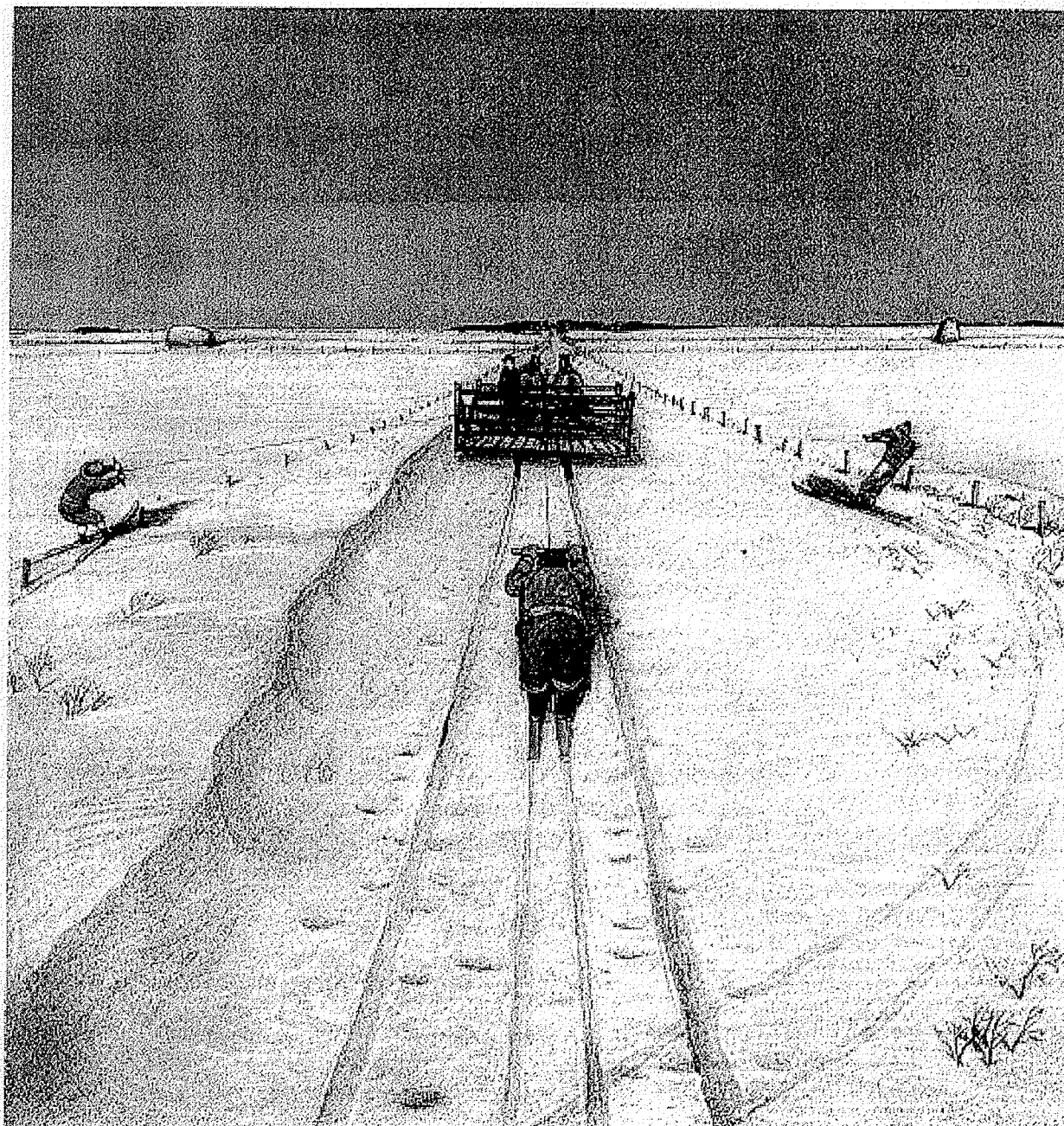
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1.1 INTRODUCTION

Like the original links golf courses, alpine ski area design has traditionally relied on the natural conditions of the site to provide the majority of the skier's experience. Unlike golf courses, ski area design has not yet evolved to take into account architectural principles and theories. Beyond issues such as circulation, lift location, water supply, snow making capacity and snow grooming requirements, the aesthetic considerations of the site and the actual skiing experience are rarely considered. While technological advances are allowing ski areas to function better with greater lift facilities and snowmaking equipment, this has tended to overshadow the potential for improving the ski experience. An opportunity exists to provide a better skiing experience by applying practices of landscape architecture to the design of ski trails.

The goal of this practicum project is to design a ski trail system using principles and theories of landscape architecture. The project explores how landscape architecture can

enhance the alpine skiing experience. This practicum project applies the landscape architecture principles of visual sequence, proportion, scale, enclosure and the spatial effects of light, colour, texture and detail. The project also explores how concepts in environment-behavior studies including perception, cognition and wayfinding can be applied to alpine ski trail design.

This study is executed using a variety of media including scaled physical models, design drawings, geographic information systems, computer models and animation where appropriate to effectively present the findings.

The site of the proposed ski area is located within the boundaries of the Asessippi Provincial Park in western Manitoba. The park is west of Riding Mountain National Park and approximately 16 kilometers north of the town of Russell.

Russell is an agricultural community of 1670 people situated along the Yellowhead Trail some 320 kilometers north-west of Winnipeg.

The Asessippi Ski Association filed a proposal in May of 1990 to develop an alpine ski area on parts of N1/2 32-22-28 WPM, SW 3-23-28 WPM and S1/2 4-23-28 WPM on the north facing slopes of the Shell River located west of PTH#83. The devel-

opment would require approximately 14 hectares of land to be leased from the Asessippi Provincial Park. A feasibility study and market analysis of the project was carried out by D. R. Matthews and Associates Inc. which concluded that the project was viable. A total of 55,205 skier visits per year was projected for the ski area. The plan proposed a first class ski facility comprising of two state of the art quad chairlifts, a beginner tow, 100% snowmaking capabilities, modern grooming equipment, 35-45% night lighting, a lodge with restaurant and lounge, a large outdoor spa area, a retail area and daycare facilities. Jim Buckingham was hired as a consultant to prepare a layout of the facilities by Asessippi Ski Association. Asessippi Ski Association recognizes the potential of using the site for nature trails, dryland skiing and banquet/meeting facilities in the future for summer use activities. Until such time as this is viable the site shall only be used for intensive winter use and must function appropriately as part of the provincial park.

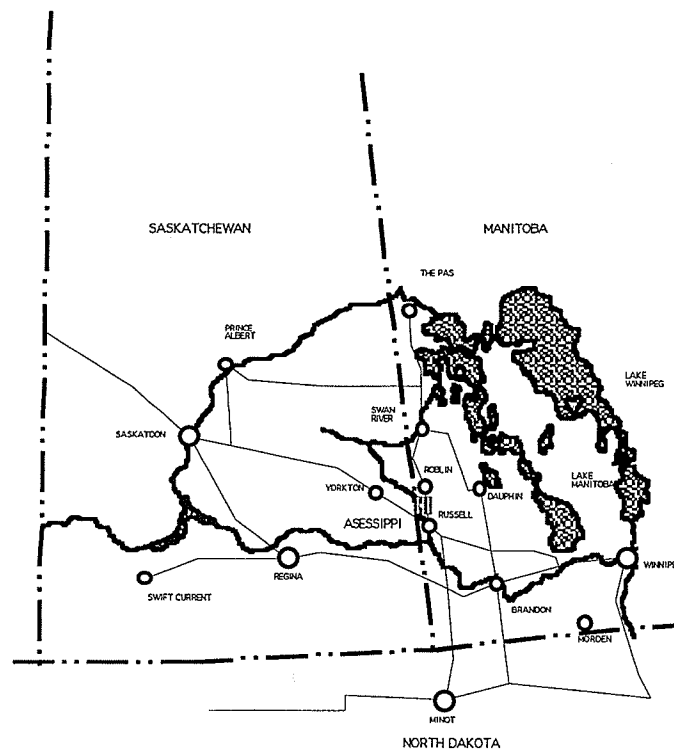


Fig. 2 Location map.

The Asessippi Ski Association proposal will act as a vehicle to test the ideas of this practicum. This practicum provides a design for the ski trail system at Asessippi Ski Area. This project demonstrates how architectural principles can be applied through the design of the trail layout, and the detailed design of two trails a chairlift unloading and loading area as well as the base area. It is not the intention of this practicum to determine whether or not the site chosen by Asessippi Ski Association is environmentally suitable for a ski area. Presently the proposal is under review by the Clean Environment Commission under the Province of Manitoba. This Commission will determine the suitability of the site and whether the development can proceed. This project is hypothetical based on the assumption that the site is environmentally suitable. As it is only the intention to test the application of specific landscape architecture principles in ski trail design, the outcome of this Commission or the future development of Asessippi will not effect the findings of this practicum; nor will the findings of this practicum effect the development as proposed by the Asessippi Ski Association. The practicum takes a neutral position on the environmental suitability of this site.

1.2 METHODOLOGY

The design process for this project involved six major phases. The first phase was the proposal and program definition. The second phase was site selection. Three potential sites were considered, one in North Dakota, one in Banff and the Asessippi site in Manitoba. Because the Asessippi proposal was under a government environmental review extensive research had been carried out on the site. The developers of the Asessippi site were provided with a report indicating the scope and intent of the study. Permission was then granted to access all of the information on the site collected up to that date.

Phase three involved site inventory and analysis. Pertinent information that would inform design decisions was collected and analyzed. This information was presented to the thesis committee in the form of drawings, photographs and a model. The information was arranged into categories of location and site, geology and physiography, soils, vegetation, climate,

slope/aspect and demographics.

The forth phase, that of development potential, involved a detailed analysis of the site inventory to look for opportunities and constraints for design. A three-step geographic information system (GIS) overlay process was used to determine the suitability of the site for skiing. Step one involved identifying land units with severe limitations, land with cultural or biophysical constraints which were considered unsuitable for development. Step two involved identifying remaining land units suitable for the development of ski slopes. Step three involved the identification of the land units that were suitable for lift loading and unloading areas. This information was presented to the thesis committee in the form of slides. After this process was complete a fall line analysis was carried out. Simultaneously the design principles to be used throughout the project were stated and a design concept was determined.

In phase five, that of the detailed design, the previous information was used to propose three alternative layouts. After

careful consideration one was chosen. As outlined in the project proposal specific areas were chosen for detailing. This included a chairlift loading area, a chairlift unloading area, a trail and the base area. These areas were then designed in sufficient detail to give a clear understanding of the intervention and intention. This information was presented through a variety of design drawings.

The final phase, the conclusion, provided a summation of the findings and directions for future research.

1.3 SITE SELECTION

After considering three alternative sites for this practicum the site proposed by the Asessippi Ski Association was chosen. The primary reason for this decision was the abundance of available information on this site. One of the reasons for this was the location of the site in a Provincial park. As a result master plans and development plans were available that described in detail much of the background information required



for a project of this nature. In preparation for environmental hearings, Asessippi Ski Association was required to carry out a full environmental impact assessment of the proposed development. The research required to complete the assessment provided some of the background information for the practicum. The availability of this information and the accessability of the site were the criteria used to select the site. The environmental suitability of the site was not a consideration.

While some ski areas are located on land rising above the prairie such as Agassiz Ski Area on the Riding Mountain escarpment other ski areas such as Holiday Mountain are located within a river valley. The fact that the site exists within a valley provided an opportunity to explore the contradiction that exists between the prairie and a valley. It also provided an opportunity to explore how people react to this contradiction.

Spatially the valley exists in a defined area carved into the prairie by an ancient fluvial river. There are various slopes

with different grades. These slopes are covered by a dense deciduous forest. The valley is quite beautiful providing many pleasing views.

For people living on the prairie there is a special appreciation of the valley. People who live and work on the prairies are people who know the land and experience day-to-day the harsh and beautiful qualities it offers. Prairie people are drawn to the valley. It provides a retreat from the open spaces, protected from the wind by abundant vegetation. The Balsam Poplar forest incites curiosity and provides an ideal spot for recreation and relaxation.



2.1 SKI AREA REQUIREMENTS

An analysis of the potential market for Asessippi Ski Area was carried out by D. R. Mathews and Associates. This data was used to calculate the design capacity. Design capacity is the number of people that can regularly be expected at the ski area per day. The design capacity combined with statistical and design guidelines of experts in the area were then used to make site requirement calculations.

According to the analysis by D. R. Mathews and Associates the primary market is estimated to be within one and one half hours drive of the area. The population base in this area is approximately 85,336. The Ski area can expect approximately 27,100 skier visits the first year and a total projected market penetration of 55,205 skier visits per year. Based on these numbers and the site selected the appropriate design capacity for the area will be approximately 1050 skiers per day (Matthews, Asessippi Market and Financial Assessment, 1992, pp. 1-6.)

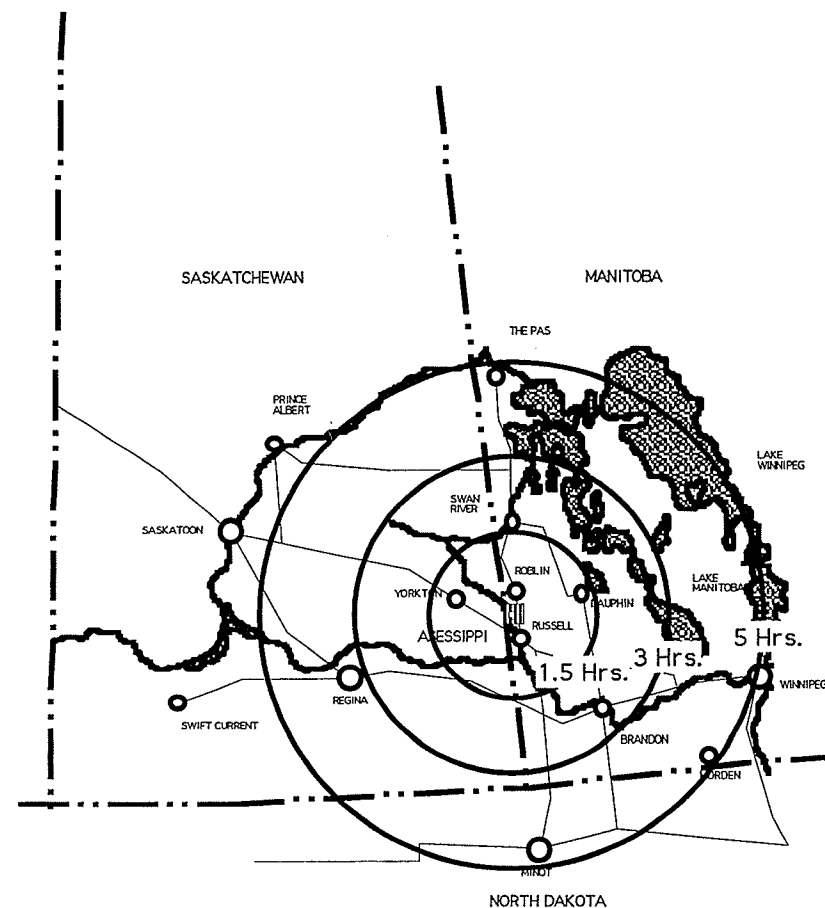


Fig.4 Skier proximity

	*Design Capacity (skiers)	**Area Required (sq. meters/skier)	Total Area (hectares)
Base Area	1050	256	27
Skiing Area	1050	varies according to ability	***36
			Total 63

* Number of skiers per day(Mathews, 1992, p.14.).

** Area required for milling, runnout, buildings and parking
(Farwell 1988, p.5.).

*** Based on calculations for trail requirements.

Fig. 5 Space requirements for ski area.

The proposed location of the day lodge, parking and maintenance facilities at mid-hill provides unique opportunities for this ski area. Located in the dense forest of the valley wall rather than on the open prairie above, the space will be better protected from wind. More importantly this location provides a sense of being somewhere away from the vast prairie. The skiing terrain is ideally suited to this location as there is a natural progression from beginner to expert terrain as the skier moves away from the base area or daylodge. The location of the chairlifts will mean that a skier will only be able to access

the second pod, that is the trails accesible from a given lift, and expert trails by first riding the lift in the first pod. This is similar to skiers accessing the backside of a mountain and will give the impression of there being more area to be discovered. To return to the lodge and base area skiers will be required to use the same lift to avoid walking on flat terrain. In order to facilitate this objective the lift in the farthest pod will have to be closed earlier than the other lift. There should be no inconvenience to this layout in part because skiers using this lift will be, for the most part, of higher skiing ability.

2.2 LIFT REQUIREMENTS

There are a wide variety of lifts in operation at ski areas today. The most common lift and the most preferred by skiers is a chairlift--however, there are also t-bars, rope tows, platter lifts and at larger ski areas, gondolas and trams.

A chairlift is composed of two terminals, one at the bottom of the hill and one at the top. One terminal contains the machinery



Fig. 6 Platter loading area, Fairmont B.C..

to operate the lift. Towers or pylons support the cable of the lift between the terminals. Chairs are attached to the cable and vary in capacity from single to quadruple seating. A suitable location for the lift requires a flat area at the top and bottom of the hill for each terminal. The area at the top of the hill is comprised of a lift terminal and ramp and a space for skiers to regroup and prepare their equipment for the next run. A trail map, garbage receptacles and seating is usually provided. The

ramp allows skiers to quickly move out of the way of the chairlifts after they disembark from the lift. After an often cold ride on the chairlift a sunny sheltered area is desirable. This area must be accessible by grooming equipment but should also be enclosed to provide shelter. Skiers like to regroup at the top of the lift to decide which runs they will ski next. It is important to provide clear alternatives.



Fig. 7 Unloading area, Fairmont B.C..

The flat area at the bottom of the hill is not only required for the terminal and loading area but also for the lift line or maze and an appropriate amount of space for skiers to slow down before entering the maze area (Buckingham, Plan for the Layout of Lifts..., 1991, pp.7-8.) The following chart provides the maze row requirements for a 10 minute lineup.

<u>Lift type</u>	<u>Width</u>	<u>Area(sq. m)</u>
Double	1.5m	230
Triple	2.25m	345
Quad	3m	460

(Ramsey, Architectural Graphic Standards, 1994, p.17.)

The maze should be as flat as possible with the approach to the loading area graded at a 1% - 3% downhill slope for at least 15m (Ramsey, p.17.) The maze area must be accessible by equipment for grooming the snow. The lift line is the area where skiers usually make their first contact with their friends after the ski run. The designer can expect skiers in this area to

be excited and talkative as they express their skiing experience to their friends. Having just exerted themselves while skiing down the hill or having just left the lodge the skiers are usually "warmed up" when they are in the lift line. Nevertheless whenever possible this area should be protected from wind and exposed to the warmth of the sun.

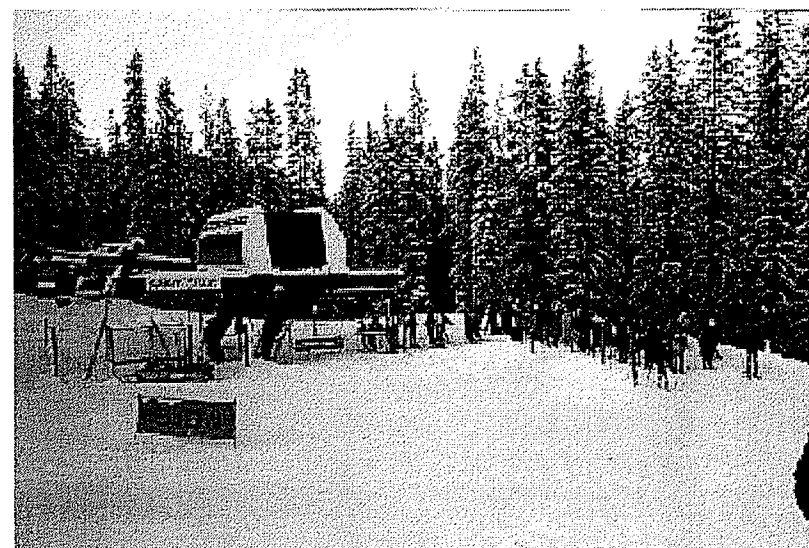


Fig. 8 Loading area, Mystic Ridge, Alta.

Most lifts, including chairlifts, run directly up the slope perpendicular to the contours. Although it is possible to angle lifts across a slope this is not desirable as it will make the lift longer and more expensive for the same amount of vertical drop (Buckingham, Plan for the Layout of Lifts..., 1991, pp.7-8).

Traditionally skiers progressed from using the rope-tow to the t-bar and finally the chairlift as their ability level improved. However, fewer and fewer t-bars are in use now so many people are moving from a rope-tow system directly to the chairlift. The chairlift provides a different experience for the skier than a t-bar. Unlike the t-bar there is not the sensation of snow moving under one's feet. Chairlifts are more relaxing. They provide an excellent opportunity to sit back and enjoy the scenery. They are also colder as they rise above the trees and are more exposed. The chairlift is seen by many people to be an exciting component of skiing. There is an association between riding the chairlift and experiencing rides at a fair. Chairlifts are also social places where skiers can converse with friends or meet other skiers.

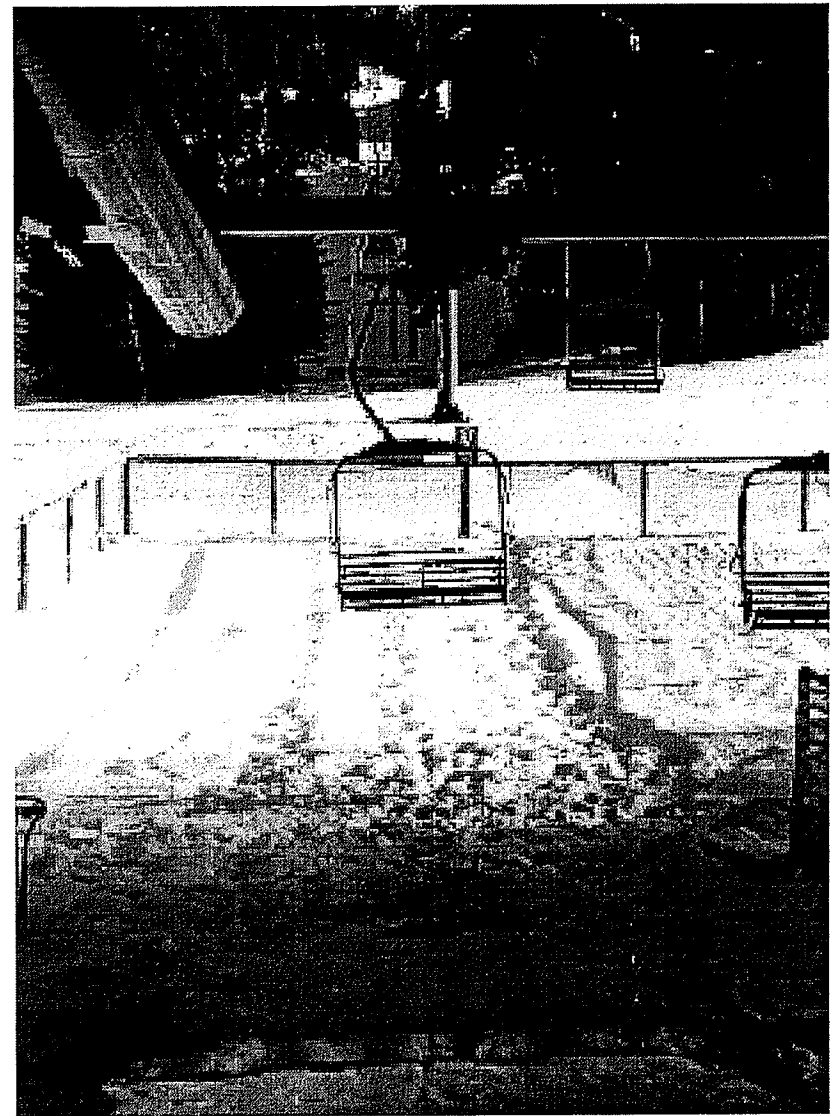


Fig. 9 View looking up lift line, Fairmont, B.C..

The developers of Asessippi ski area plan to install two quad chairlifts and a beginner tow. Asessippi Ski Association has indicated that they would like to include an International Ski Federation's (FIS) approved hill in the design. At least one chairlift should access 110 vertical meters in order to meet the FIS requirements for an approved slalom hill (Ramsey, Architectural Graphic Standards, 1994, p. 17).

*Number of Skiers	**Number of Runs Per Hour	Total Lift Capacity	***Capacity of Two Quad Chairlifts	Capacity of Beginner Tow
		(skier runs/hr)	(skier runs/hr)	(skier runs/hr)
1050	5	5250	4800	450

* Number of skiers per day (Mathews, 1992, p.14.).

** Vertical terrain skiers expect to ski per day is approximately 2834 meters which is the equivalent to 5 runs per hour at this ski area (Farwell, 1988, table 2).

*** Doppelmayr quotation(Mathews, 1992, p.35.).

Fig. 10 Lift requirements.

Unlike skiing in the mountains, skiers at this site will be riding the same lifts all day. To minimize boredom while riding the

lift it will be important to provide interesting things for the skiers to look at and experience during the ride. This may be achieved, for example, by having trails visible from the lift so that people on the lift can watch others skiing. Unusual views or momentary vistas that build a sense of anticipation can be provided. Furthermore by using visual illusions, lifts can be made to look shorter or longer.

According to the lift manufacturer consulted by the developer there will be 60 chairs on each quad chairlift. The chairs will be spaced at approximately 14m intervals. Each chair can carry 4 people therefore there will be approximately 120 skiers on the lift at one time. There is expected to be approximately 8 towers positioned at 13.5m contour intervals or spaced approximately 51.5m apart. The lift travels at 139.5m/minutes which is the equivalent to 8.4 km/hour. The time spent on the lift by the skiers would be approximately 3 minutes 10 seconds (Mathews, Asessippi Market and Financial Assessment, 1992, p.34). This is not a lot of time for skiers to wait between runs when there is no lift line. In this case skiers may wish to relax

at the top or bottom of a hill before making their next run. Skiers will tend to prefer to do this at the top of a lift if a comfortable environment is provided. As skiers are likely to feel cold after riding the lift and perhaps waiting in the lift line, sunny warm sheltered spaces will be desirable at the top of the lift.

2.3 TRAIL REQUIREMENTS

Every ski area must provide trails suitable for every level of ability. Market research carried out by each ski area will determine the required amount of trails for each ability level. Ski trails are often classified as suitable for beginners, intermediates or experts although some designers are creating more elaborate systems. This classification is based on the assumption that beginner skiers enjoy gentler slopes, while experts prefer steeper slopes and intermediate skiers complete the range in between. Designing ski trails requires an understanding that expert skiers can ski both intermediate and beginner slopes while beginners cannot ski intermediate or expert

terrain. A general rule for the designer is that any pitch of 75 linear meters or more that exceeds the maximum grade of a class of slope will place the trail in the next higher class.



Fig. 11 Beginners require gentle slopes.

According to statistics intermediate skiers account for approximately 60% of skiers and therefore the design of the facility should reflect this (Farwell, The Concept of Balance..., 1988, table 2).

Ability Level	*Percentage of Skiers (%)	**Number of Skiers
Beginner	25	263
Intermediate	60	630
Expert	15	157
total	100	1050

* Average based on Buckingham, Farwell and Harley.

** Based on 1050 skiers per day total.

Fig. 12 Number of skiers according to ability.

Trails must begin and end at a lift terminal and should not require the skier to walk on flat terrain. Most trails should follow the fall line of the terrain as side slopes are often difficult to ski and maintain. The fall line is a line directly down a slope. Curving narrow trails are often more interesting to ski than trails that are wide open and straight. Trees are often left undisturbed between trails to provide visual barriers, physical barriers and wind protection to the trails. At small ski areas this vegetation is also important as it makes skiers feel that there are a variety of trails. Usually this undisturbed area accounts for 55-70% of the total skiing area (Buckingham, A

Primer on Trail Design..., 1993, p.3). When it is not possible to provide fall line skiing "ski ways" can be used to connect trails and lifts. Ski ways are roads that are used by skiers and grooming equipment and are created using cut and fill techniques. Including ski ways in a design should be avoided as they are expensive to construct and not usually exciting to ski. All trails at ski areas that rely on artificial snow must be accessible by snow grooming equipment or "snow cats". This

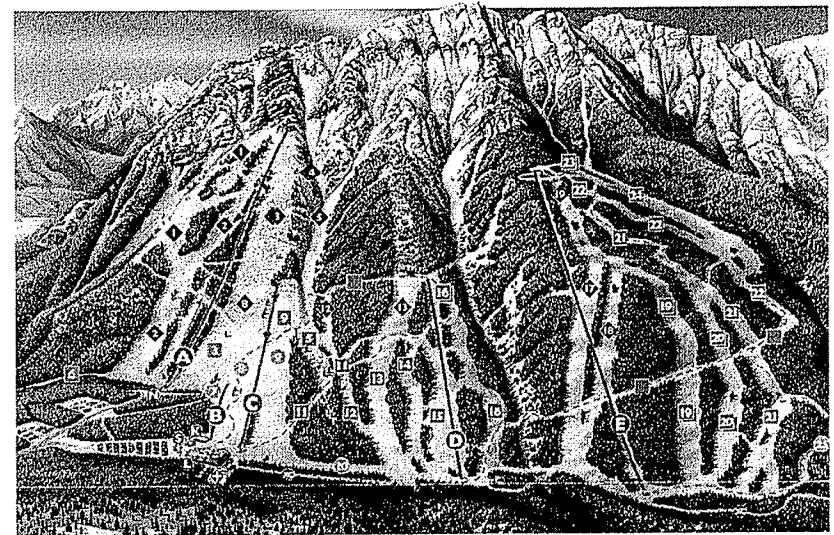


Fig. 13 Trees define trails, Mystic Ridge, AB..(©Mystic Ridge, 1994).

equipment varies in size with the largest being approximately 7 meters long, 6 meters wide and 3.5 meters high (Ramsey, Architectural Graphic Standards, 1994, p.17).

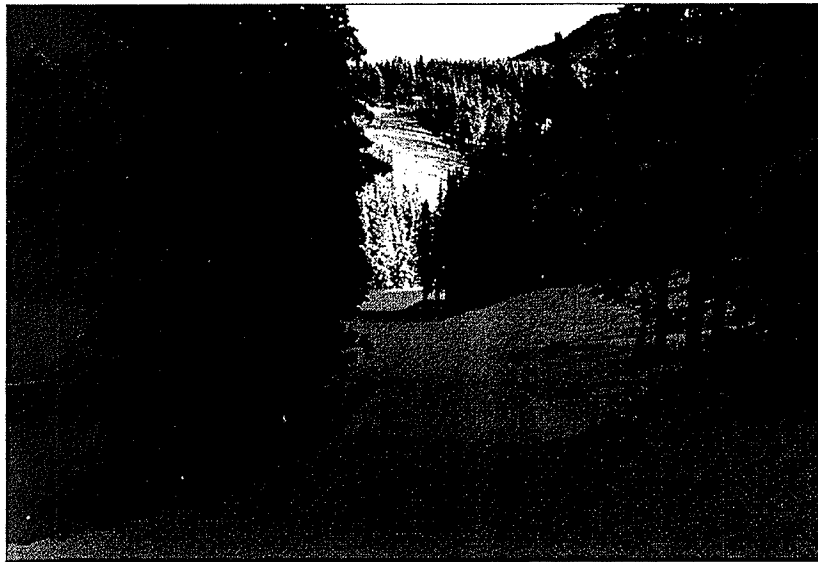


Fig. 14 Ski way, Mystic Ridge, Alta..

The average width of trails is 45 meters however they can vary in width from 15 - 80 meters (Farwell, The Concept of Balance..., 1988, p. 15). The type of turns a skier makes is the result of the desired speed and the conditions under which they

are skiing. When a skier wants to go faster fewer turns or larger radius turns are made. On flatter slopes, for example, skiers will tend to make less turns or larger radius turns as this will enable them to maintain their speed. As a result these trails can be narrower in width. These narrower trails have the desired effect of emphasizing speed. On steep terrain a skier makes more frequent smaller radius turns to control their speed. For trail width this means that if a trail is wide it will be easier and safer to make large fast turns or perhaps go straight. When a trail is narrow and steep it is not possible for the skier to make large turns and the skier will make smaller turns to control their speed.

When the trail is rough, as when moguls have formed, skiers will be forced to make small turns to maintain control. When the trail is smooth or recently groomed it will be safer to increase speed and larger turns will be made.

Ski areas that rely on artificial snow must groom the ski trails regularly. As a result wide steep slopes which would usually

be covered in moguls are smooth and conducive to fast skiing. To reduce the speed on steep slopes that are groomed regularly it is necessary to make them narrower.

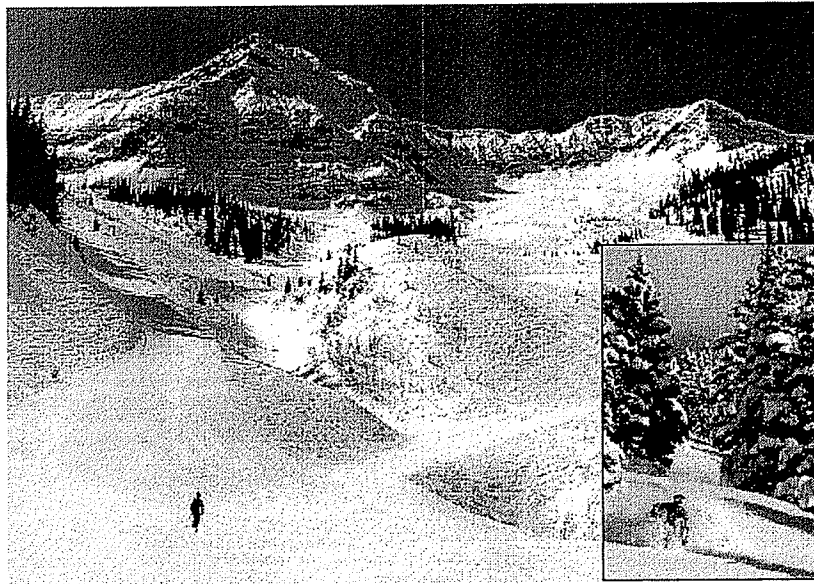


Fig. 15 Skiing in the trees is a different experience to skiing in open spaces, Fernie B.C..

Islands of vegetation in a wide trail can have the effect of slowing skiers down as they provide a visual obstacle. Islands

also provide interest and opportunity for skiers to make choices. In various light conditions the trail on one side of an island may be exposed to full sun while the other will be in shade. Each side of the island will provide a different atmosphere. Individual trees may provide similar experiences.

Edge condition is very important to the skiing experience as movement is exaggerated in the periphery of the eye and is emphasized by straight edges and contrasting vertical bands (Hall, *The Hidden Dimension*, 1982, p. 72). As a result the trails defined by vegetation will emphasize motion more than trails in open areas. Deciduous trees are more likely to provide the effect of alternating vertical bands than coniferous trees. The linear shadows cast by deciduous trees can be used to effect speed perception.

A consensus does not exist in the industry as to the slope requirements for the various ability levels of skiers. The following are the slope requirements used in this project.

Beginner slope = 5-15%

Beginner and Intermediate slope = 15-25%

Intermediate slope = 25-30%

Intermediate and Expert slope = 30-40%

Expert slope = 40-55%

There is more discussion on this subject in the section on skier suitability (see Section 4.0 Skier Suitability).

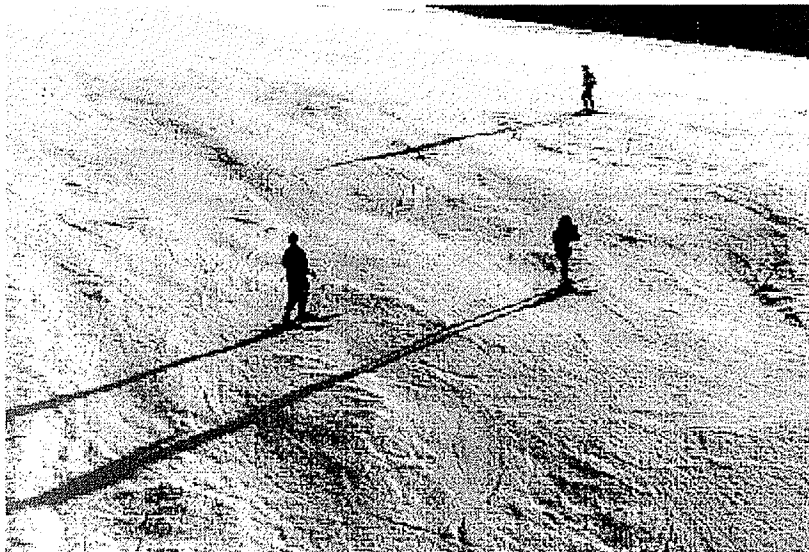


Fig. 16 Open slopes are more conducive to fast skiing.

Ability Level	*Trail Density	**Number of Skiers	Area Required of Skiing Trails
	(skiers/hectare)		(hectares)
Beginner	85	116	1.3
Intermediate	32	277	8.6
Expert	15	70	4.5
	totals	***463	****14.4

* Density acceptable to various abilities (Farwell, 1988, table 2).

** Based on the percentage of skiers in each ability level.

*** Expected percentage of the people at the hill skiing at one time is 44% (Farwell, 1988, table 2).

**** Area required of skiing trails represents 40% of the gross skiing area as 60% is left forested. At a width of 45m, 3200m of trails are required.

Fig. 17 Space requirements for skiing trails.

Asessippi Ski Association has indicated that they would like to include competition venues in the design. The International Ski Federation (FIS) which governs alpine ski racing requires a minimum of 110m vertical drop for a men's and women's slalom course. The project also calls for a suitable trail for a moguls course and ballet area for freestyle competitions. Freestyle mogul competitions require slopes between 44% and 63% with a minimum length of 200m and a maximum of 270m. The width of the course is 15m to 25m. Ballet requires a slope of between 21% and 29% with a length of between

150m and 170m. No section longer than 20m can have a slope greater than 30% or less than 19%. The course width is between 35m and 40m (International Ski Federation, Technical Specificationsof Freestyle Courses, 1993, p.1).

2.4 BASE AREA REQUIREMENTS

All base areas function as the major access/egress portal to the ski terrain. They contain most of the skiers support functions and comforts. The base areas should reflect the constraints of topography and the configuration and size of the mountain. Base areas can vary from ski area to ski area, some use large singular base areas and others use dispersed multiple base areas. Because of their nature base areas experience intense rates of morning arrivals and afternoon departures (Barnhart, "Thinking About Bases", 1985, p.82). At areas where the only eating facilities are located at the base area this can occur at lunch as well. Skiers activities within the base area can be grouped into six categories: circulation and entry corridors, staging area, activity areas, queuing/waiting areas, and equip-

ment storage areas. Each of these areas can be further subdivided into three skier functions: walking with skis on, carrying skis, or standing with skis (Barnhart, p.83).

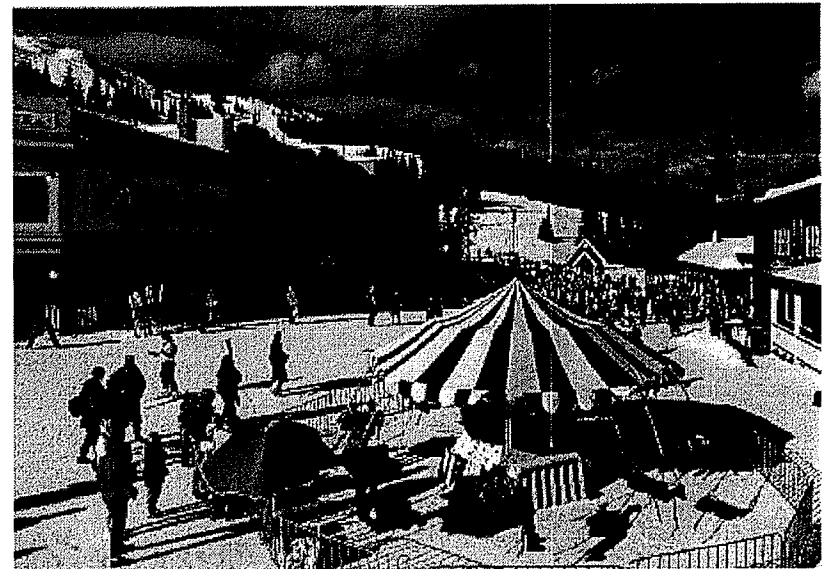


Fig. 18 Base area, Silver Star, B.C..

The lifts at Asessippi are not located in the base area. Therefore queuing and waiting areas will not be located in the base area either. Most of the base area must be covered by snow to

allow skiers access on skis. Grooming equipment must also be able to access this area so all immovable objects such as trees must be spaced accordingly. The base area should also be situated to allow for ample room for skiers to slow down before entering the area for safety reasons. The skiers will spend between 5-15 minutes in this area (Farwell, The Concept of Balance..., 1988, p. 22). When possible the base area should provide direct access to the automobile parking.

2.5 SNOW MAKING REQUIREMENTS

A snow-making system includes a water pipeline and pumping system, an electric and/or compressed air distribution system, one or more air compressors and several snow guns. There are three different types of snow-making systems in common use in the ski industry. These are air/water, airless and low air systems. Snow can be made with all these systems at temperatures below -6°C .

The humidity, wind speed, and the distance the snow has to fall

to the ground (as a result of the slope of the hill) will effect snow production (Buckingham, A Plan for the Layout..., 1991, pp. 28-31). Snow-making requires approximately 800 litres/cubic meter of snow. The snowmaking hydrants are usually spaced approximately 45 meters apart. When the snow melts in the spring 78% of snow returns to water shed (North / South Consultants Inc., Asessippi Ski Area Environmental Impact Assessment, 1994, p. 53).



Fig. 19 Airless snow making equipment.



3.1 LOCATION AND SITE

The terrain that the developer chose for Asessippi Ski Area is the north-facing slope of the Shell River valley. The slope has a broad "U" shape following the curve of the Shell River. The river valley cuts through gently rolling prairie and the break from the prairie to the slope is very abrupt. The prairie is cultivated land with scattered clumps of Aspen Poplar. The slope is covered with Aspen and with Black Poplar along the river. Throughout the wooded area there is a very dense underbrush. In general the slope is gentler toward the west and steeper toward the east. In the most easterly portion, along the new highway, the slope becomes very irregular with steep-sided ridges and gullies, thus less suitable for ski terrain (North/South, Asessippi Ski Area Environmental Impact Assessment, 1994, p. 61).

When driving to the ski area from Russell along the major highway the skier will pass many kilometers of flat agricultural land before turning off onto a two lane minor highway. The

agricultural land becomes spotted with clumps of trees and small streams and marshes. The road turns on to an old gravel highway which abruptly drops into the valley. Cut into a side slope the road is enclosed on one side by the valley wall and the other by forest vegetation.

3.2 GEOLOGY AND PHYSIOGRAPHY

The hilly uplands of the Riding and Duck mountains are the most prominent relief features of the area. These morainic hills bisect the area from north to south dividing it between two broad physiographic areas known as the Manitoba Lowlands and the Second Prairie Steppe of the Great Plains Region. The steep eastern slopes of the Riding and Duck mountains form segments of the Manitoba Escarpment, which marks the western limit of glacial Lake Agassiz. In this area, the escarpment rises over a thousand feet above the Lake Agassiz Basin and attains the highest land elevation in Manitoba on Baldy Mountain (825 meters above sea level) located in the Duck Mountains. West of the Riding and Duck mountains the land fall is

more gradual and the morainic hills give way to an undulating plain deeply incised by river valleys (Matthews, Site Assessment, 1992, pp 24-36).

The rugged terrain of the Riding and Duck mountains is in sharp contrast to the gently sloping Valley River Plain and the flat to slightly rippled landscape of the Lowland Plain. The Valley River Plain occupies a former bay of glacial Lake Agassiz. Commencing at above 515 meters above sea level, the land falls gradually over lake washed till and shallow deltaic deposits to the prominent glacial lake beaches at about 365 meters above sea level. Below these sandy beach ridges, the Lowland Plain stretches far to the east and south in a gradual descent to the axial portion of the Lake Agassiz Basin, now occupied by Lake Winnipeg and the Red River Valley (Manitoba Tourism, Outdoor Recreation Master Plan, 1973, pp. 101-104).

West of the morainic divide, the surface runoff waters flow through intermittent creeks and draws to enter the deeply cut

valleys of the Shell and Assiniboine rivers and their tributaries. These valleys, which in places reach dimensions of 60 to 100 meters deep and more than one and a half kilometers wide, dissect the Newdale Till Plain and are a major feature of the landscape. At the site of the proposed ski area the valley has a vertical rise of 100 meters (Matthews, Site Assessment, 1992, pp 24-36).

The Assiniboine and Shell River valleys divide the study area into three distinct physiographic units: the uplands on either side of the valleys, the steeply sloping valley walls, and the flat valley floors. The entire study area is underlain by Cretaceous shales and sandstone (Matthews, pp 24-36).

3.3 SOILS

The Proposed ski area is located in the glaciofluvial valley of the Shell River. The hills of the valley have a relief of up to 100 meters. The steep valley slopes are formed in the till,

underlain by shale bedrock well below the valley bottom.

There is no evidence of slumping or instability (North/South, Asessippi Ski Area Environmental Impact Assessment, 1994, pp. 60-71). At the site the soils consist of a 3.5 meter-thick upper till unit. This is underlain by a 47 meter-thick middle till unit. Both are of stiff to very stiff low to intermediate plasticity clay. Below the middle till unit there is a 42 meter-thick lower till unit of dense silts and sands (North / South, pp. 60-71). The midbank near-surface clay till has been reworked with numerous silt and sand layers to a depth of 1 to 6 meters. At the base of the valley alluvial sands with some silt and gravel extend from the 1 to 3.7 meter depth, with bedrock at a depth of at least 12 meters (elevation 418-420m) (North/South, pp. 56-57).

The bedrock at the proposed site consists of soft shale of the Millwood member underlying the valley walls. On the uplands east of the site, the fractured shale of the Odanah member overlies the Millwood shale to a thickness of 60 meters at Inglis 8 km to the east (North /South, pp. 60-71).

The clay till units are relatively dry with low moisture contents. The piezometric level of the confined sand and gravel/shale Millwood bedrock unit is approximately 60 meters below the surface (elevation 480 m) at the top edge of the valley and slopes below the valley floor, to an approximate elevation of 420 meters, with springs discharging at elevation 432 meters (North/South, pp. 60-71).

The parent material for topsoil in this area is from glacial drift deposits and recent alluvium. The area is underlain by Cretaceous shales and sandstones. Topsoils are primarily dark grey chernozems on the level to gently undulating upland plains. The soils are typical of the Aspen parkland area, where cooler temperatures and more humid conditions prevail than on the lower prairie grassland (North / South, pp. 60-71).

The KSG Group was authorized by Ski Asessippi Ltd. to undertake a feasibility level geotechnical site investigation and stability assessment of the impact of the proposed ski hill

development. The scope of the assessment included: a review of the regional surficial geology and hydrogeology, a review of other geotechnical engineering works in the vicinity of the proposed ski hill development, an air photo review of valley wall stability conditions on both the Shell and Assiniboine valleys, completion of a feasibility level geotechnical site investigation, and a computer-aided slope stability analysis. The assessment focused first on existing valley wall stability, and then considered the impact of the construction of the proposed ski hill facility (North/South, pp. 60-71). Based on the assessment the following recommendations were made:

1. Development of the proposed ski hill site may proceed with only minor impact on the overall slope stability of the valley (based on the preliminary development scheme.)
2. Geotechnical instrumentation monitoring will establish long term ground water levels and the occurrence of any slope movements that may be associated

with either instability or natural creep processes.

3. The mound design should include internal granular drains to prevent construction pore pressure buildup and future saturation from surface water infiltration.
4. Based upon this feasibility level analysis, it appears that the mound set back 30 meters from the rim will result in a relatively minor (1%) decrease in the estimated critical factor of safety (FS). Should the mound be located on the valley rim, then an estimated reduction in the critical FS is 6%. During final design more detailed slope stability analysis, based upon laboratory strength testing and updated groundwater monitoring, is required to determine the appropriate set back distance and mound geometry.
5. After construction, all exposed slopes should be revegetated to prevent surface erosion or increased water infiltration, which could be detrimental to both

local and overall slope stability.

6. The borrow area to be used for the mound construction should be located an adequate distance away from the site to ensure that it will have no impact on any future development.

7. Final design should address the foundation and stability concerns of the detailed development scheme, including the type and location of all structures, and grading plans for individual ski runs. This should include spring or summer site inspections of existing ground conditions (North / South, pp.72-73).

3.4 VEGETATION

The proposed ski area is in the transitional zone between grassland and deciduous forest characterized by grasslands interspersed with sparse Aspen groves and Balsam Poplar forest. The ecological land classification for the area with the

exception of the river valleys is Rackham Hills habitat sub-region of the prairie parkland eco-region (Wickware, Forest Ecosystem Classification for Manitoba, 1994, pp.1-9).



Fig. 20 Vegetation along walls of Shell River valley.

The vegetation on the valley slopes, according to the new Forest Ecosystem Classification for Manitoba, is Balsam Poplar Hardwood and Mixedwood Forest. This type of forest

is described as mixed stands dominated by Balsam Poplar and Trembling Aspen in the overstory. The understory is herb and shrub rich, but ground moss cover is sparse. The vegetation occurs on deep, moist mineral soils of morainal, lacustrine, glaciofluvial or fluvial origin. These forests are successional stable. However, in many stands the tendency towards a higher proportion of conifers develops (Wickware, p.30).

Surveys of this particular area found vegetation cover of the slopes to be fairly consistent as far as dominant species were concerned. On moving down the slope more plant species requiring more moisture appeared. Specific groups of plants or communities clustered around areas where favourable conditions permitted. As a general rule, the Aspen Poplar (*Populus tremuloides*) and Balsam Poplar (*Populus balsamifera*) were the dominant species. The most common shrubs which formed a thick layer under the forest canopy were: Beaked Hazelnut (*Corylus cornuta*), Chokecherry (*Prunus virginiana*), Saskatoon (*Amelanchier alnifolia*), Red-osier Dogwood (*Cornus stolonifera*), and Highbush Cranberry (*Viburnum opulus*).

Common plants of the forest floor were: Sarsaparilla (*Aralia nudicaulis*), Wood Violet (*Viola rugolosa*), Northern Bedstraw (*Galium boreale*), Rose (*Rosa acicularis*), Baneberry (*Actaea rubra*), Fairbells (*Disporum trachycarpum*), Meadow Rue (*Thalictrum sp.*), Strawberry (*Frageria virginiana*), Limber Honeysuckle (*Lonicera dioica*), and Canada Anemone (*Anemone canadensis*) (North/South, Asessippi Ski Area Environmental Impact Assessment, 1994, pp. 99-101).

In addition to the species mentioned previously, Paper Birch (*Betula papyrifera*) and Manitoba Maple (*Acer negundo*) favoured the lower, moister ground. The Balsam Poplar (*Populus balsamifera*) trees were also more abundant in the wetter conditions. Although the Highbush Cranberry (*Viburnum opulus*) was present at all levels of the slope, it was more common at the lower reaches and tended to replace the Beaked Hazelnut (*Corylus cornuta*). The lowest plateau, before the river, supported many species typically found in a river-bottom forest. In the areas prone to spring flooding where water collects and often lies for extended periods, different vegeta-

tion patterns were evident. Understory plants included those mentioned previously as well as: Tall Lungwort (*Mertensia paniculata*), Dewberry (*Rubus pubescens*), Twinflower (*Linnaea borealis*), Bunchberry (*Cornus canadensis*), Pink Pyrola (*Pyrola asarifolia*), Bishop's Cap (*Mitella nuda*), Cow Parsnip (*Heracleum lanatum*), Gooseberries (*Ribes spp.*), Currants (*Ribes spp.*), Sedges (*Carex spp.*), Rice Grass (*Oryzopsis asperifolia*), Wild Lily-of-the-Valley (*Maianthemum canadense*), and Sweet-scented Bedstraw (*Galium triflorum*). This area was particularly noteworthy for the large specimens of Aspen and Balsam Poplar trees (North/South, pp. 99-101).

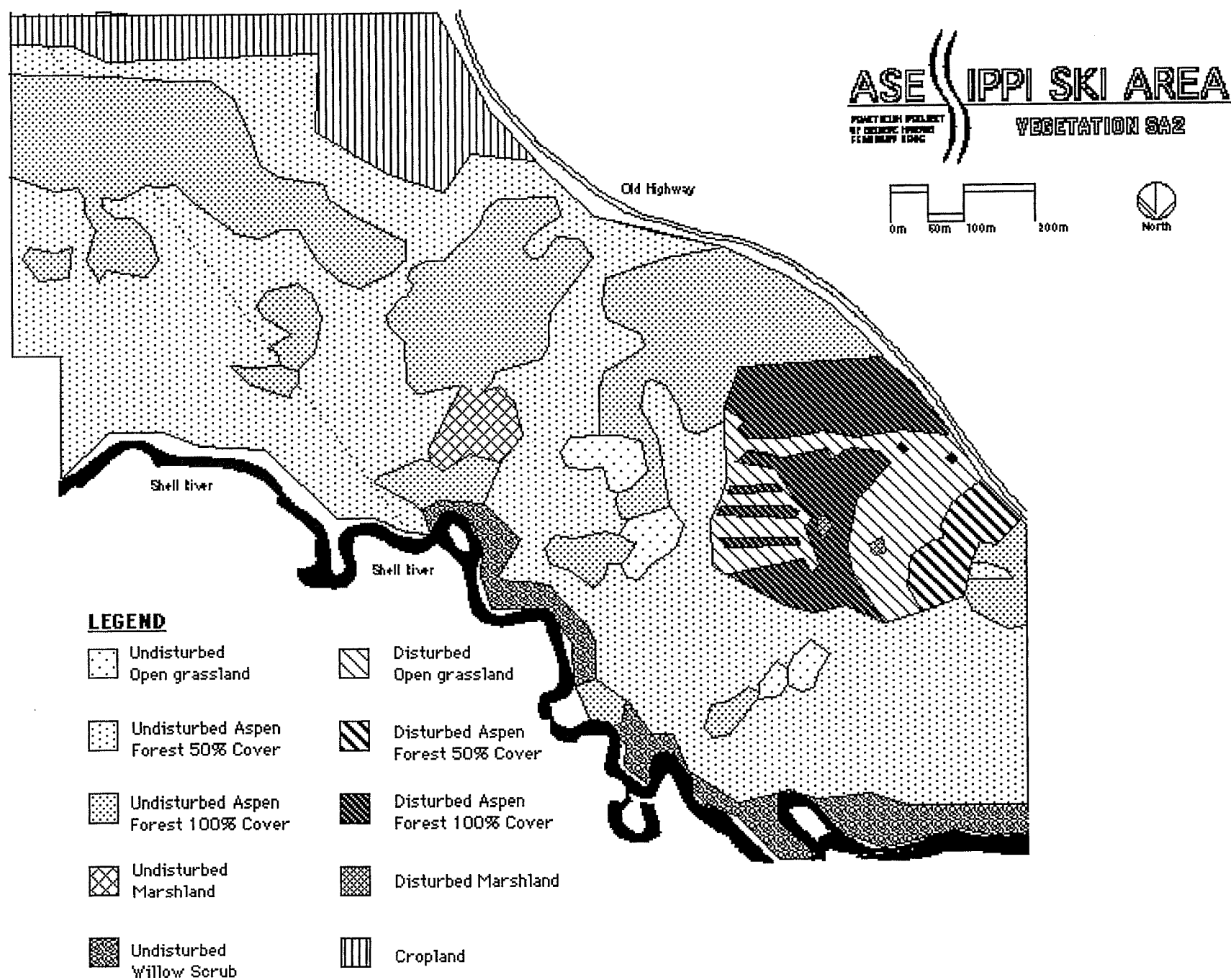
One steep section of the hill had slumped, likely due to the underground action of the springs. As the slumping soil moved down the slope, trees fell leaving bare ground suddenly exposed to bright sunlight and hollows where water collected. The vegetation of this site was made up of invasive species, which were colonizing the bare ground in and around the wet areas. Colonizers included: Willows (*Salix spp.*), Field Horse-

tail (*Equisetum arvense*), Jewelweed (*Impatiens capensis*), Common Mint (*Mentha arvensis*), Canada Thistle (*Cirsium arvense*), Fireweed (*Epilobium angustiflorum*), and Blue Grass (*Poa sp.*). The wet hollows supported: Sedges (*Carex spp.*), Soft-stem Bulrush (*Scirpus lacustris*), Canary Reed-grass (*Phalaris arundinacea*), Giant Reed-grass (*Phalaris australis*), and Cattail (*Typha latifolia*) (North/South, pp. 99-101).

Below the slump, the spring continued above the ground supporting lush growth along its banks. In this area a Paper Birch (*Betula papyrifera*) measured 44.5 centimetres in diameter and a Speckled Alder (*Alnus rugosa*) measured 9.5 centimetres in diameter. These are large specimens and indicative of old plants on rich soil (North/South, pp. 99-101).

Manitoba Maple (*Acer negundo*) and Peached-leaved Willow (*Salix amygdaloides*) were the dominant trees in the flood plain. Willows (*Salix spp.*) and Speckled Alder (*Alnus rugosa*) were the most common shrubs. Underneath the widely spaced Maples and large Willows were: carpets of Sweet Grass

Fig. 21 Existing Vegetation



(*Hierochloe odorata*), Rye Grass (*Bromus ciliates*), Red Top (*Agrostis stoloifera*) and Canada Anemone (*Anemone canadensis*). Ostrich Fern (*Matteuccia struthiopteris*) grew in some of the shady hollows. Wet areas on the river banks supported: Sedges (*Carex spp.*), Common Mint (*Mentha arvensis*), Spike Rush (*Eleocharis sp.*), Field Horsetail (*Equisetum arvense*), Marsh Horsetail (*Equisetum fluviatile*), Sandbar Willow (*Salix exigua*), Water Parsnip (*Sium suave*) and Marsh Marigold (*Caltha palustris*). There were also a number of species colonizing the ground left bare by receding spring waters. These included: White Clover (*Trifolium repens*), White Sweet Clover (*Melilotus alba*), Yellow Sweet Clover (*Melilotus officinalis*), Sow Thistle (*Sonchus arvensis*), Silverweed (*Potentilla anserina*), Common Plantain (*Plantago major*), and Dandelion (*Taraxacum officinale*) (North/South, pp. 99-101).

The vegetation on the site can be classified according to its suitability for ski trail development. Areas with dense tree cover that require more clearing being less suitable than those

areas with little tree cover. Dense tree cover not only means more work in clearing but this vegetation is more desirable for separating trails. Some areas on the site have previously been disturbed for use as a nursery and are more suitable than undisturbed areas. The areas of saturated ground are sensitive to development and are less suited for trails. In all there are no areas of vegetation that are completely unsuitable for trails.

The following is a list of some of the predominant tree and shrub species found at the site.

Aspen Poplar (*Populus tremuloides*): The Trembling Aspen grows to 9-10 m and has an upright oval form. It has a slender trunk and moderately stout branches forming an open round-topped crown. The bark is greenish-white to almost white in some cases. In winter the long vertical trunk is a dominant element. This tree species is not usually a defining edge to a space. When spaces are cleared for trails the dense vertical trunks will provide a strong edge. When the white trunk is exposed to sunlight it can produce a strong contrast to the

forest. In silhouette against the sky the dark vertical trunks will provide the perfect element to emphasize motion.

Balsam Poplar (*Populus balsamifera*): Balsam Poplar grows to 30m and has an upright oval form. The canopy is open and the tree has a decurrent habit (the crown structure of the tree when the lateral branches tend to grow independently of the central or main stem). Bark is grey green and deeply furrowed in mature trees. The dark bark contrasts well with the light coloured bark of the Aspen.

Beaked Hazelnut (*Corylus cornuta*): This shrub grows to 2m and has an upright-spreading form. These characteristics give it a spindly unrecognizable form in the winter. The shrub does not have outstanding winter characteristics.

Chokecherry (*Prunus virginiana*): This shrub is usually found at the sunny edge of Aspen forests and grows to 4m in height. It has an upright spreading form. The shrub does not have outstanding winter characteristics.

Highbush Cranberry (*Viburnum opulus*): This shrub grows to 3m and has an upright spreading form. The shrub does not have outstanding winter characteristics although this plant has excellent ornamental features during other times of the year.

Manitoba Maple (*Acer negundo*): The Manitoba Maple grows 12-15m in height. It has an upright oval form with the head of the tree being high above the ground. The canopy is open and the habit is decurrent. The bark is dark brown. The limbs of the tree are thick and create very good and clear silhouettes.

Paper Birch (*Betula papyrifera*): This tree grows to 8m and has an upright oval form. In the winter the reddish-brown branches contrast with the white trunk. The bark of the tree is initially dark and becomes creamy to pinkish-white with age.

Peached-leaved Willow (*Salix amygdaloides*): There were various species of Willow found at the site. The Peached-leaved Willow is a large deciduous shrub to small tree with

somewhat drooping branches. The bark is smooth when the plant is young and becomes scaly as the plant matures. The bark is reddish-brown. The plant is found in moist areas usually near water. The dense linear texture of the branches is unique and casts long clear shadows. The shrub has excellent qualities for creating snow drifts.

Red-osier Dogwood (*Cornus stolonifera*): Red-osier Dogwood grows to 2-3m and has a mound-like form. The bark is particularly attractive in winter as it has a dull red colour. The red colour is unique and can be used for interest.

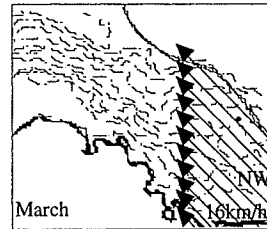
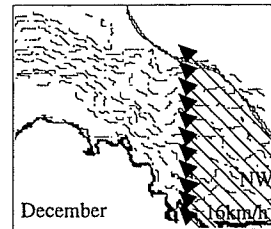
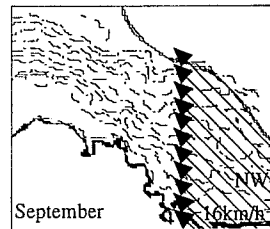
Saskatoon (*Amelanchier alnifolia*): This upright spreading, leggy shrub grows to 3m. The shrub does not have outstanding winter characteristics.

Speckled Alder (*Alnus rugosa*): The Speckled Alder grows to 5m with an upright spreading form. The bark is smooth, light-grey and glossy.

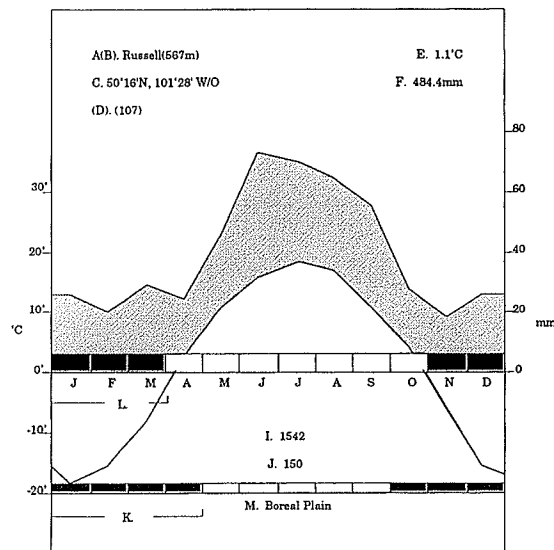
3.5 CLIMATE

The general climate of the area is sub-humid continental. Based on information gathered at the Russell Climatology Station between 1883 and 1990 the following generalizations can be made. The coldest months are December with an daily mean temperature of -15.7°C and January of -18.9°C . There are 580 degree-days below -5°C in January. On average there are only two days in January with temperatures above 0°C . The total annual snowfall for the area is 139 centimetres. In December 25.6 cm falls, in January 26.2 cm, in February 20.1cm and in March 25.8 cm. Snow cover can be expected on the ground between November and March. The number of days with measurable snowfall in December is 7, January is 8, February is 6 and in March is also 6. There are 42 days with measurable snowfall in the whole year (Wickware, Forest Ecosystem Classification for Manitoba, 1994, p.11).

According to statistics from the Yorkton Climatology Station taken between 1941 and 1990 the wind is predominantly from



Wind Diagrams
Average Speed (km/h)

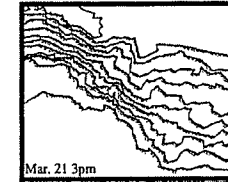
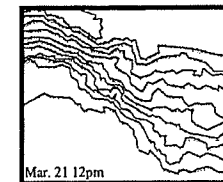
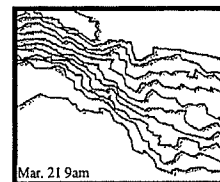
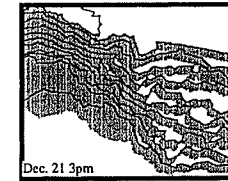
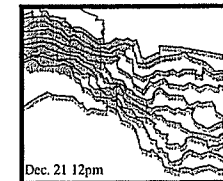
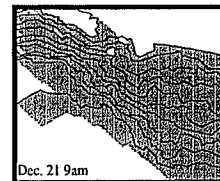
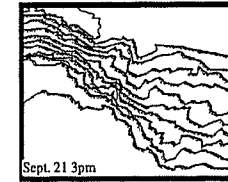
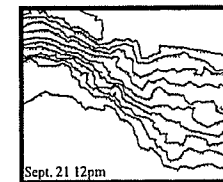
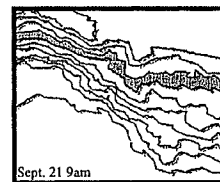


- A. Name of climatic station
- B. Elevation of climatic station (meters above sea level)
- C. Latitude and longitude of climatic station
- D. Number of years of observation
- E. Mean annual temperature (°C)
- F. Mean annual precipitation (mm)
- G. Curve of mean monthly total precipitation
- H. Curve of mean monthly temperature
- I. Mean annual number of degree days (above 5°C)
- J. Frost free period (days)
- K. Frost period (shaded area)
- L. Months with mean monthly temperature below 0°C (shown in black)
- M. Biome

Climate Diagram

ASE IPPI SKI AREA PRACTICUM PROJECT OF GEORGE HARRIS FEBRUARY 1995 CLIMATE INFORMATION SA3

SCALE VARIES



Shadow Diagrams

the north-west during November through March. The average wind speed during these months is either 16 or 17 km/h. The extreme hourly speed occurs during December with a speed of 85 km/h from the north-west. The extreme gust speed during December is 89 km/h from the north-west and during January is 98 km/h from the west. The number of sunshine hours in December is 89.1, January is 104.6, February is 128.1 and in March is 161.8 (Wickware, p.11).

Wind can have devastating effects on ski area operations. During the winter snow can be blown off a hill if the trails are not protected. In the spring a sunny day with even a slight wind will melt snow very quickly. It is difficult to make snow when it is windy and very difficult to control its distribution. Chairlifts can become dangerous in extremely windy situations. To the skier a wind of 85 km/h in the cold of winter can be dangerous. Even a milder wind combined with the skier's speed will be chilling. Whenever possible the skier should be protected from these cold winter winds. Protection from the loud sound of wind can bring about a sense of enclosure and

shelter and create the impression of warmth on a cold day.

Vegetation can be used as a wind screen or as a snow fence.

When used properly vegetation can insure that snow drifts on the trails in a desirable way.

The effect of sun and shadow at different times of the day and year can be used to locate facilities. Shadow diagrams reveal that the majority of the terrain located in the western portion of the site will lie in shadow during most of the day in the early part of the season. It will be important that the flat area at the top of the hill utilize the sun as much as possible. As the season progresses towards March this area will receive more late morning and early afternoon sun. The terrain in the eastern portion of this site will get some sun in the early and late afternoon all year but will see limited sun in the morning during the early part of the season. To gain the most from the sun the skier will have to be well sheltered from the overpowering winds that the area can experience.

3.6 SLOPE

The Geographic Information System (GIS) mapping of the site indicates that there are 2.4 hectares of land with slopes suitable for beginner skiers. Over half of the site has slopes suitable for the beginner-intermediate range. Land with slopes only suitable for intermediate skiers accounted for 3.8 hectares and the intermediate-expert terrain amounted to 3.9 hectares. Slopes suitable for expert skiers alone accounted for 3.8 hectares. In all there are 29.5 hectares of slope suitable for skiing. The calculated terrain required for each skier ability is; beginners 1.3 hectares; intermediate 8.6 hectares; and experts 4.5 hectares. The total required skiing terrain is 13.3 hectares.

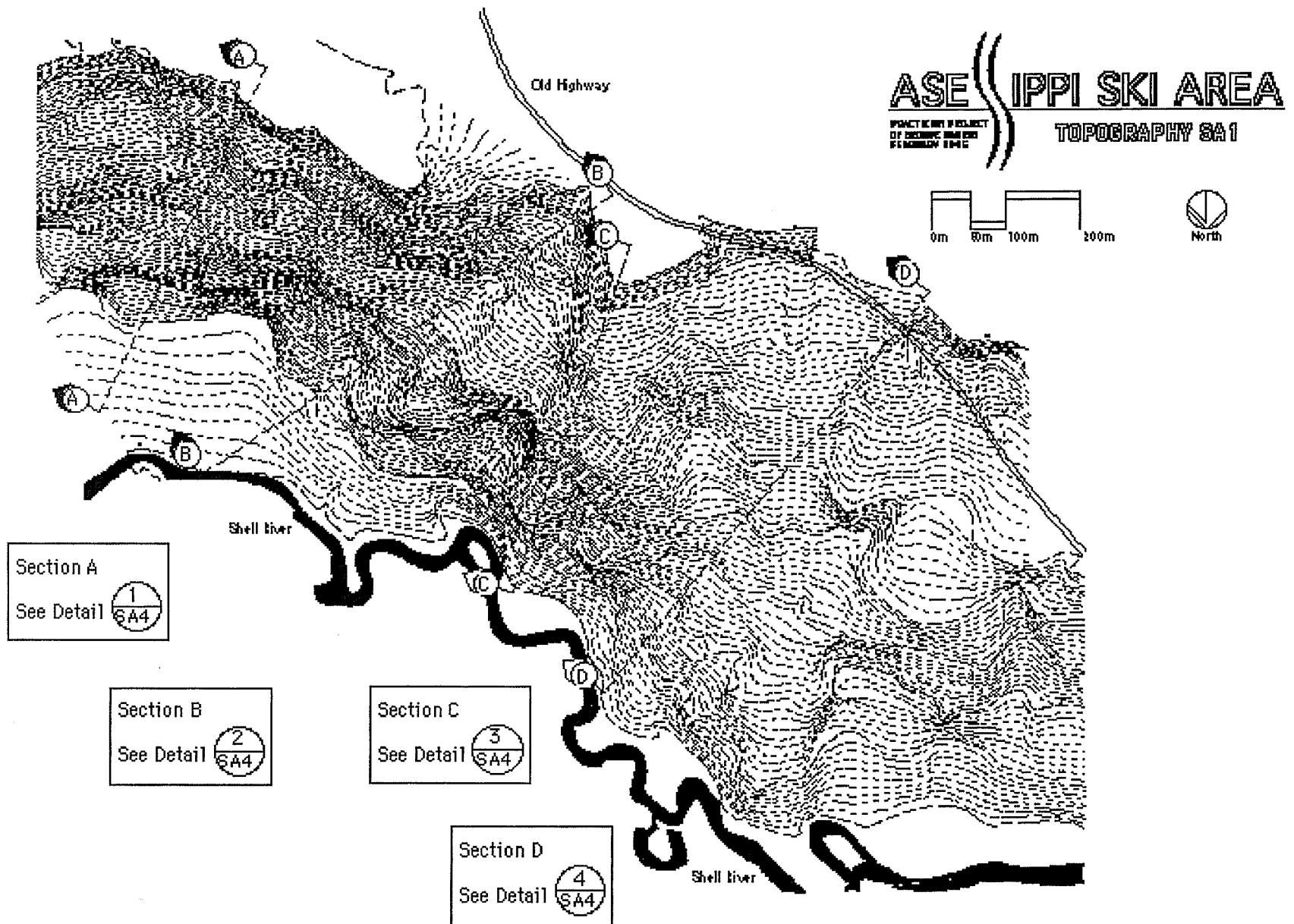
The terrain of this site is well suited to a variety of skier abilities. The western part of the site will need special design considerations because of the steep slope. The length of runs is always a concern at prairie ski areas and can be addressed in many ways. Trails can run across the slope to increase length and can be designed to be interesting. However these

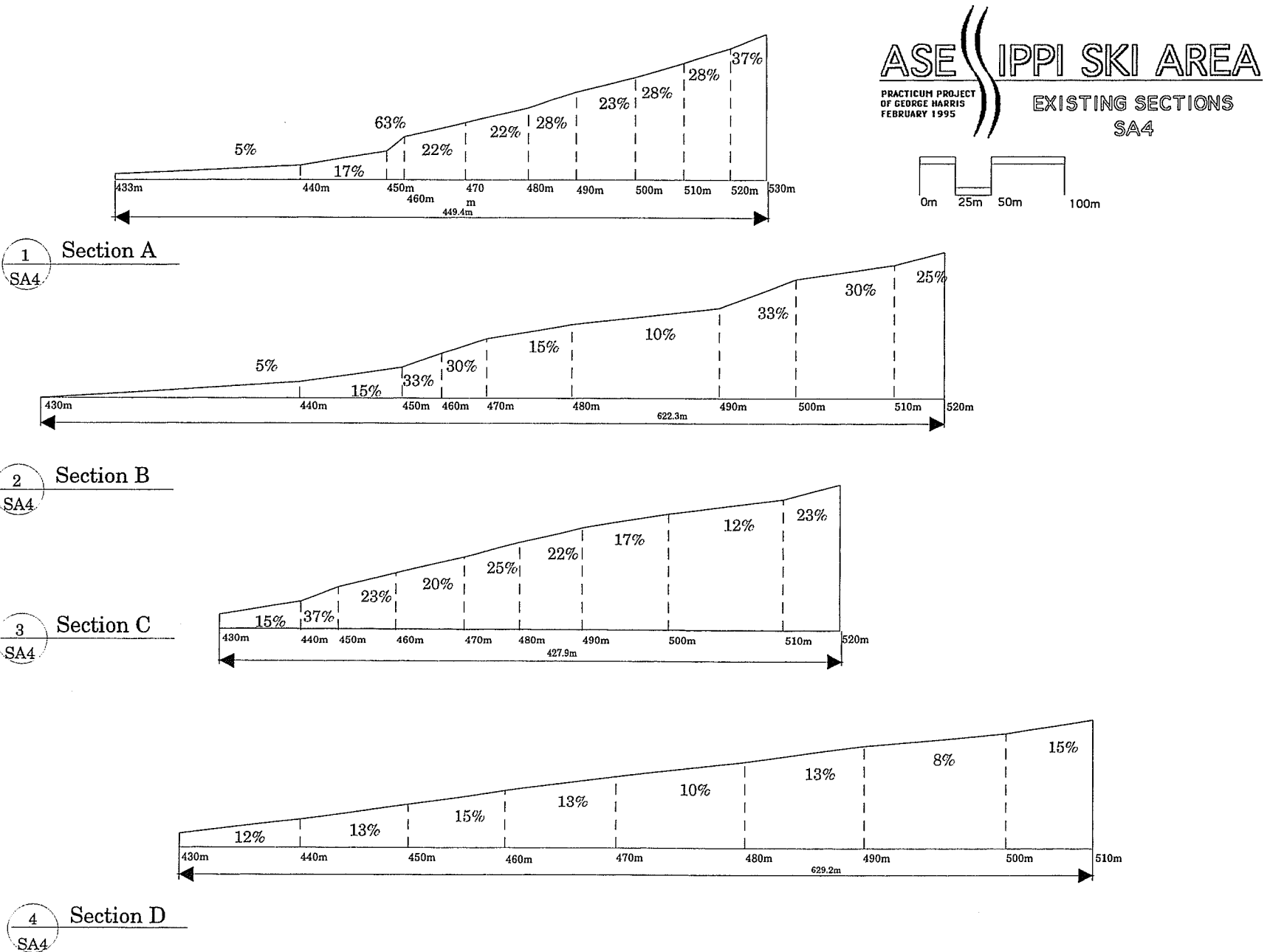
Ability Level	Slope	* Existing Area (hectares)
Beginner	5-15%	2.4
Beg.-Int.	15-25%	15.6
Intermediate	25-30%	3.8
Int.-Exp.	30-40%	3.9
Expert	40-55%	3.8
	total	29.5

* Area of site found suitable according to slope.

Fig. 23 Slope requirements.

trails require a lot of space. Designing the ski trails to provide a variety of experiences will increase skier interest. Furthermore greater variety of trails can be provided by spreading the trails out over a large area. Each trail should have unique qualities that set it apart from the others. These qualities may be designed to change from one day to the next. For example, trees may be positioned to cast shadows across the trail at various times of the day. Another example of trail qualities might include the proportion of the spaces. Within a certain trail the spaces may change from narrow to wide, enclosed by trees or open. To distract the skier from focusing on the bot-





tom of the hill specially placed objects along the trail may be incorporated into the design.

3.7 SKIER DEMOGRAPHICS

The Asessippi marketing study carried out by the Diversa Group Incorporated of Manitoba created a profile of the Asessippi skier. The study was based on the D. R. Mathews report, Canadian Ski Industry Publications, local and other industry reports. The study was based on national statistics showing the average age of a skier is 30 years and 72% of "active" skiers are under 35 years. "Active" skiers are defined as twelve years of age and over and who ski six or more times per ski season (Deversa Group Inc., Asessippi Market Study, 1993, pp. 3-10).

This profile, when applied to the Asessippi area, was used to determine the potential number of visits to the area. In the immediate or local surroundings (within 50 km) the area population is approximately 17,206. Of this figure 14,797 are

over the age of 12 and 1,332 (or 9% of the total population) could be considered "active" skiers. According to the marketing study formula which is (12 and over population) x (percentage of use) x 6, the potential Asessippi visits from the local population is 7,193. The same formula was applied to the broader regional area (50 to 150 km) and to the next wider or secondary range which included major centres such as Winnipeg, Brandon, and Portage. The greatest number of potential visits are expected from the regional area (50 to 150 km) with an expected 18,606 visits per season (Deversa Group Inc., pp. 3-23).

A profile of this target group was then divided into categories of age, education, gender, income and proximity to the proposed site. According to statistics the ski marketplace today is 61% male and 39% female. In terms of income studies show that 32% of skiers fall into the \$25,000 - 49,000 (annual income) range and another 32% in the \$50,000 - 74,900 annual income range. In the regional area, 50,000 - 150 km around the proposed site, average household income is \$32,885.00.

The average household income in the Asessippi trade area therefore fits favorably with the Canadian averages. Furthermore household income for the area has increased as much as 32% since the 1986 census (Deversa Group Inc., pp. 3-23).

A national education profile cites 59% of active skiers with a High School or lower education. The next largest group constitutes 25% who have a diploma or certificate. In the Asessippi region, 50 - 150 km around the proposed site, 88% of the population fall into these two categories combined. The remaining 12% are university or post secondary education graduates (Deversa Group Inc., pp. 3-23).

With regards to the geographic location of the site the study noted that available ski customers were in both Manitoba and Saskatchewan. The study segmented the ski population into three categories: 12 to 15 years of age, 16 to 24 years of age, 25 and over years of age. The first of these categories represented 21% of the overall population and characterized 25% of active skiers. This group however are financially dependent

Fig. 26 Snowboarding is popular among younger people.



and unable to get to the hill unaided. The second category, representing another 25% of active skiers, are more mobile but still dependent in varying degrees. The third category representing 50% of all skiers are highly mobile and independent. In the regional area (50 -150 km around the site) the population breakdown by age is as follows: age 12-24, 9303; age 25-54, 7815; and age 55 and older, 1488 (Deversa Group Inc., pp. 3-23). The study shows that the potential user of the Asessippi ski hill live within a 150 km radius of the area. The average household income in this area is adequate to support the activity. The study also shows that the age, education and gender profile of people in this region suit the activity according to national statistics (Deversa Group Inc., pp. 3-23).



4.1 SKIER SUITABILITY

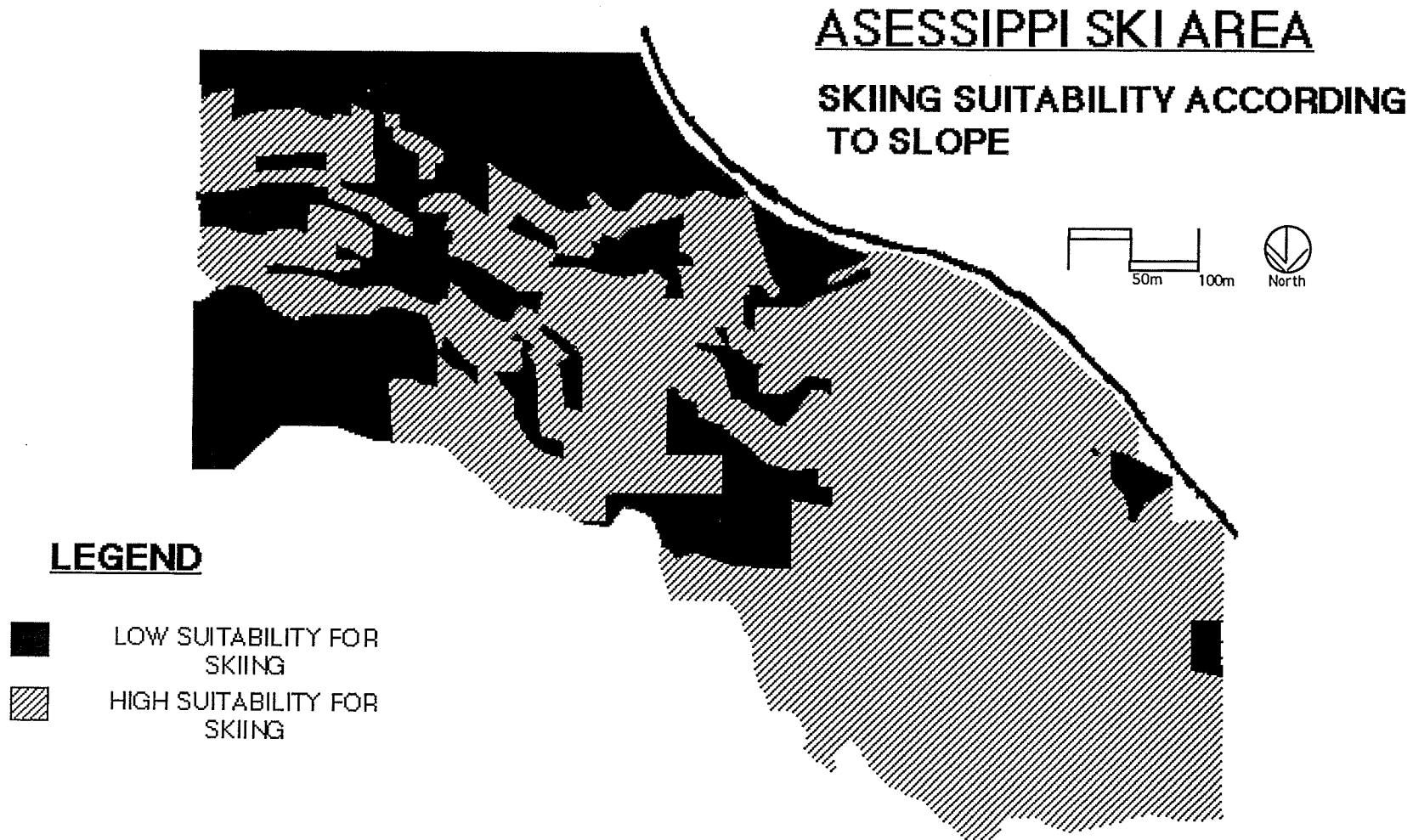
A three-step GIS overlay process was used to determine the suitability of the site for skiing. Step one involved identifying land units with severe limitations, land with cultural or bio-physical constraints which were considered unsuitable for development. Step two involved identifying remaining land units suitable for the development of ski slopes. Step three involved the identification of the land units that were suitable for lift loading and unloading areas (Johnson, "Snowy Range Ski Resort", 1990, pp. 15-18).

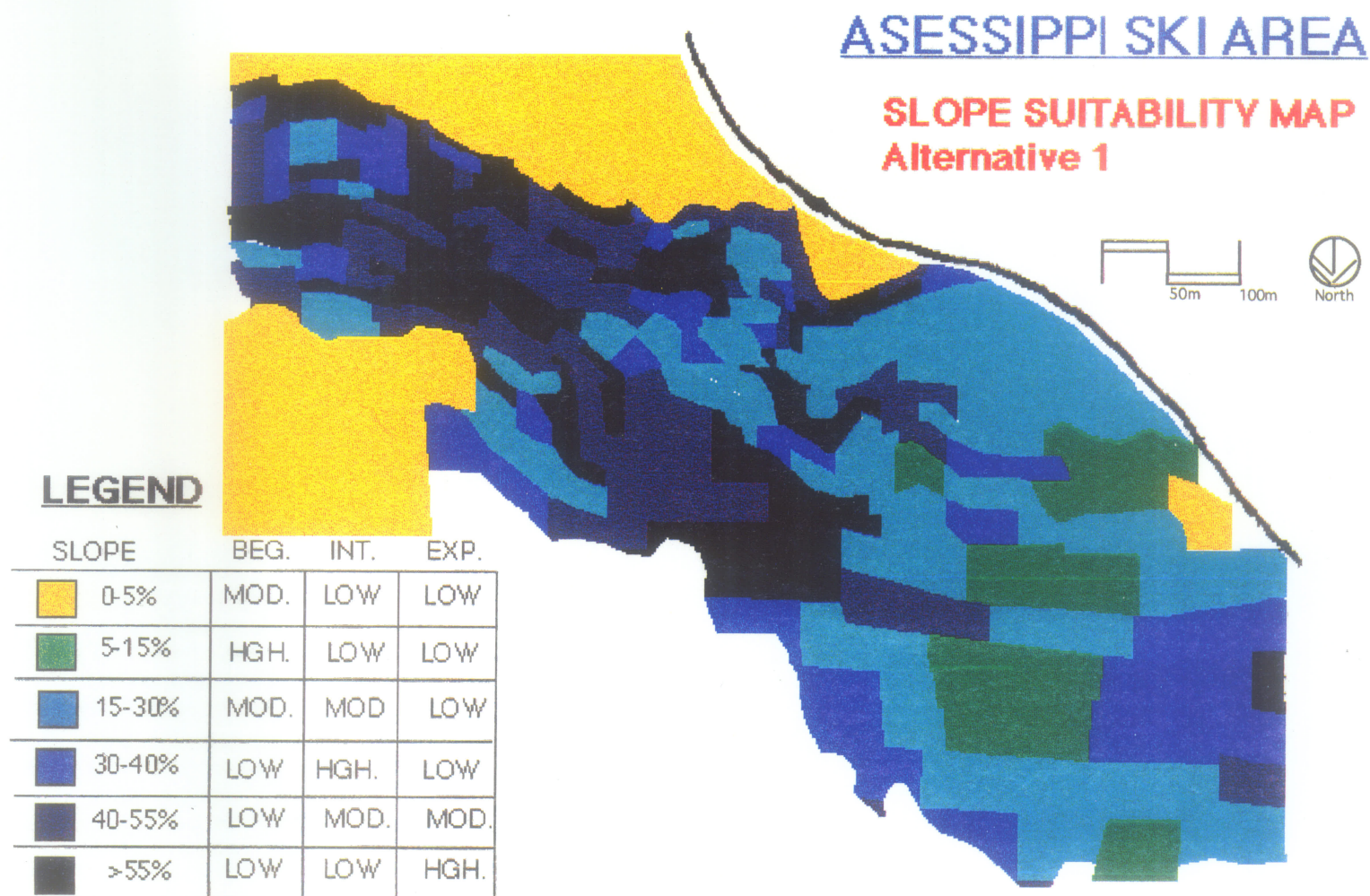
The GIS software used in the study was Map II and Map Factory (pre release version). The area in each land unit in the study is approximately 1.5x1.5 meters. This unit size allows for accurate slope classification.

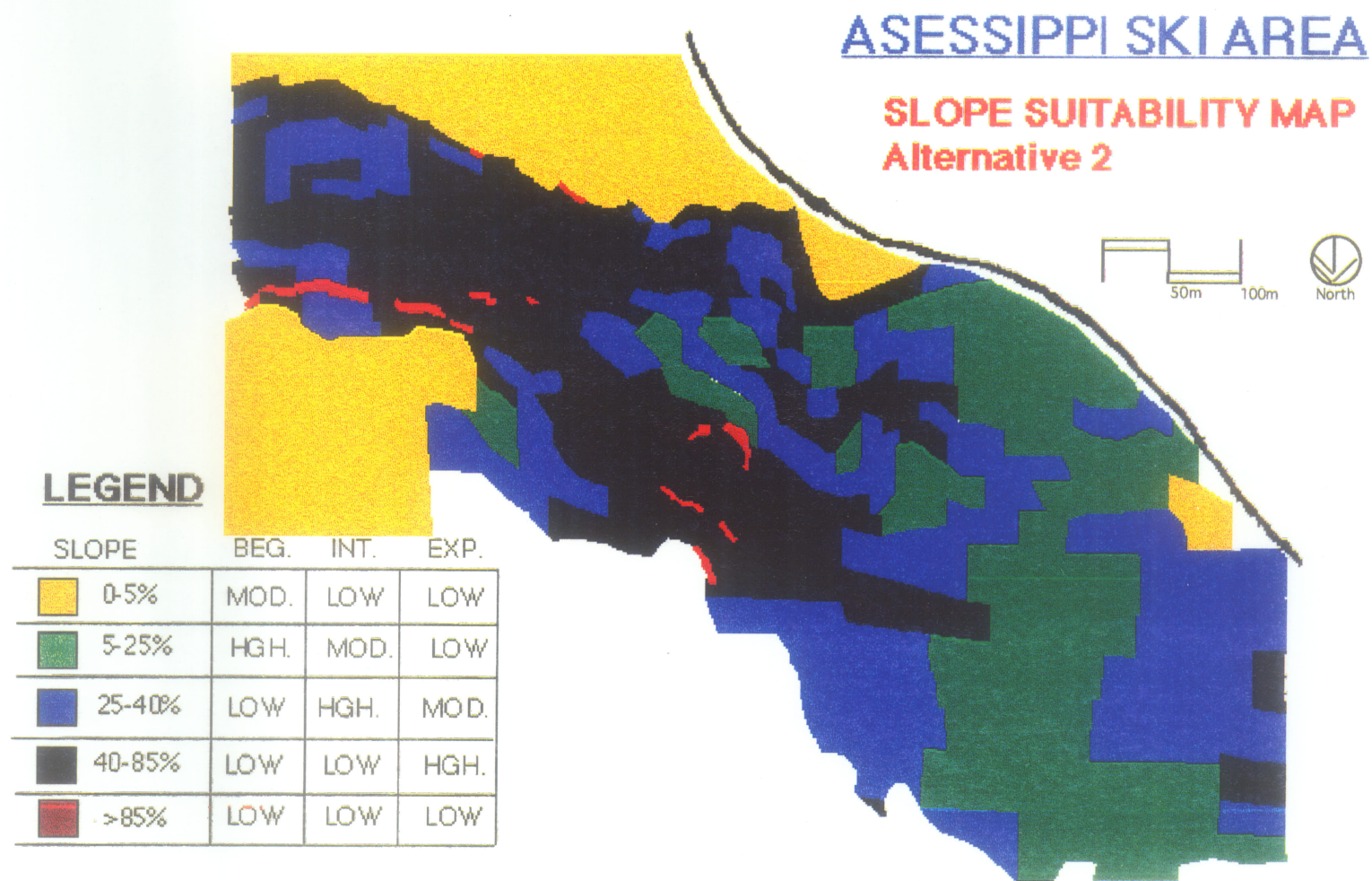
Step one involved identifying land units that could not be developed for skiing. Every ski area has a different list of constraints. Constraints such as unreliable full season snow

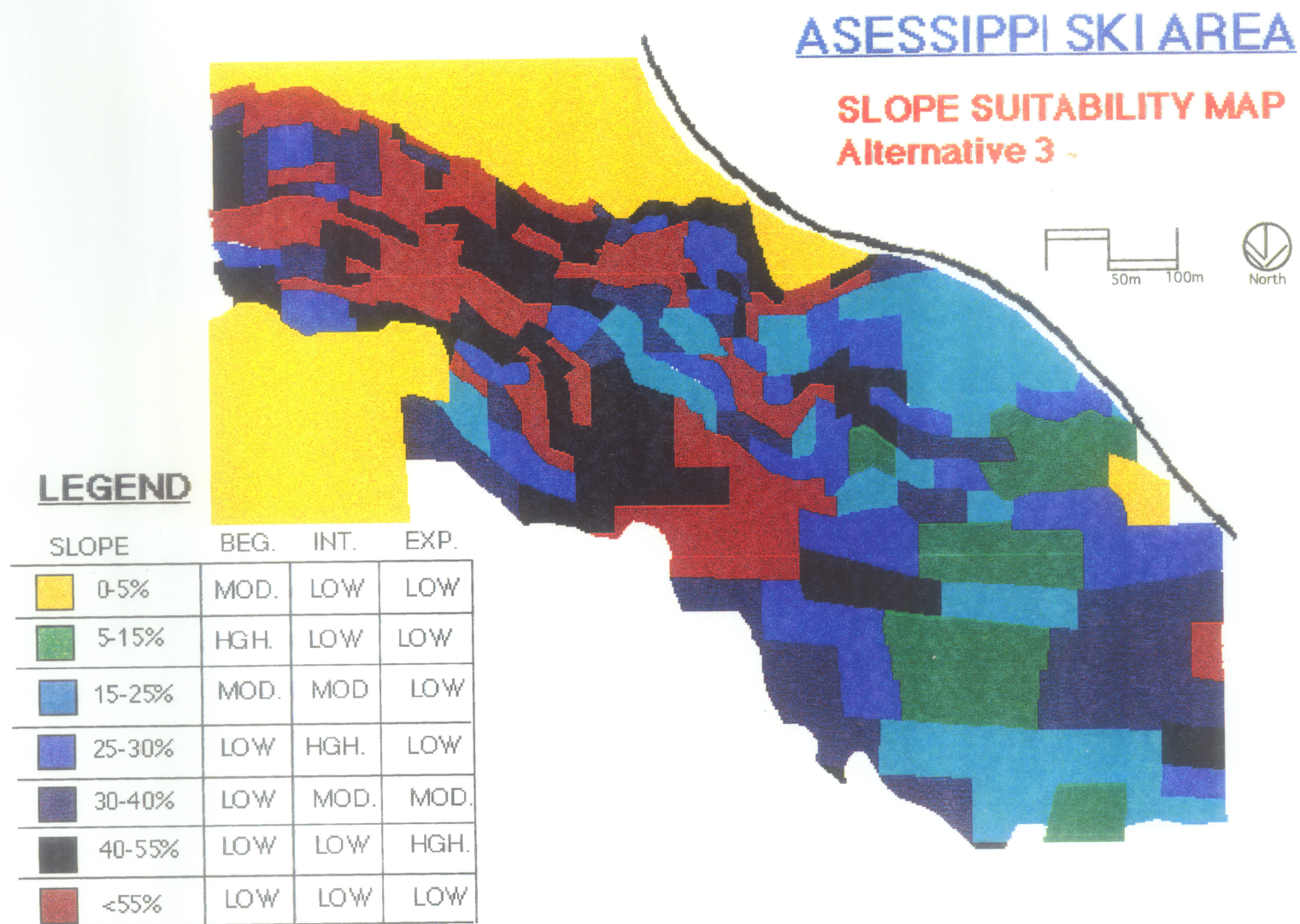
cover, critical wildlife habitat, avalanche dangers or historically significant areas are common. The developers of Asessippi have determined that the skiing area will be covered by machine-made-snow. Unreliable snow cover is therefore not a concern and there are no other constraints that will impose severe limitations on any of the land units on this site. All of the land units were therefore considered potential skiing sites.

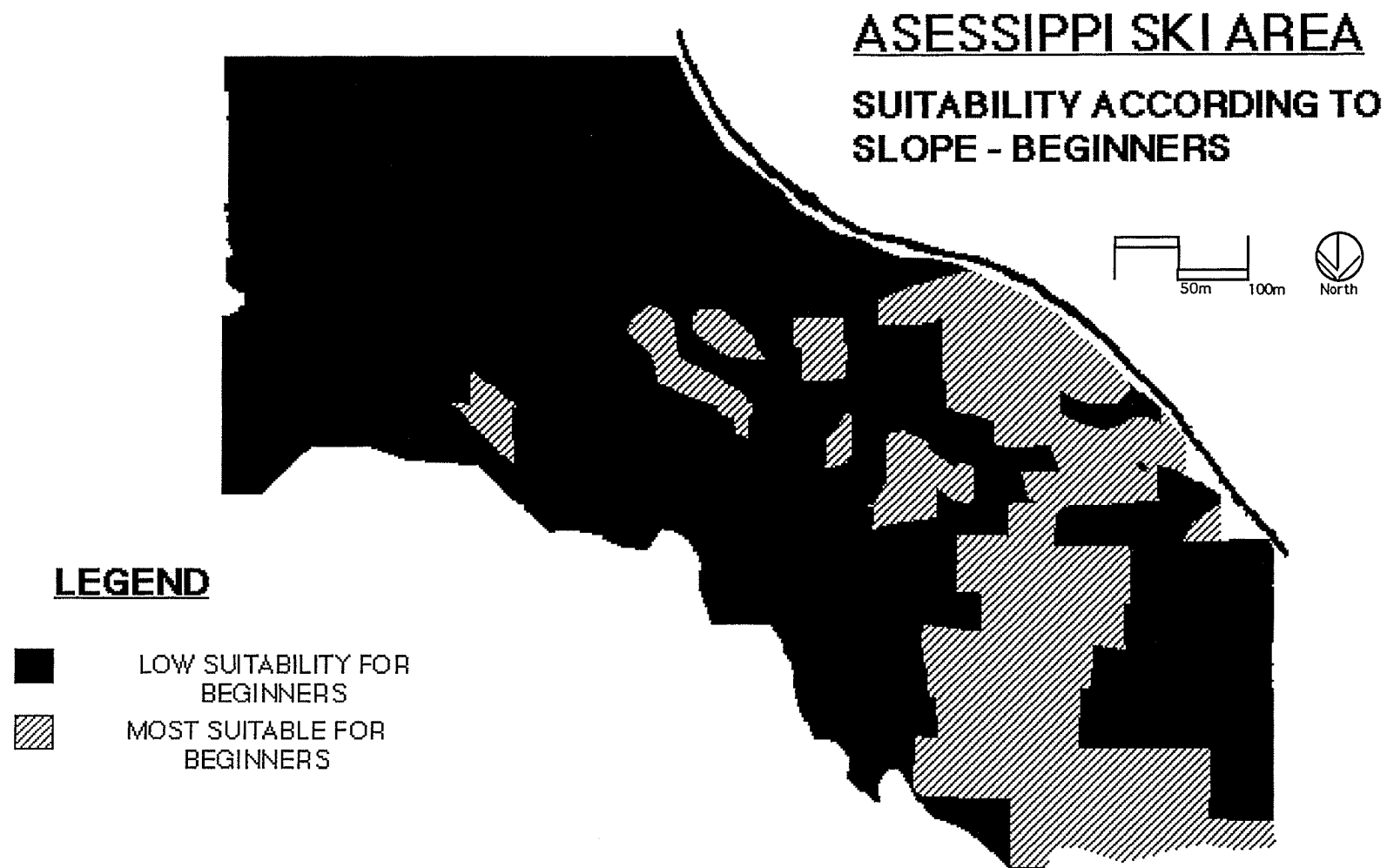
In step two, these potential skiing sites or land units were then searched for suitable skiing land using two criteria, slope and vegetation. First, slopes appropriate to various skiing abilities were identified using a topographic map (Fig. 25). There exist various opinions on degree of slope suitable for skiers of different abilities. The largest discrepancy occurs at the expert level. Some experts in the field believe that all slopes are suitable for skiing while others believe that slopes greater than 55% are too steep under certain conditions. In situations where snow must be made, for example, consideration must be given to maintenance and the capability of snow grooming equipment

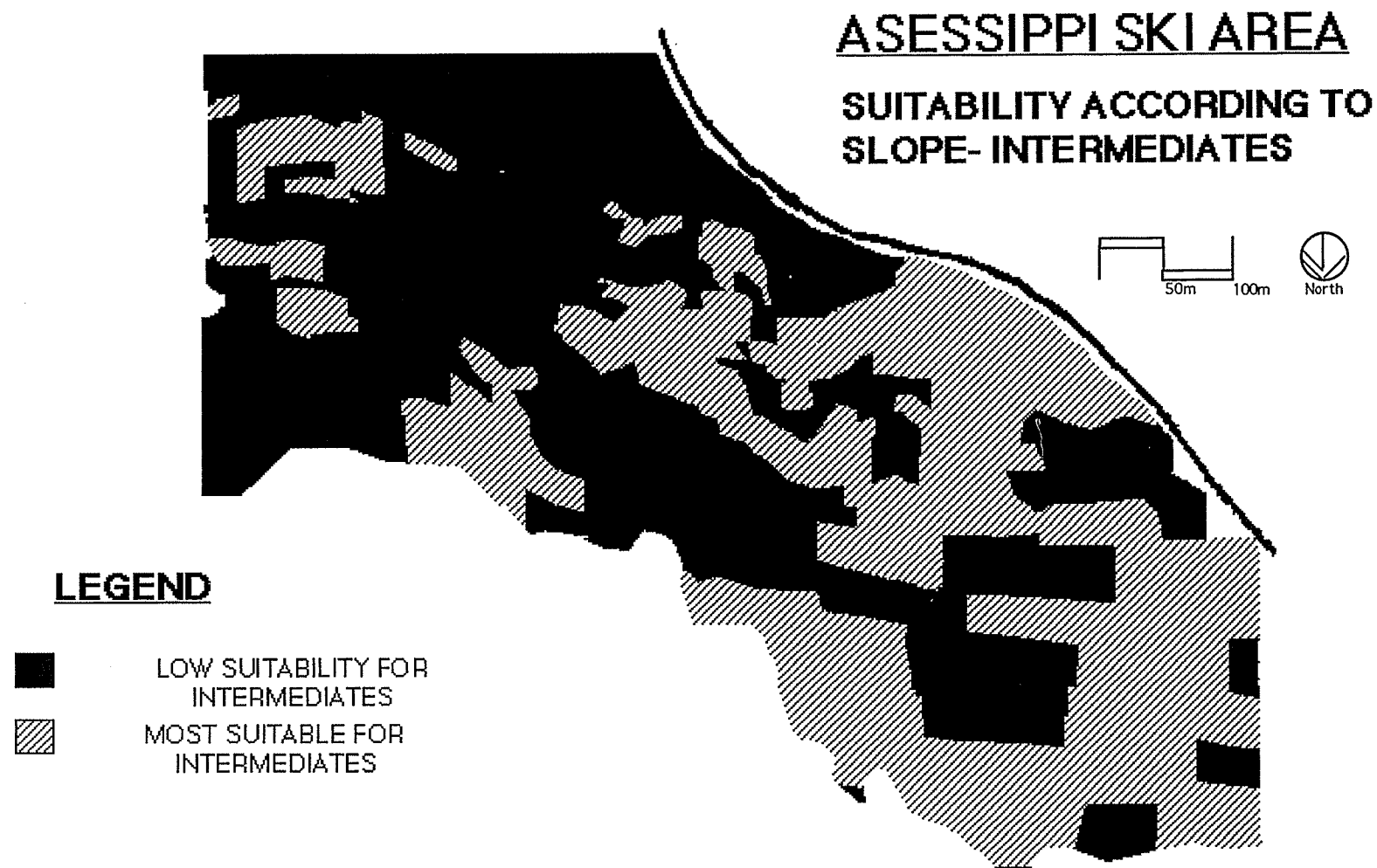


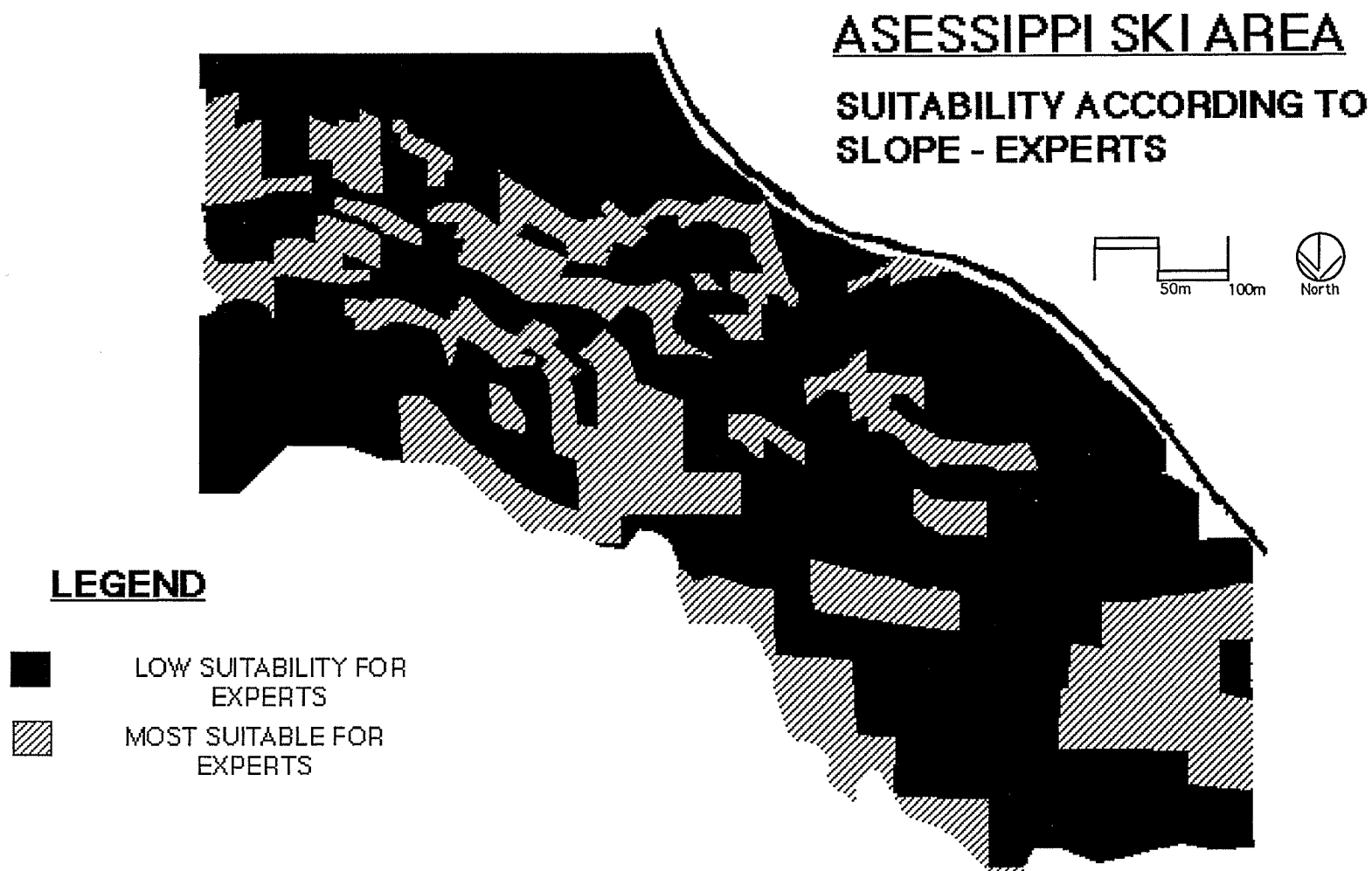












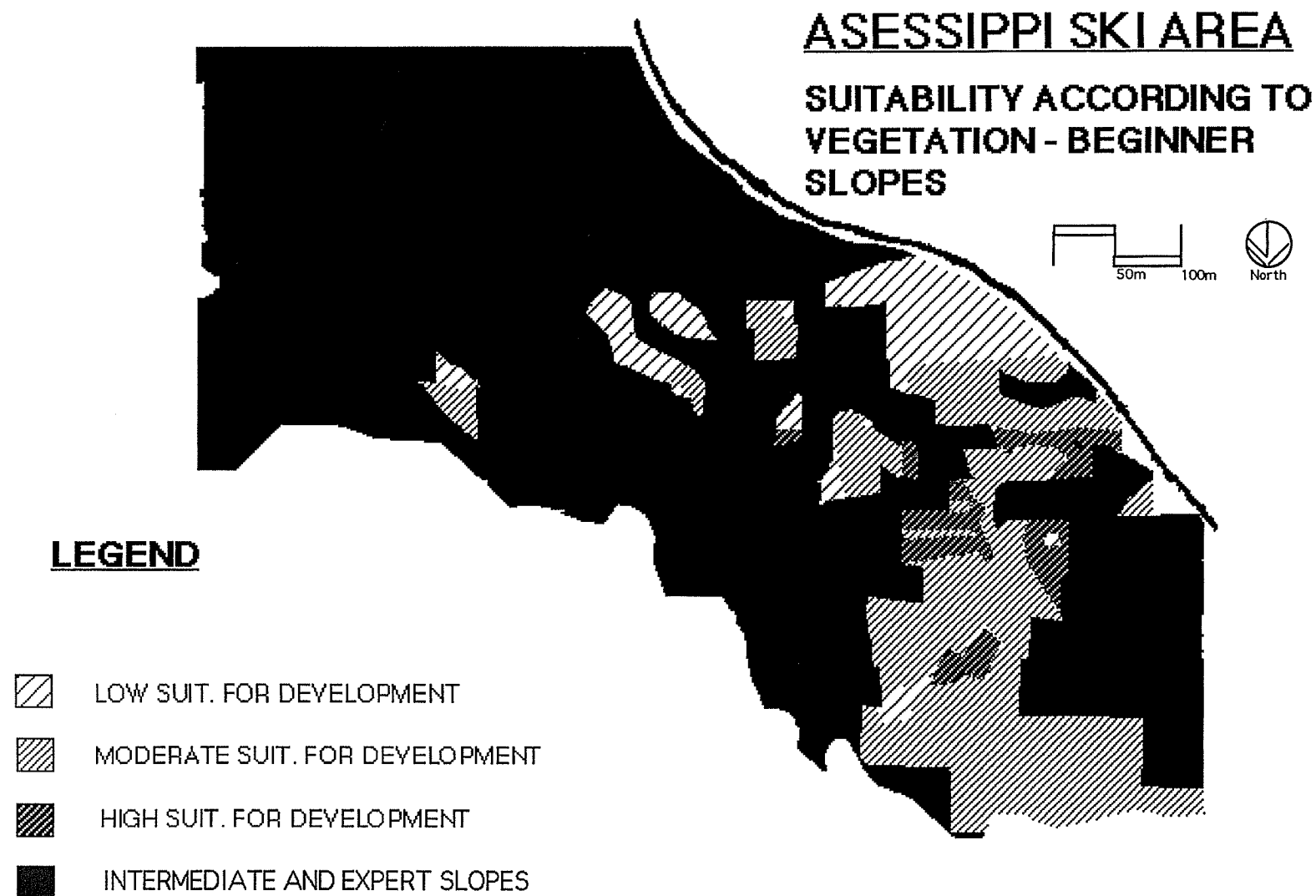
to move easily throughout the area.

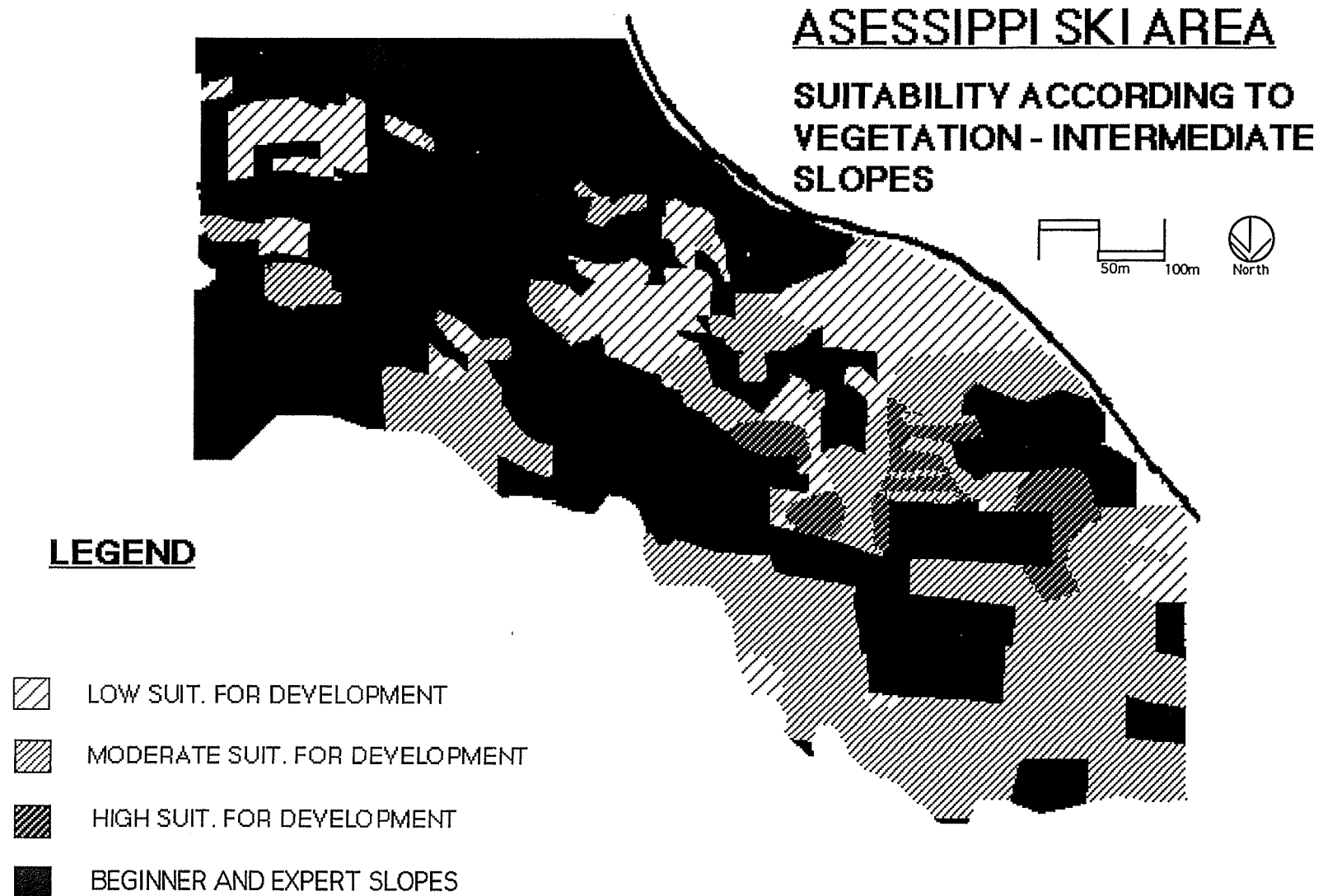
Three different slope criteria were mapped and the positive and negative aspects of each were considered (Figs. 29-31). The primary considerations were cost of construction, maintenance, skier safety and skier demand. Steeper slopes would preclude costly construction costs as little or no grading would be required. The maintenance of steeper slopes however, would require higher quality grooming equipment capable of moving over very steep terrain. Furthermore the inclusion of steeper slopes would necessitate the availability of more first aid personnel and facilities. Finally the number of potential skiers capable of skiing steeper terrain is small therefore the total market potential for the site would be reduced. The opposite is true if gentler slopes are planned.

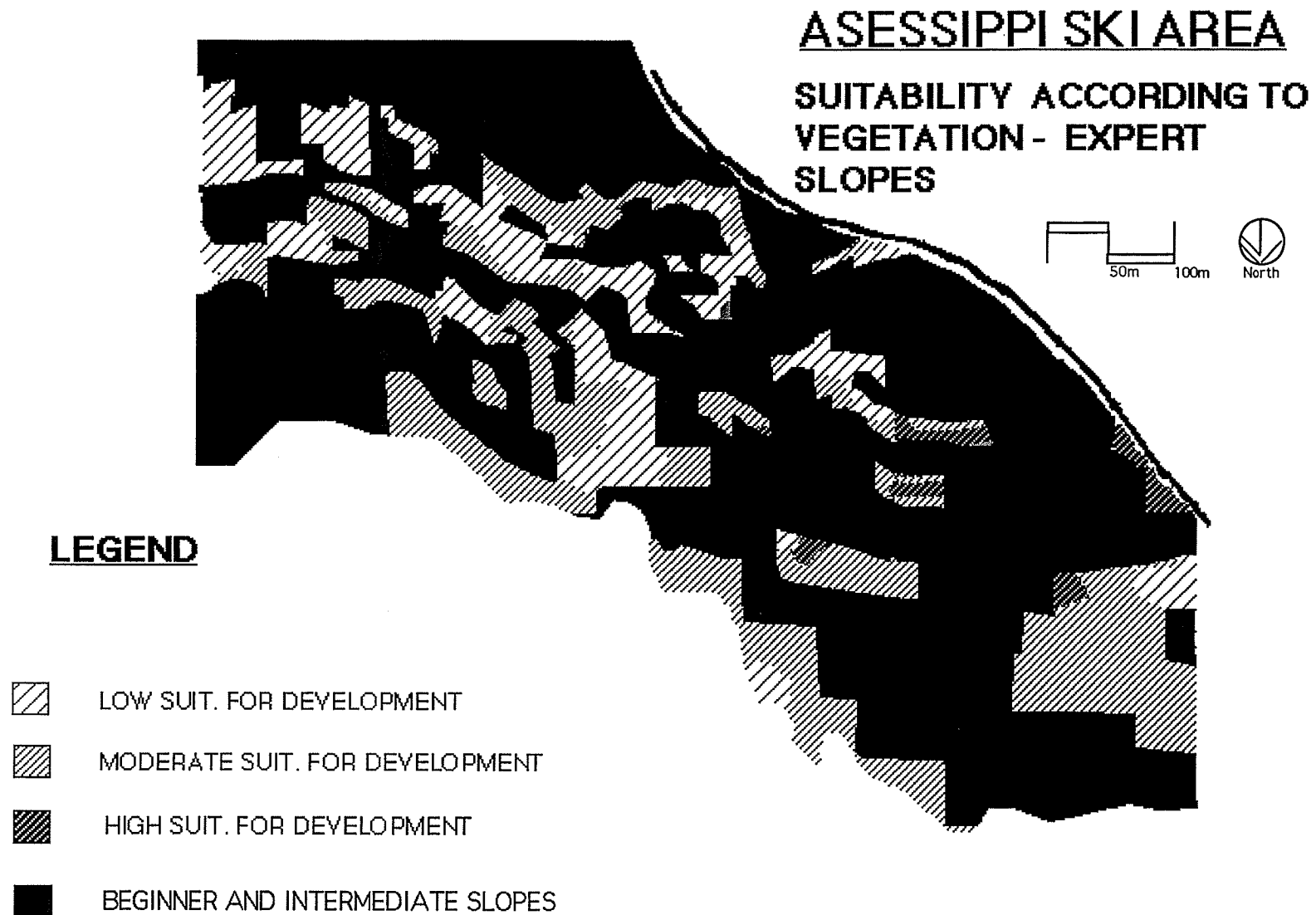
Based on the 3rd alternative (slope suitability up to 55%) suitability maps according to the slope for the various abilities, beginner, intermediate and expert, were calculated. (Figs. 32-34)

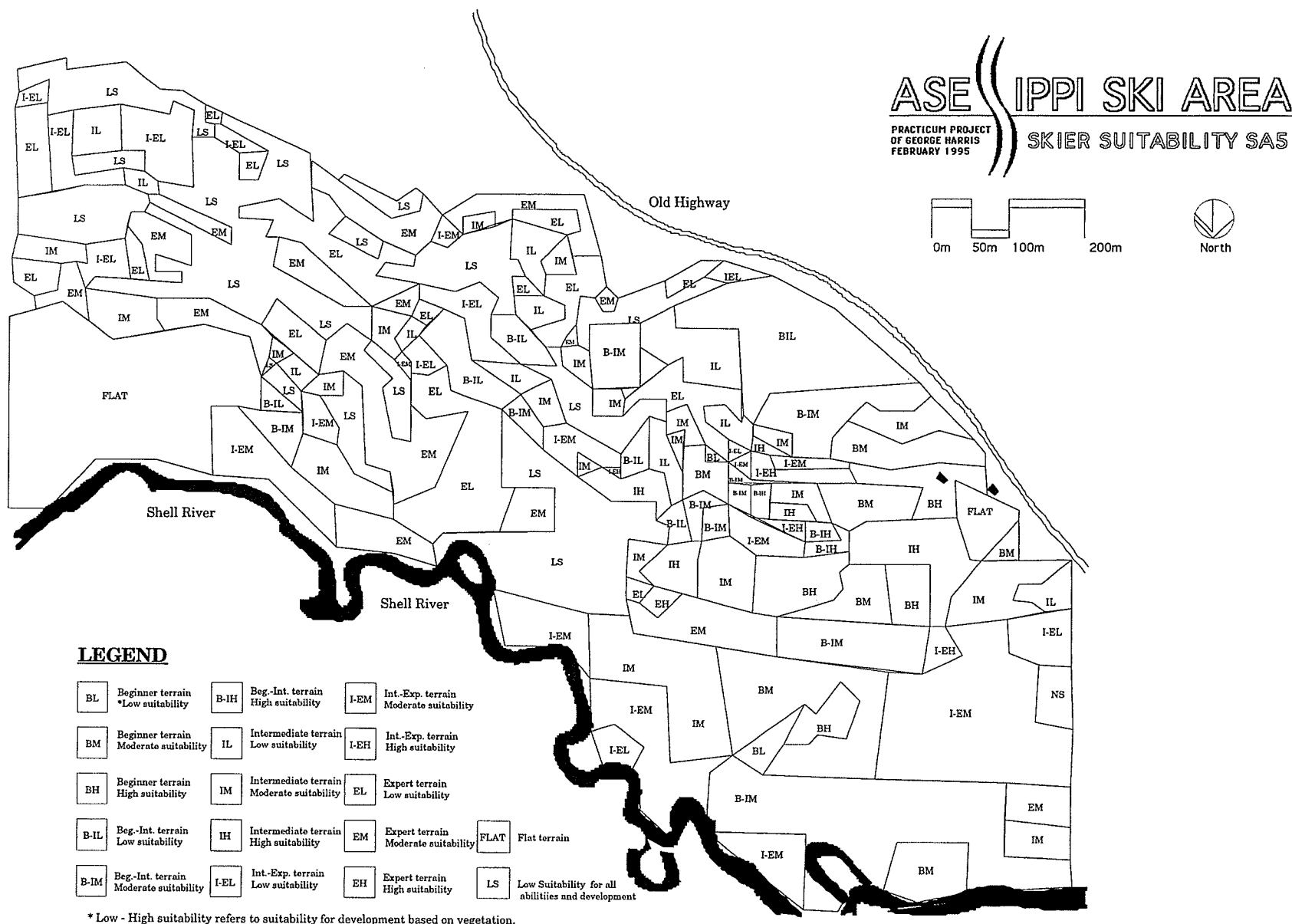
The second criteria for determining suitable land was based on vegetation. At this stage the land units were classified according to vegetation cover (Fig. 22). With the use of a matrix the land units were ranked. Those with little or no tree cover were considered more suitable because of the limited need for tree removal, and the limited cost of forest management. Land units that were previously disturbed were considered more suitable for development than those undisturbed. The slope and vegetation maps were then combined to give a series of skiing suitability maps (Figs. 35-37).

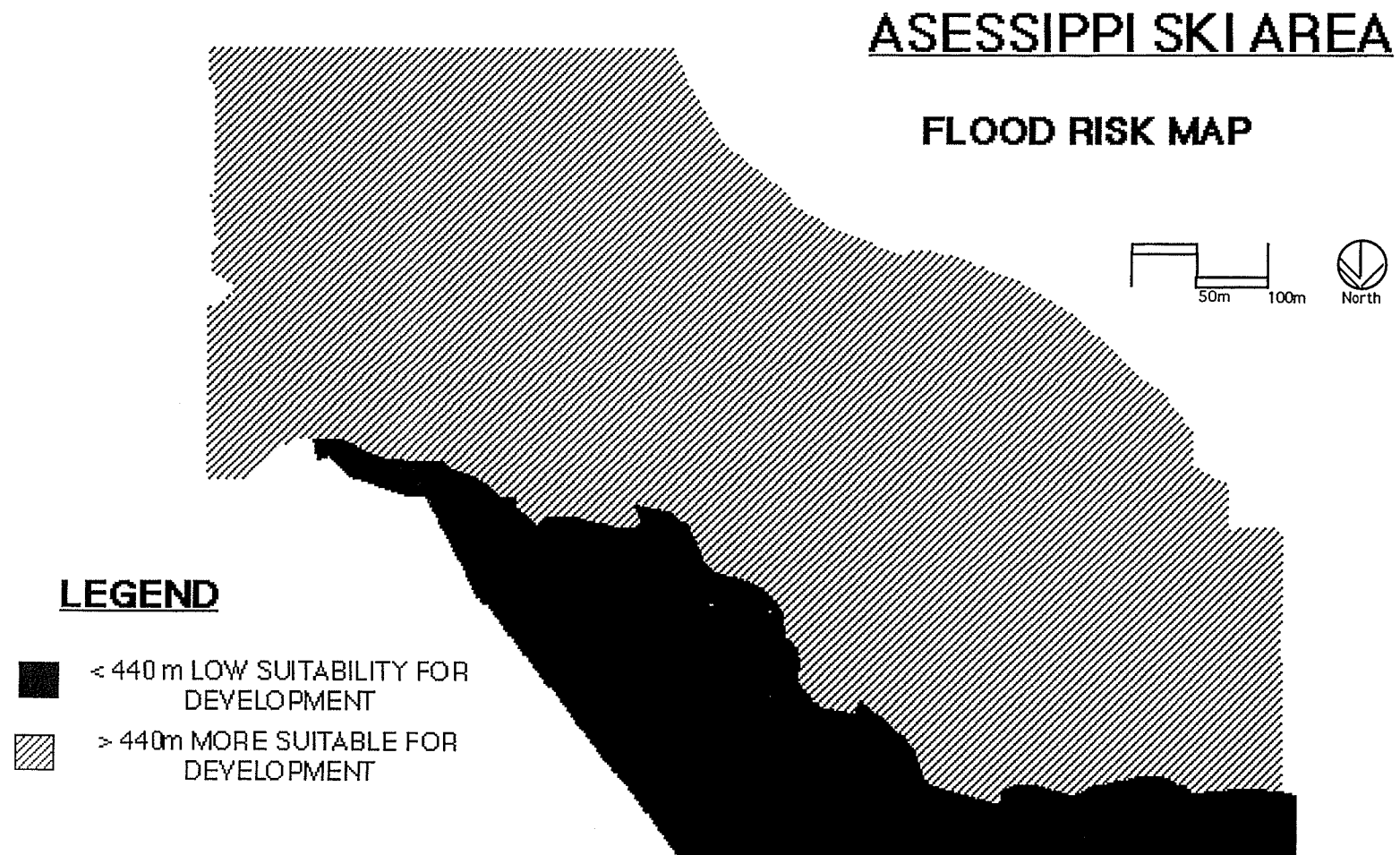
To find the best lift loading and unloading areas the following criteria were used. Using the maps generated in step two for skiing terrain, flatter slopes were considered more suitable than steeper slopes. This information was then combined with a flood risk map which determined those areas of the site most likely to flood.

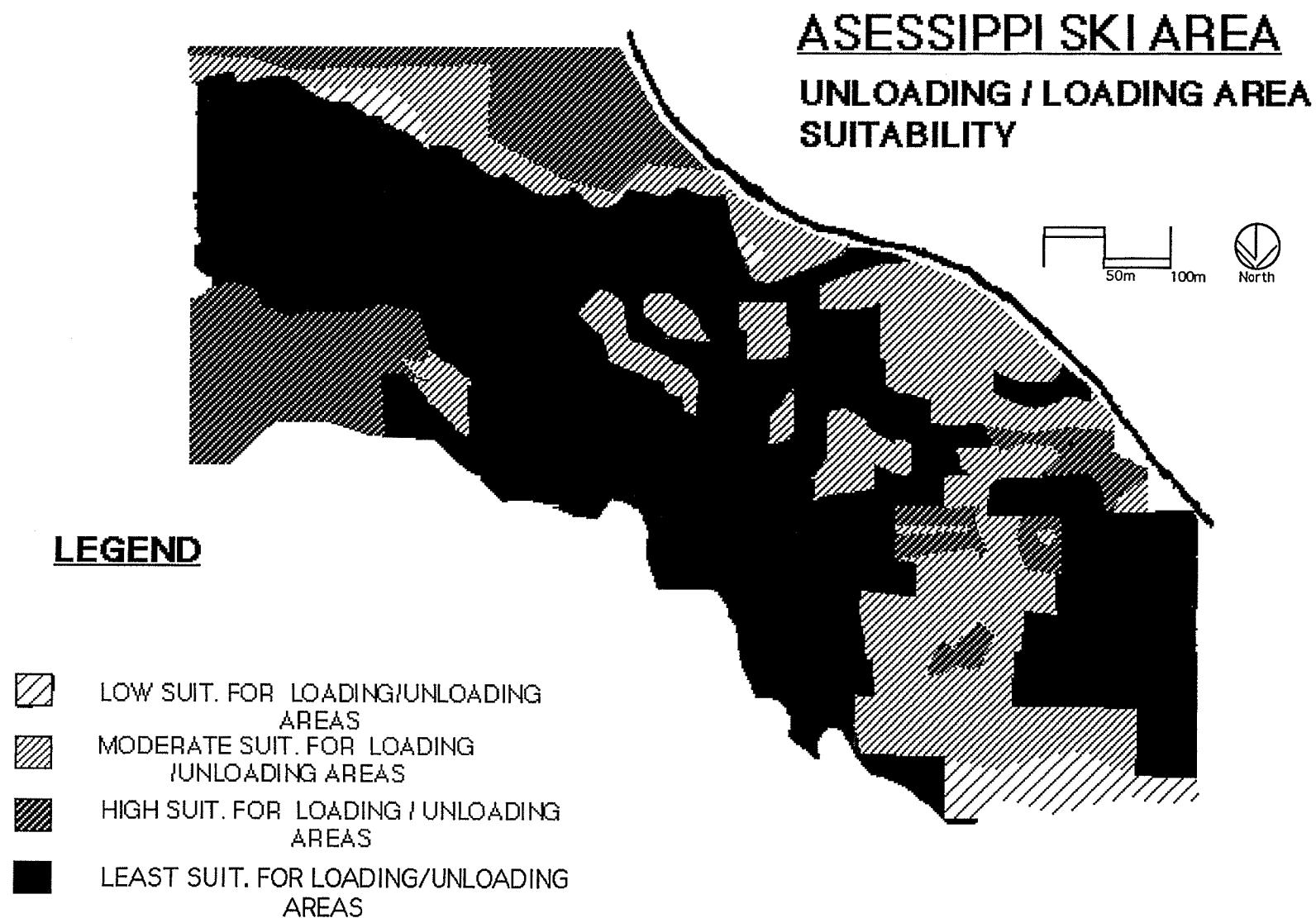












From these maps a suitability map was created which situated loading and unloading areas in flatter terrain away from potential flood zones as much as possible.

SUMMARY

The results of the GIS work identified most of the western portion of the site as being suitable for beginners (Fig. 35).

There were some land units in this area that were identified as being least suitable based on the slope that will require grading.

The central portion of the site was mostly suitable for intermediate skiing (Fig. 36). There were land units of unsuitable slopes that could potentially interrupt continuous trails of intermediate terrain from the top of the hill to the bottom.

These areas would require grading work if they were included in the ski trail system. Most of the expert terrain was located in the eastern half of the site with small pockets of land units found in the rest of the site (Fig. 37). Like the intermediate terrain the expert terrain was broken up by unsuitable terrain that would require grading work to make appropriate for skiing.

This mapping work was then used to identify potential problem areas, positive attributes, and alternatives. The information acts as a base map for further design analysis and ultimately for the final layout (Fig. 38).

4.2 FALL-LINE ANALYSIS

The fall-line is the shortest distance between consecutive contours and is best described as the path a ball might follow when allowed to roll unobstructed down a slope. As described earlier ski trails are usually designed to follow the fall-line as much as possible to make the skiing experience more enjoyable and to avoid expensive construction costs from regrading.

4.3 DESIGN PRINCIPLES

Skiing is an interaction between the skier and the environment. The sensual qualities of the environment are integral and

essential to the experience of skiing.

The sensuous experience of skiing is primarily a spatial one, a perception of the space that surrounds the skier while in motion, experienced or perceived through the eyes, ears, and skin.

The spatial qualities of a place are effected by; how the space is defined, the proportion and scale, the light, the texture and materials, the topography, and by the activities that take place within the space.

Relationships between spaces in sequence is central to the skiing experience. Because the landscape is usually experienced by a skier in motion, the experience of a single space is not as important as the cumulative effect of a sequence of spaces.

Within a sequence of spaces, orientation, the form of motion, the placement of objects, the skiers speed and the spatial form determine the sequential experience.

Ski area design like all good architecture must express the true sense of a place. Place-making can be facilitated by understanding the natural and built qualities of the environment and the qualities of the people who will use the area.

4.4 THE PRAIRIE

The prairie is about the earth, the sky, the vegetation, and the sun's light reduced to their simplest elements and boldest features.

Extending to the horizon and beyond the prairie is monumental in scale. There are few hills or trees to provide shadow and lend depth to the scene. Exposed to the sun, wind, snow, rain a severe austerity prevails. Rigid straight roads, railways, and telephone lines draw the eye as far as it can see emphasizing the inhuman scale. Elevators command attention in the otherwise horizontal landscape.

Our insignificance is exaggerated under the huge and daunting sky which feels so close yet continues forever. With few elements to stand in the way one sees more stars, more space than can be imagined. Clouds pass quickly through the unyielding blue sky that turns orange with the setting sun.

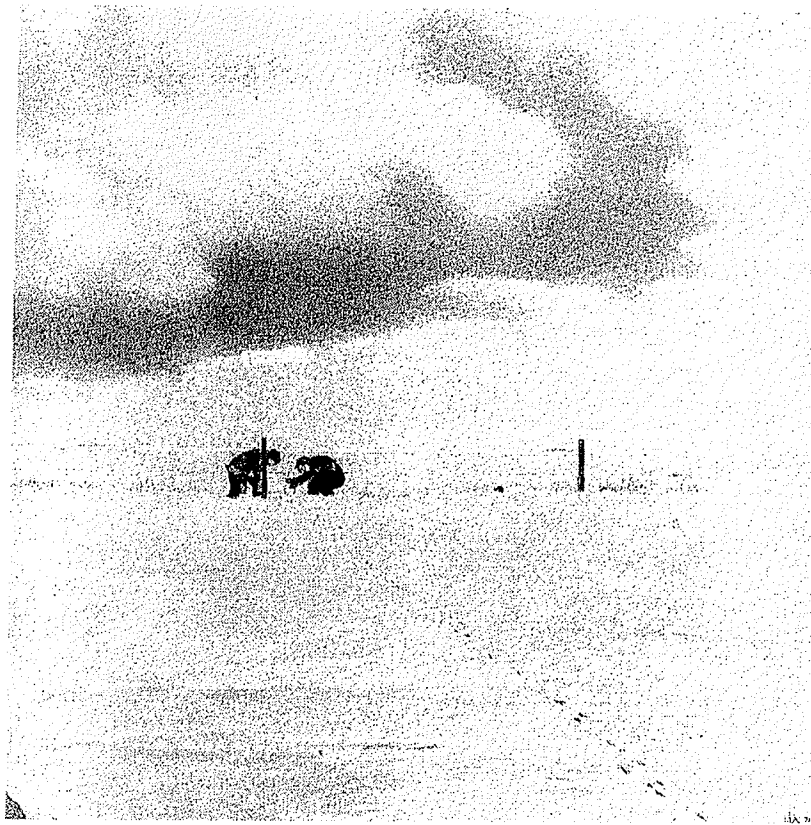


Fig. 40 The inhuman scale of the prairie (Kurelek, 1973).

The clear and crisp air on the prairies creates a brilliant quality of light. There is little humidity to soften and enchant.

Winter's sun creates long clean sharp shadows on the snow as it sits above the horizon, often blinding as it reflects off the cold white blanket.

Bathed in sunlight, subtly discriminating values of pinks, yellows, blues and greens wash over the landscape. Grasses, flowers, and shrubs cling to the ground claiming our attention from the uncompromising landscape, attracting the eye and asserting their individual charm. Clumps of trees create islands where homesteads find safe harbor.

Exposed to the relentless lashing wind that chills and burns, there is little escape. Snow and soil is carried to distant places, drifting in ditches and scouring the roads. Solitary rows of trees brave the unstoppable wind as it sweeps freely across miles and miles of prairie. Bitterly cold in winter, hot and dry in summer, even the slightest wind is punishing to the prairie soul.

Drawn to the edge of ancient fluvial rivers, recognizable by the lush vegetation that over flows the valley walls, the valley incites curiosity. Like an oasis set into the prairie surface, it



Fig. 41 Working on the prairie (Kurelek, 1973).

provides a relief from the vast open spaces and shelter from total sky and untrammled wind. Standing on the brink there is an open view across and down. The river carves a suave flowing line that allows the eye to meander. The gently undulating terrain provides safety for a variety of life. There is a calm serenity in the forests of poplar with their gleaming white trunks and shimmering leaves. Rhythmically they stand in shadow silhouetted against the sky their branches are interweaving graceful lines. Sheltered from the wind and bathed in the warm sunlight, comforting spaces, personal and human in scale, unfold within the forest. Hidden places invoke discovery along the river and beyond. Looking up from the valley floor the sky is less intimidating.

4.5 SKIING ON THE PRAIRIE

The cold air whistles passed your ear as you plunge down the valley slope. Ahead the trail opens up to the flats of the valley bottom as you drop below the horizon of the opposite bank.

Slowing down, the river is silent, the hum of the chairlift can be heard in the cold dry air. Voices chatter excitingly, snow crunches under ski boots, and there is the sound of brightly coloured Gortex and Thinsulate held crisp by the frosty air. Circled by trees the wind is silent and quickly the warmth of the sun is felt touching the end of your nose and cheeks.

Singles, doubles, triples, together you prepare for the ride. Ski poles in one hand, points forward, quickly you sit and are whisked up and away. There are many chairs ahead, the top is still out of sight. Now moving at a steady pace the chairlift rises up the hill. From above the trees the trails flow like rivers, joining and branching off again. Unprotected the wind rushes over your shoulder and past your ear and bites at your cheek as the chair draws you out of shelter and up towards the edge of the prairie above. Safety bar raised, tips up, you shuffle preparing to unload. Quickly the chair passes, and turns to descend into the valley for others.

Standing at the top, exposed, overlooking the bald prairie. In the vast abandonment of snow covered ground and sky solitary objects stand alone. The sun is bright but the wind is blowing you decide quickly to turn and retreat back into the valley to rediscover its sheltered charm.

Down a narrow shaded path voices rise above the trees. A fire burns and provides warmth as people gather to talk among friends. Maybe next run, there is much to explore. The path winds softly through the trees opening into spacious rooms, narrowing again into mysterious corridors.

Stopping briefly to survey the trail ahead, the walls of trees on either side, you remind yourself of the view from the chair. The trail is narrow but not too steep, an island of trees blocks your view, you begin to make your first turn. Quick short turns are all that are possible here. The trees cast long shadows across the snow like telephone poles. The trail gets steeper then flattens out as it suddenly opens up. Sunlight reflects off the snow. The opposite valley wall is clearly visible from here.

A fork in the trail catches your eye. You continue to carve wide flowing turns as you swoop around islands of Poplar. Their long shadows create rhythmic patterns across the trail. The musical score of which you have become a part increases in tempo and you shorten your turns to slow the pace. The walls open and close, spaces shrink and expand and the floor beneath you dips and swells under your skis.

Just as your thighs begin to burn, the lift line and it's kaleidoscope of colour come into view and once again the valley walls surround you as you plan your next run.

4.6 DESIGN CONCEPT

The design explores the concept of DISCOVERY. During the interaction between the skier and the environment there are many opportunities for discovery to take place. Discovery can be the disclosure of an object such as a tree, a great trail or of a concept such as speed or fear.

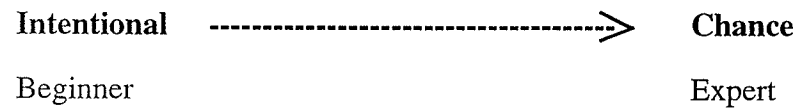
The conditions under which discovery takes place are as important as that which is discovered. Discovery is the result of chance such as when we encounter a deer in the woods or intention such as when we search for speed. As the designer we have the ability to disclose an object or concept intentionally or allow it to be disclosed by chance.

The environment naturally lends itself to the potentials of chance disclosure as it is constantly changing. In many situations it is a challenge for the designer to disclose natural elements of the site. However, in other situations it is necessary to design the elements to be discovered.

Discovery can be facilitated through contradiction or simplification. The designer can intentionally conceal, screen, or cover something so that it can later be found, revealed, or exposed.

The conditions of discovery, or how discovery will take place, can be explored in the layout of the facilities. The objects and concepts that are to be discovered can be explored in the detailed design of the spaces.

In the layout of trails beginners discover with the guidance of intention. Trails for the more experienced skiers allow for more discovery by chance. A layout designed for discovery by intention is traditional in that the trails are well defined and wide. A gladed or forested layout with natural openings relies more on free will and chance discovery (Fig. 43).



What is to be discovered either intentionally or by chance was determined in the detailed design.

Ski Trail Layout Concepts

INTENTIONAL
BEGINNER



CHANCE
EXPERT



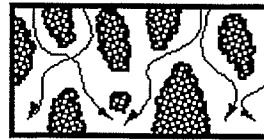
Traditional
20% cleared 36m wide



Tree Islands
30% cleared 45m wide



Large Islands
40% cleared 55m wide



Interconnected
50% cleared 150m wide



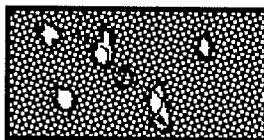
Semi-gladed
70% open 90m wide



Gladed
90% open 90m wide

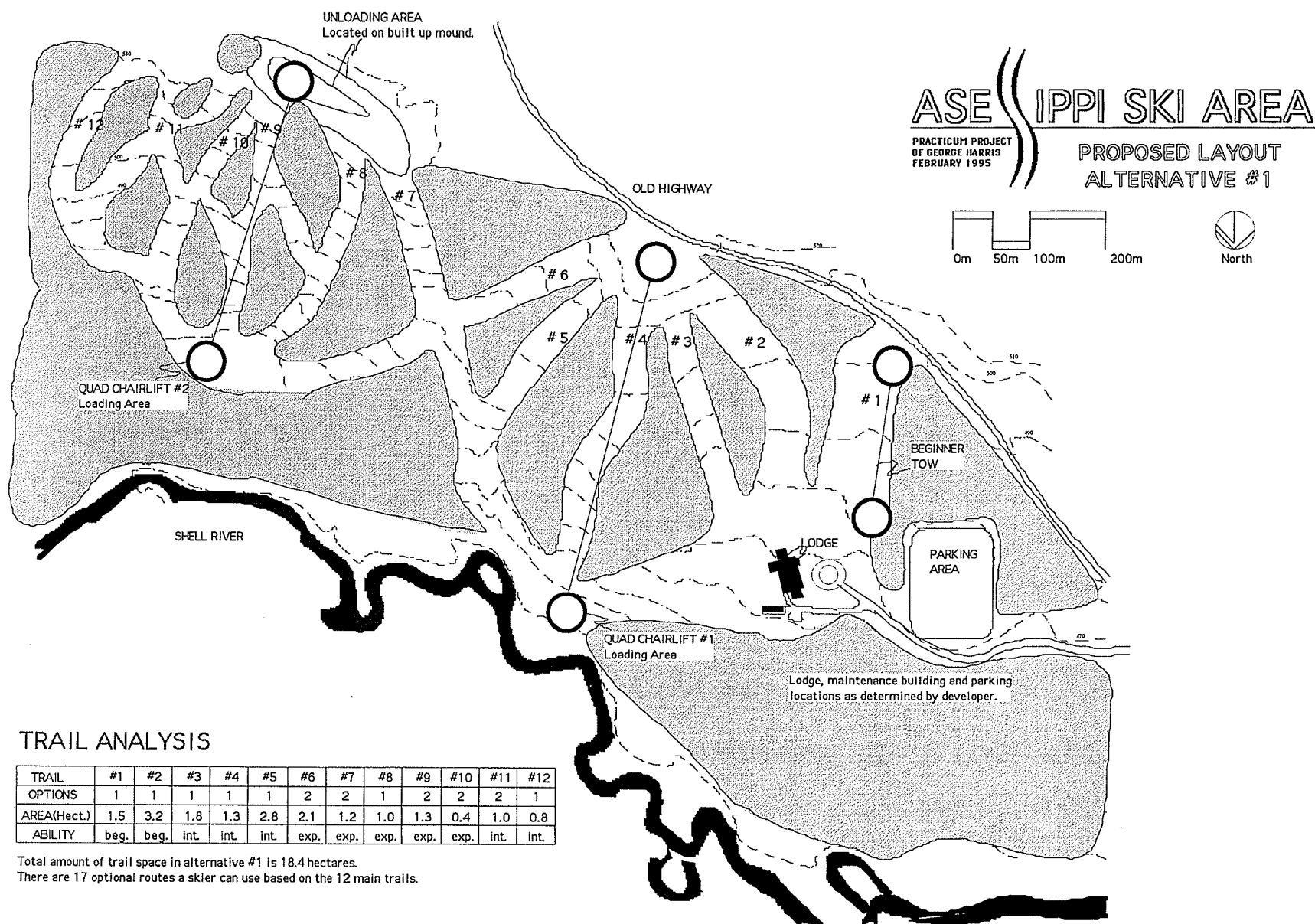


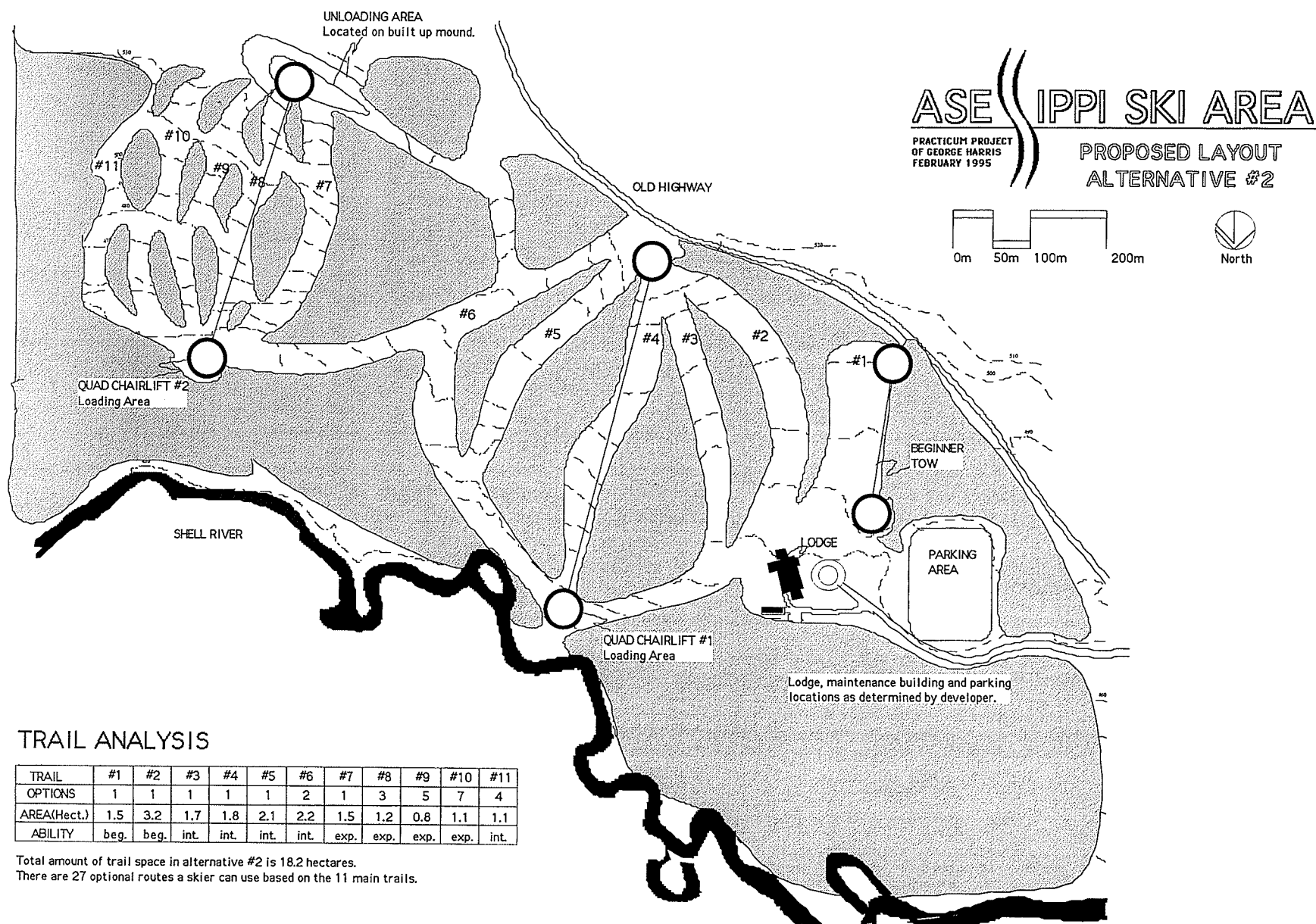
Open Parks
100% open 150m wide

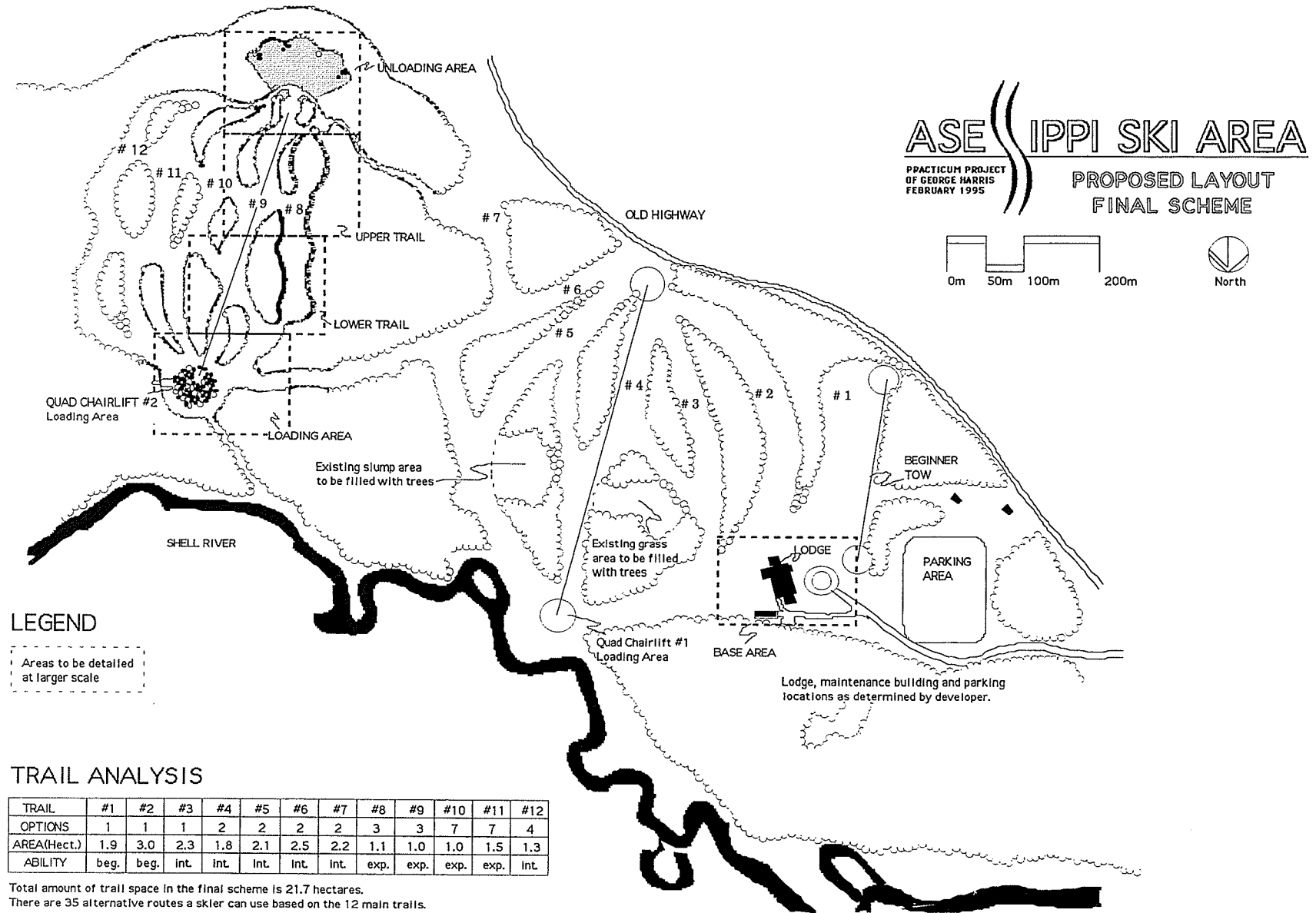


Forested
Natural Openings



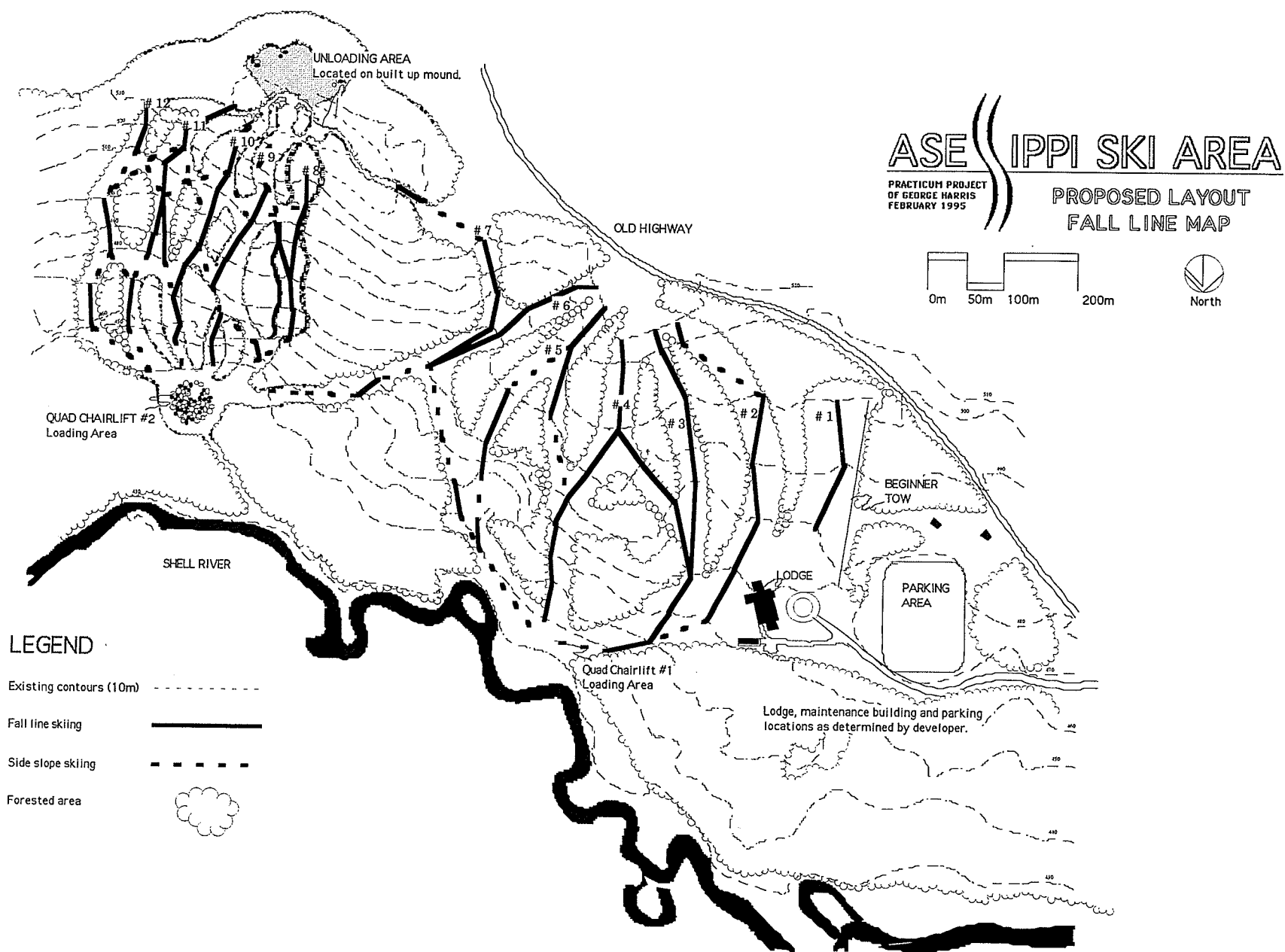


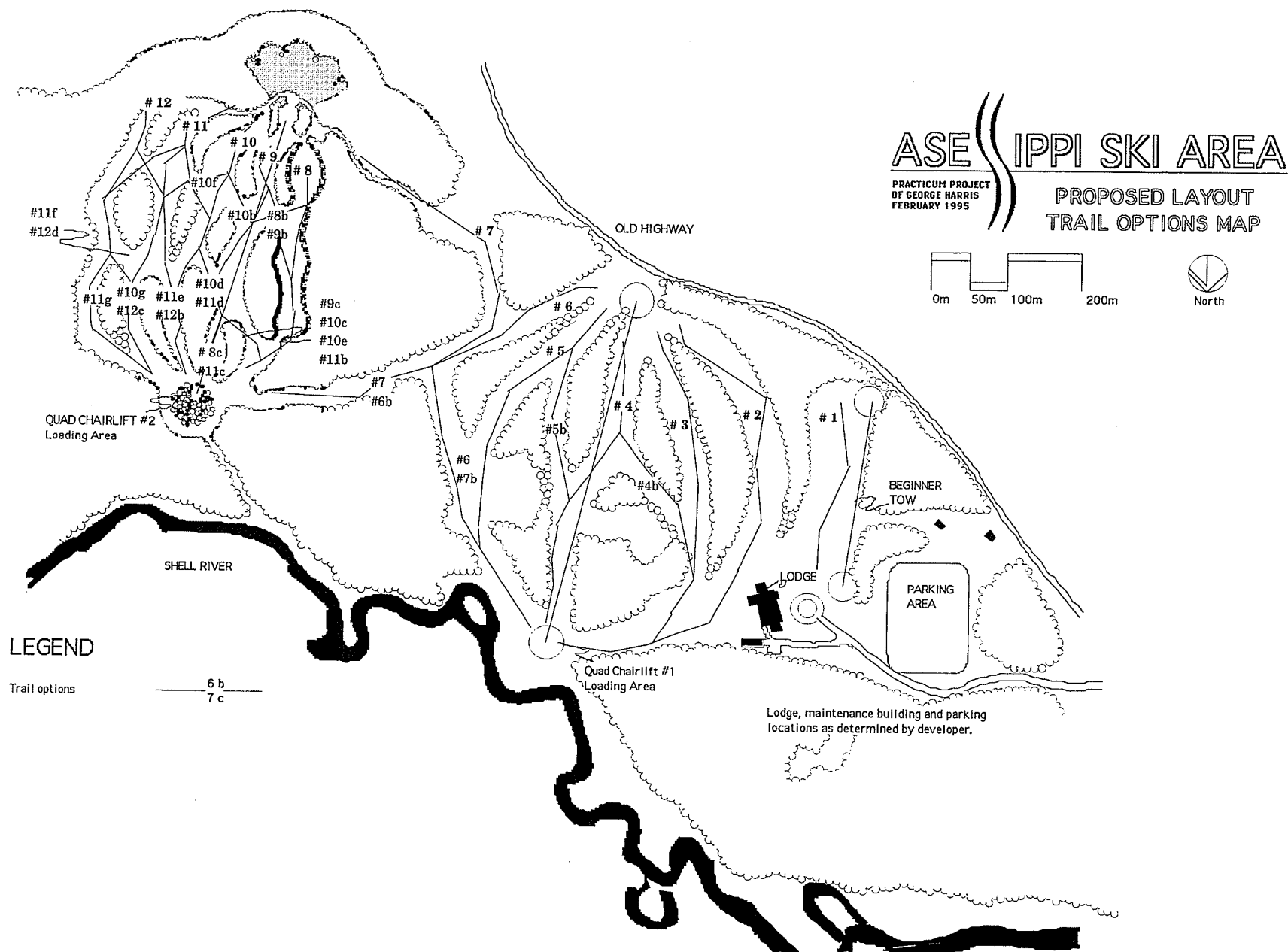


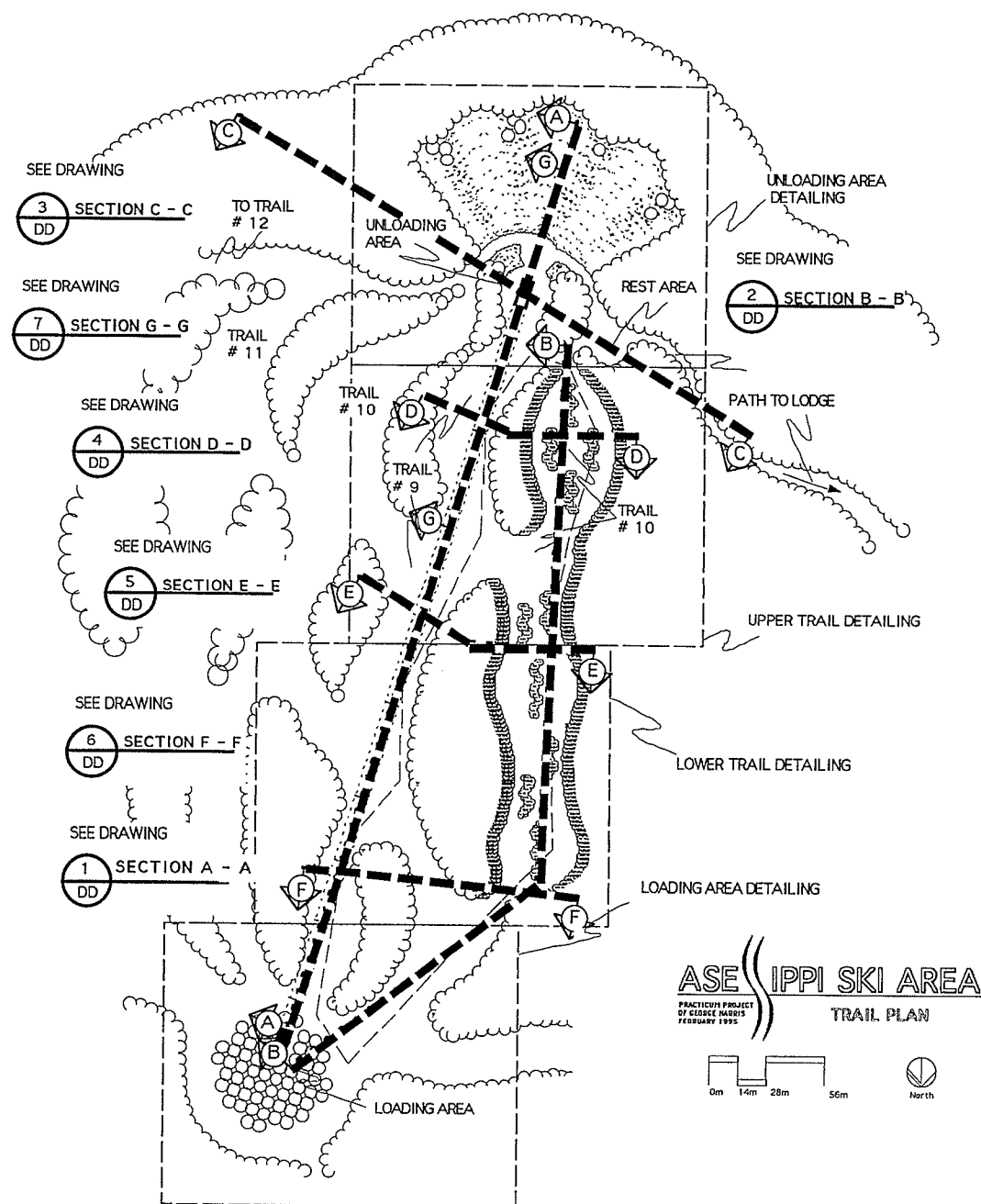


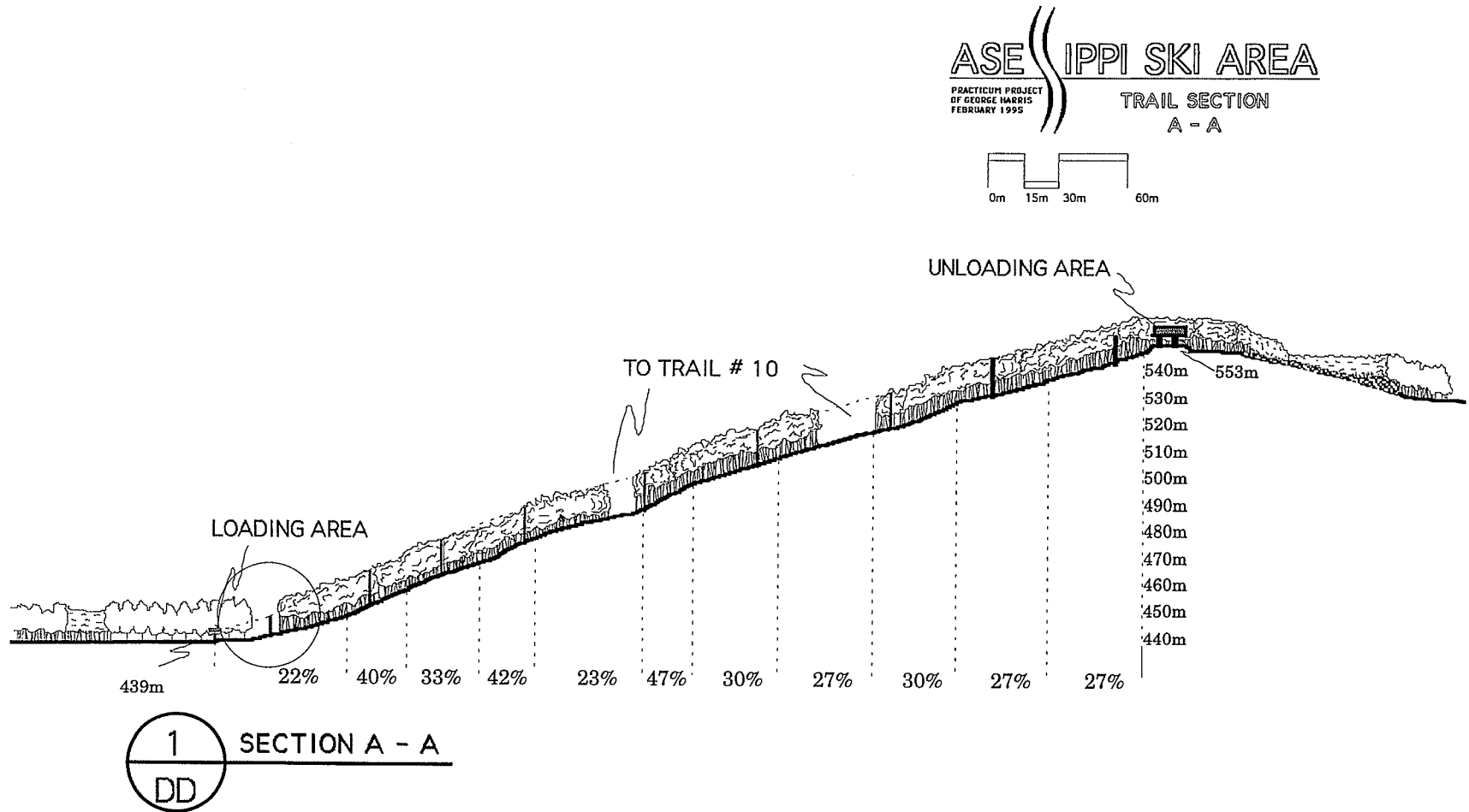
Total amount of trail space in the final scheme is 21.7 hectares.

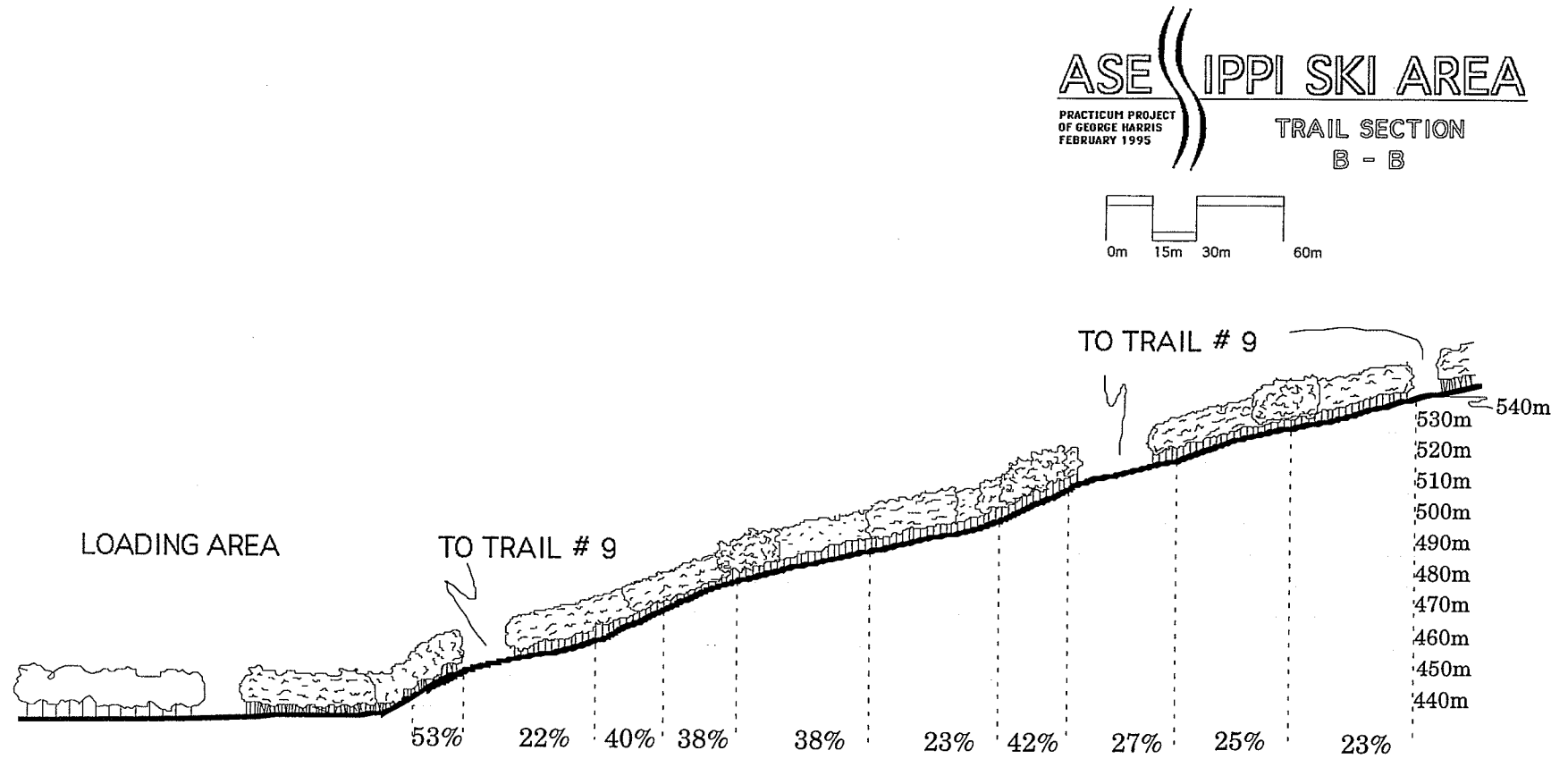
There are 35 alternative routes a skier can use based on the 12 main trails.





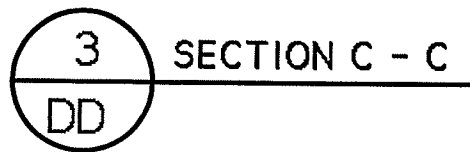
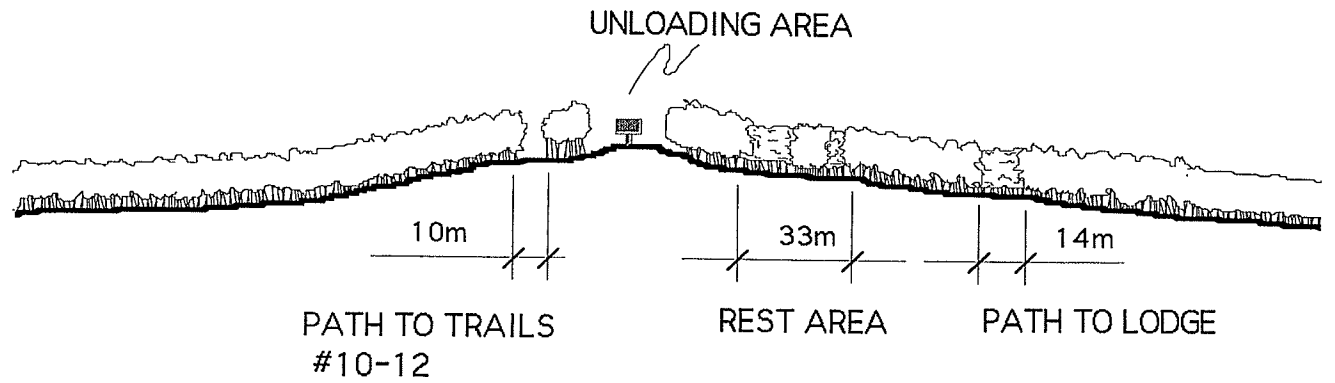
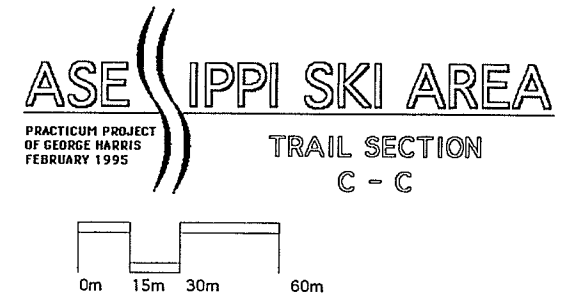


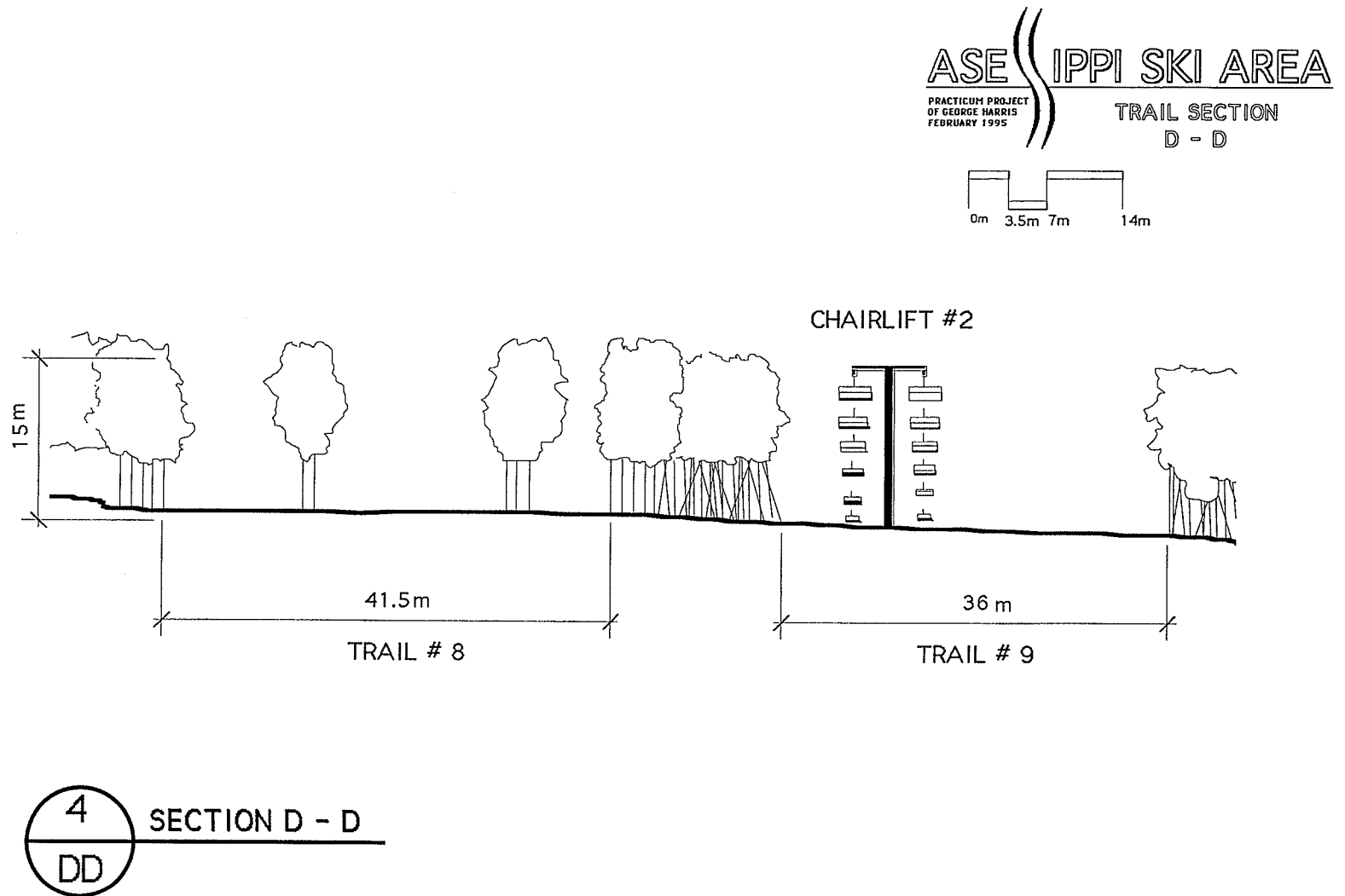


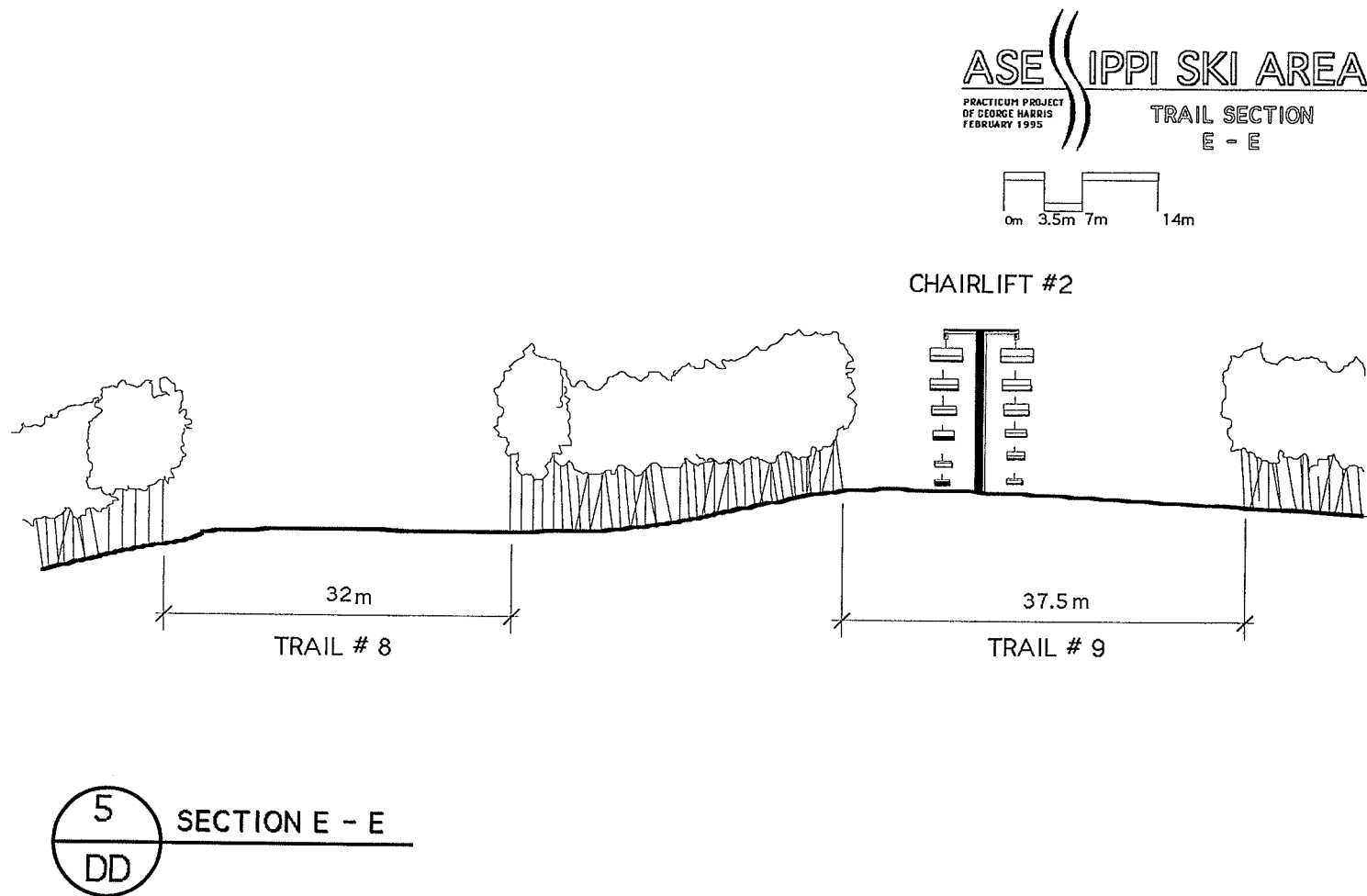


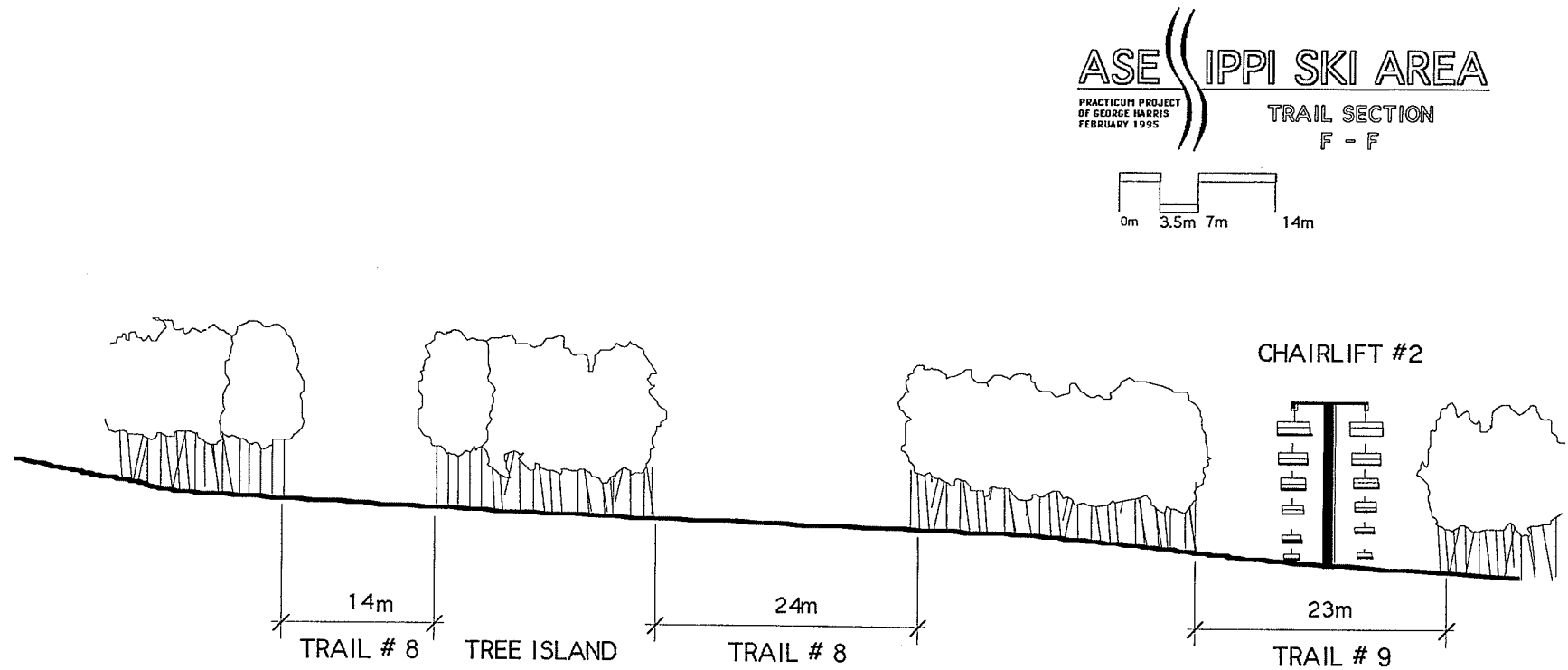
2
DD

SECTION B - B



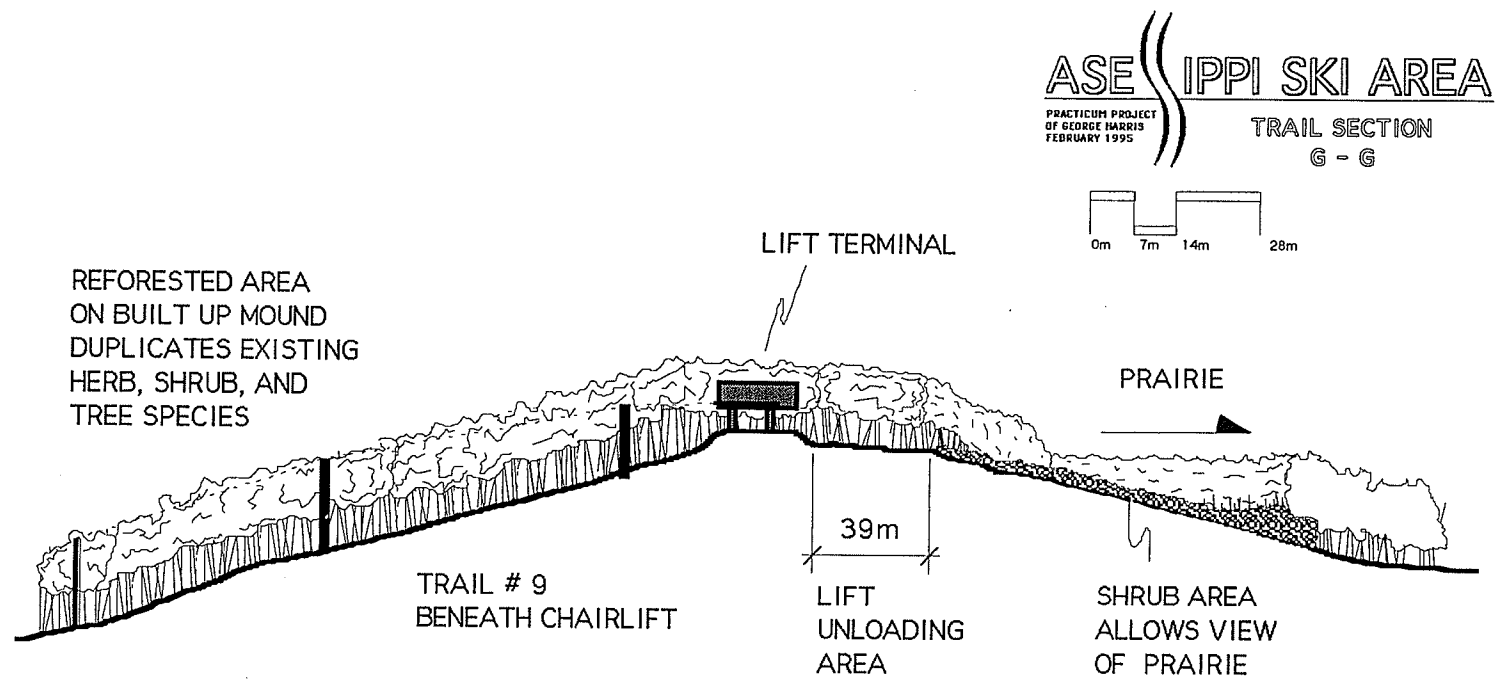






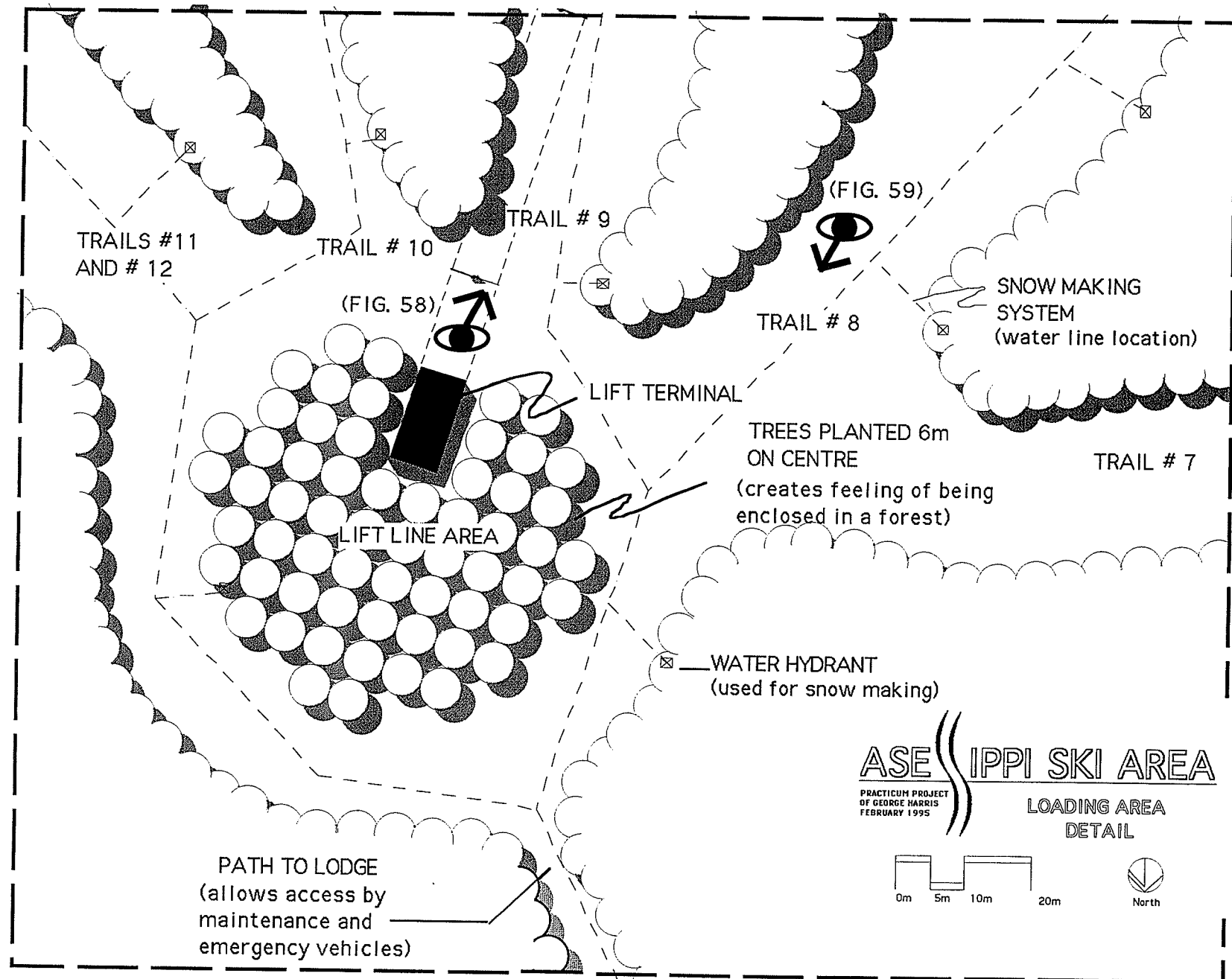
6
DD

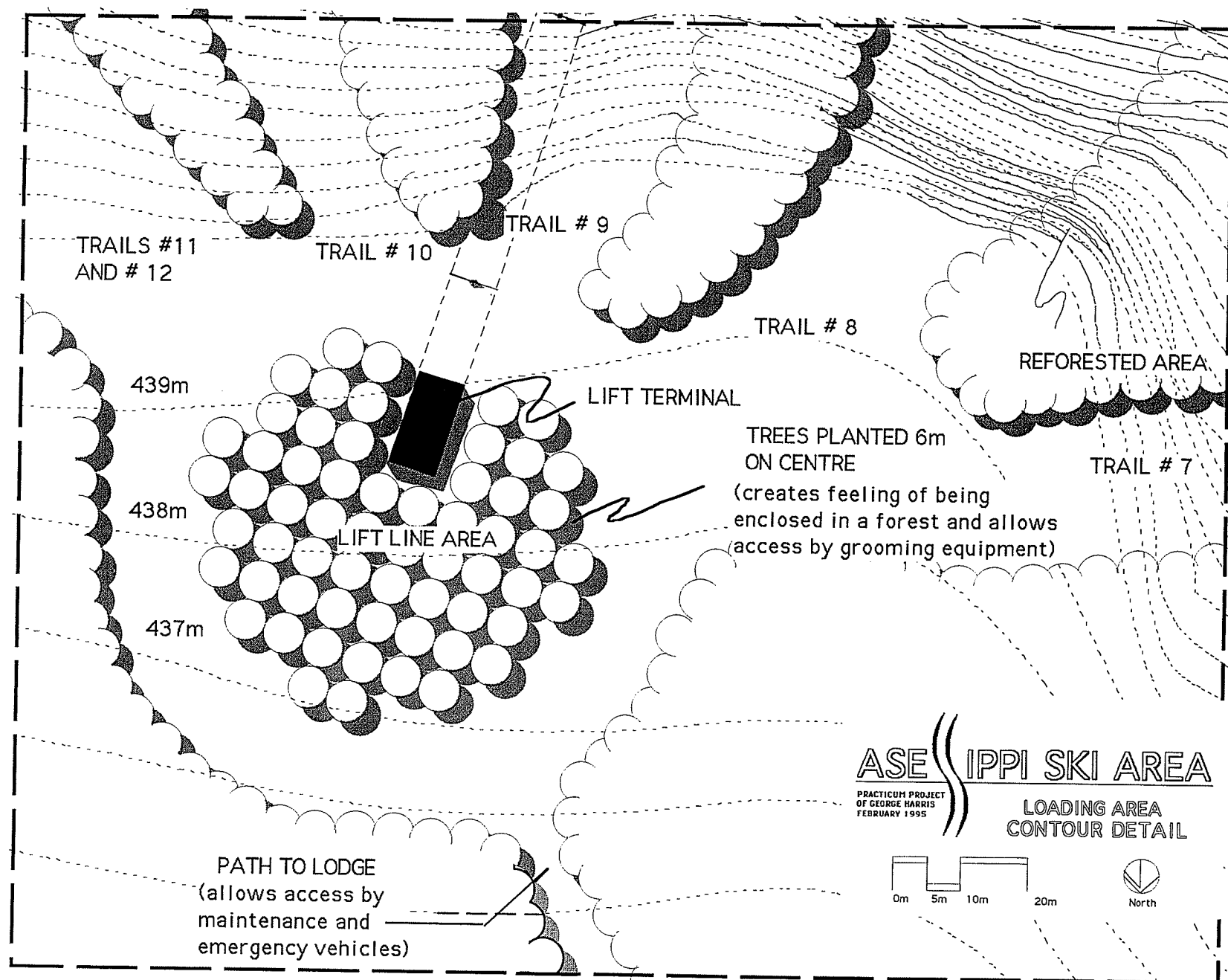
SECTION F - F

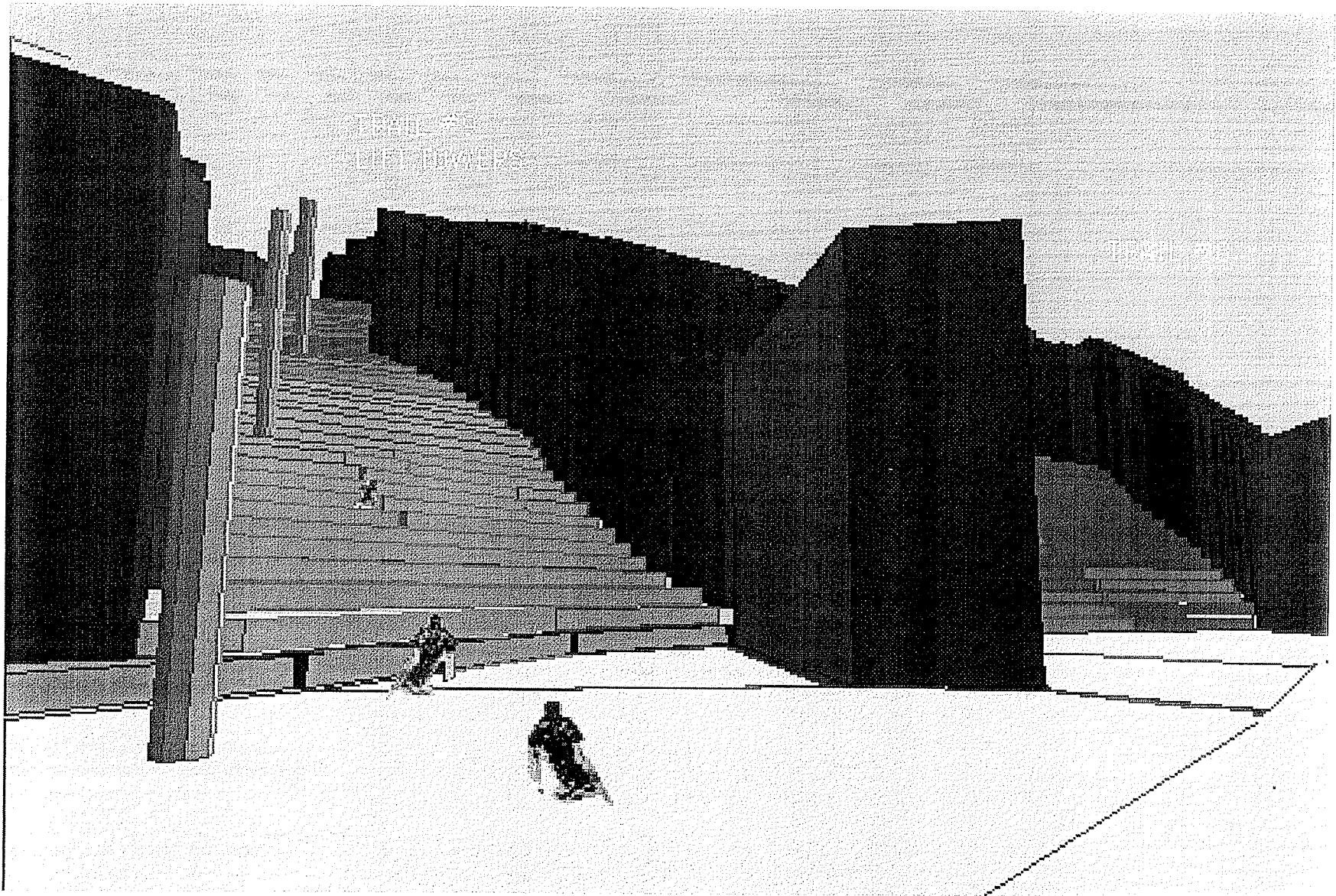


7
DD

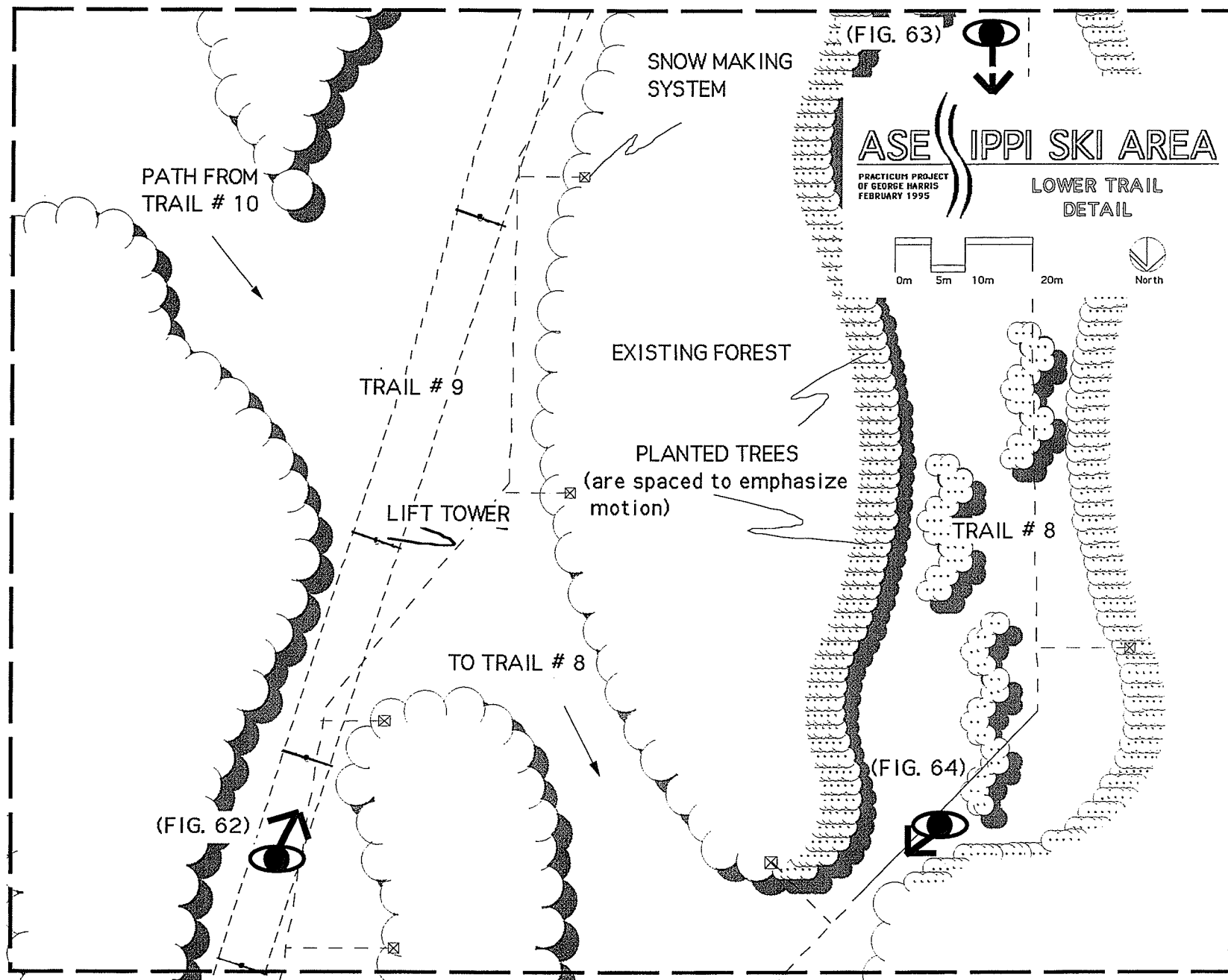
SECTION G - G

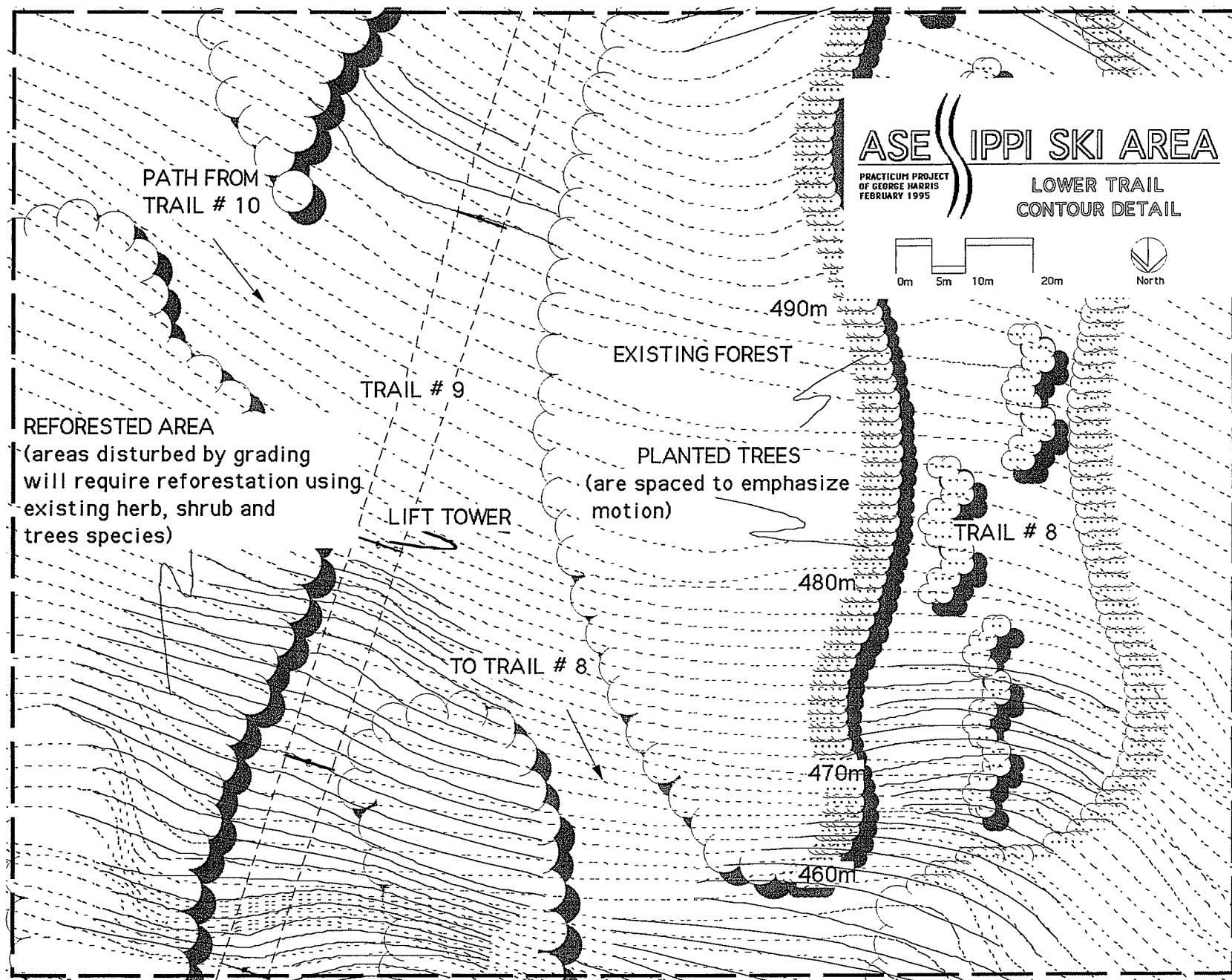


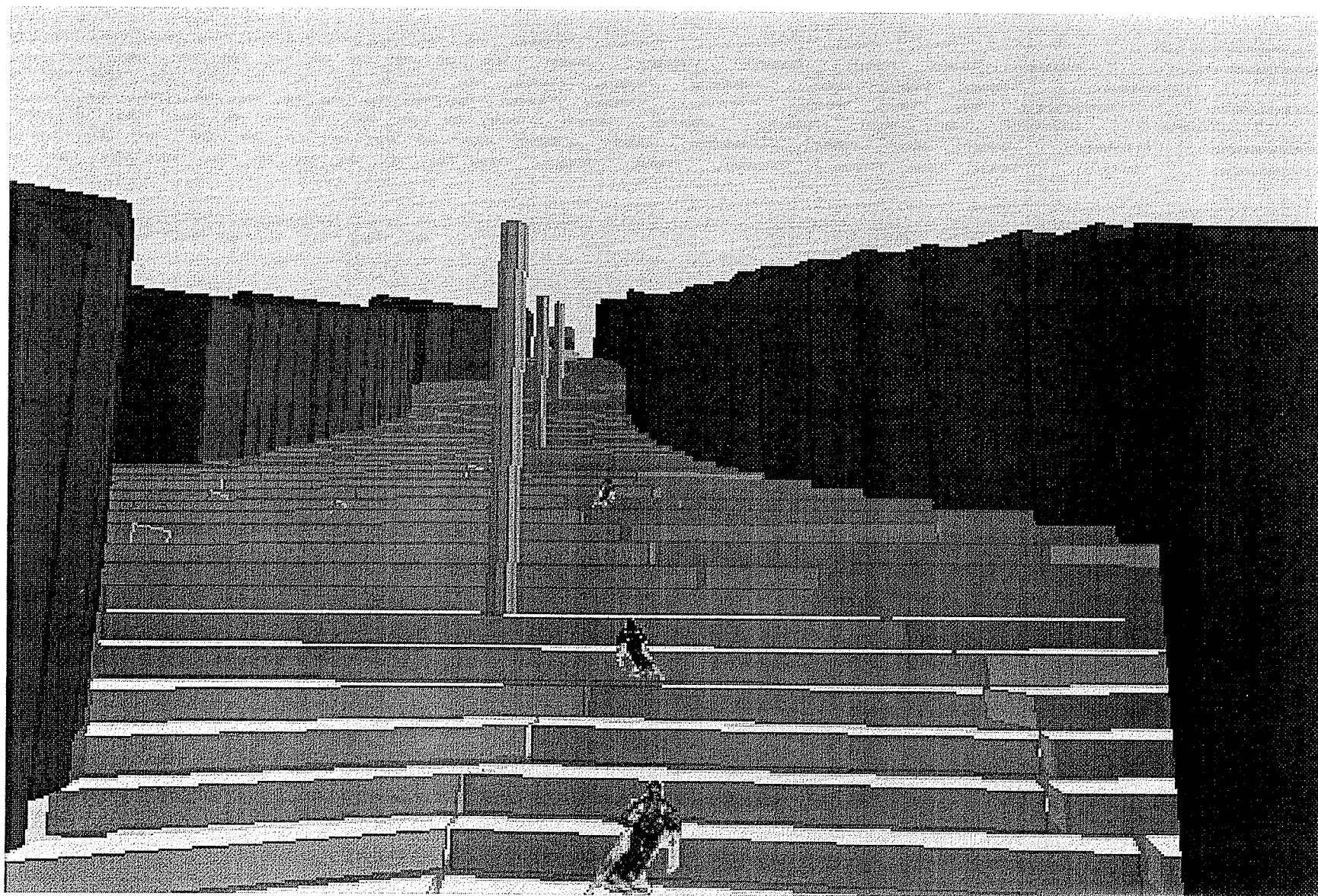




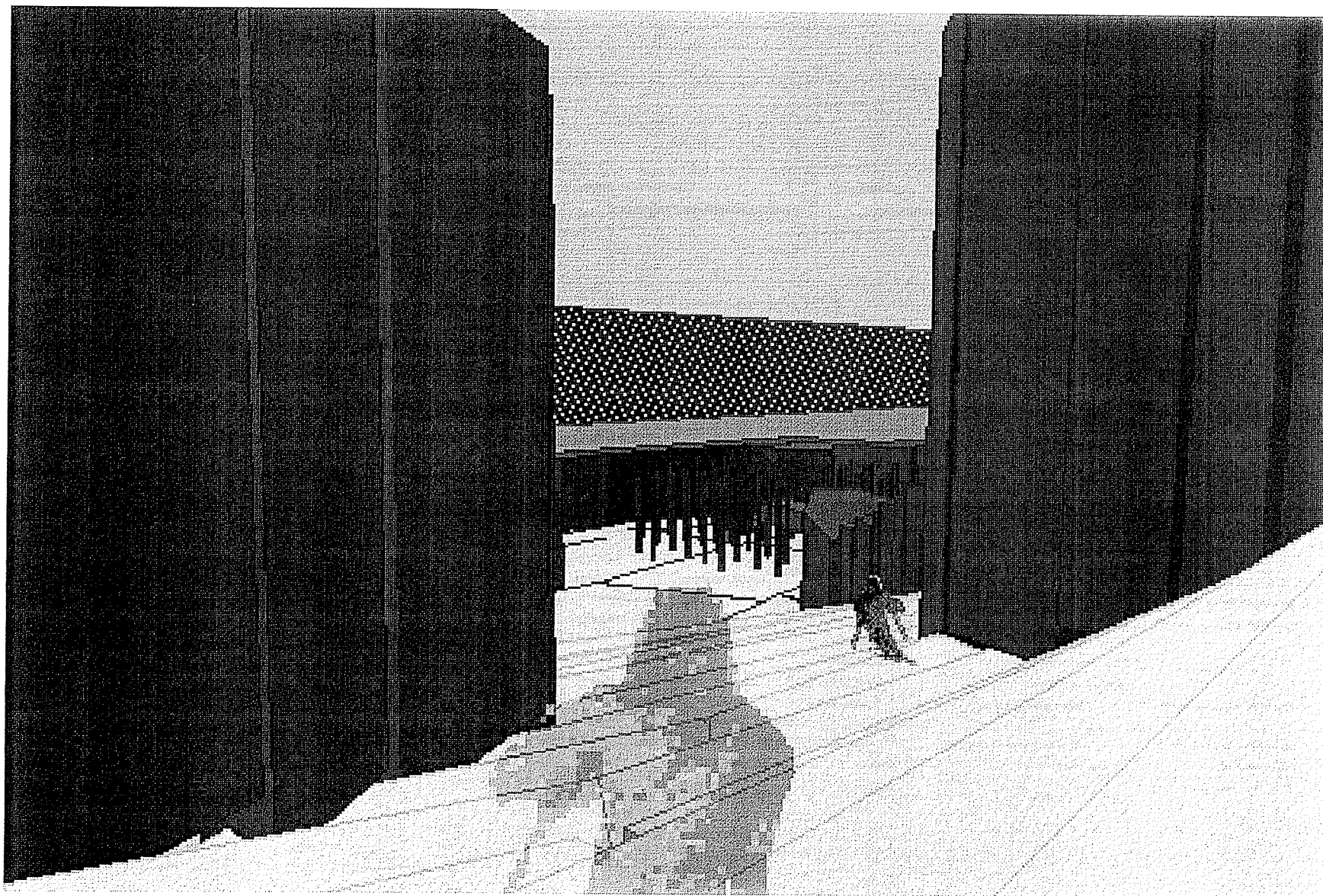


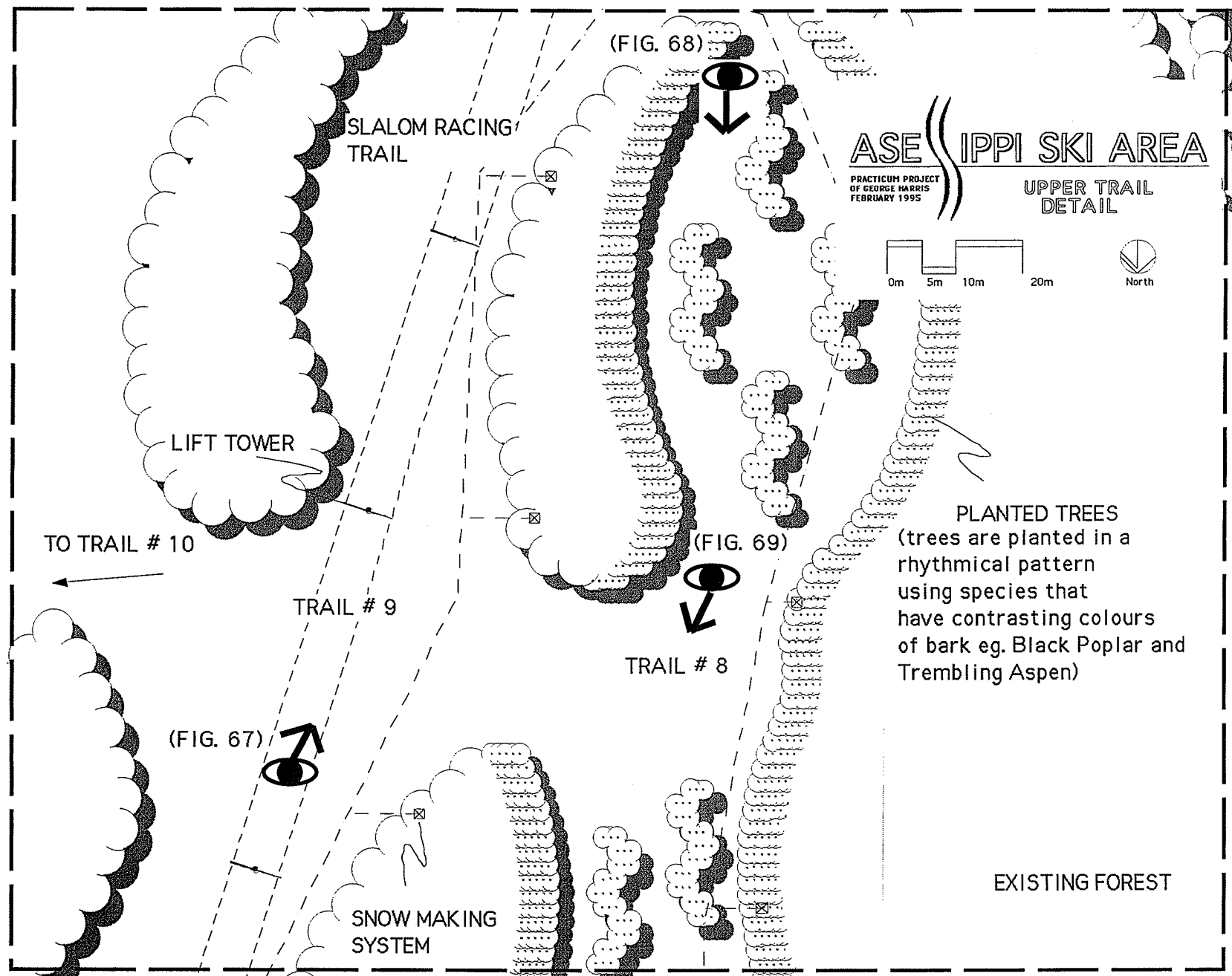


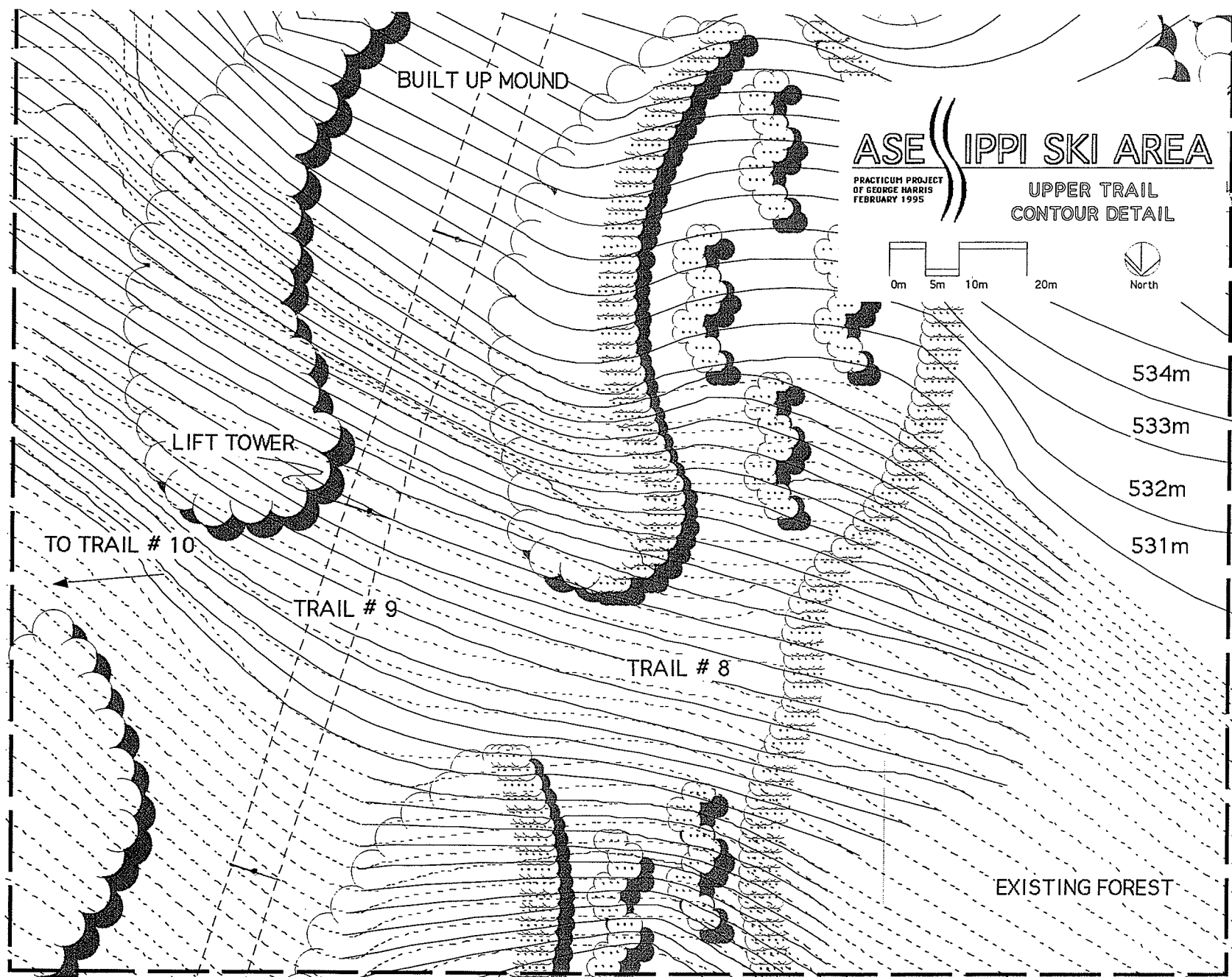


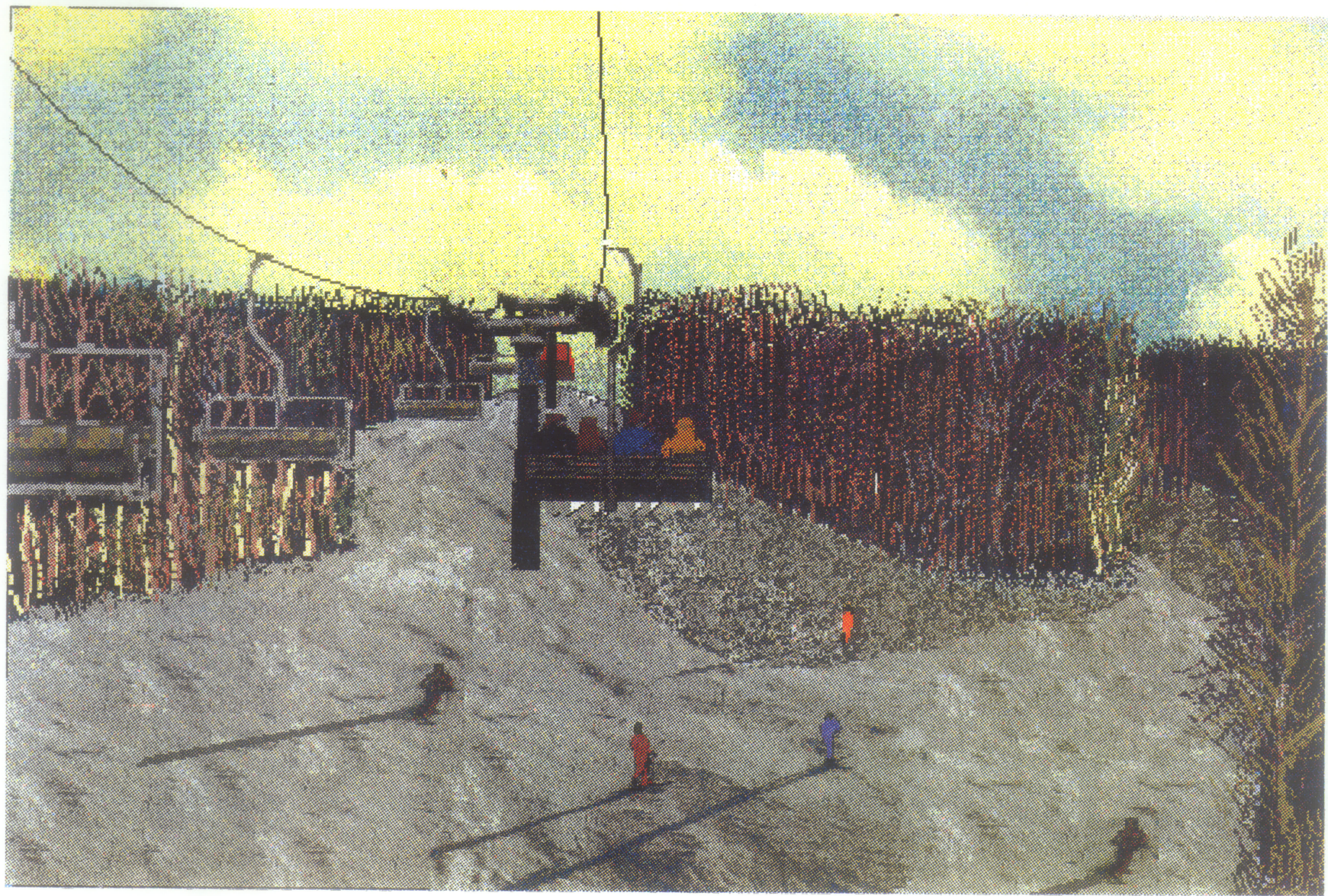


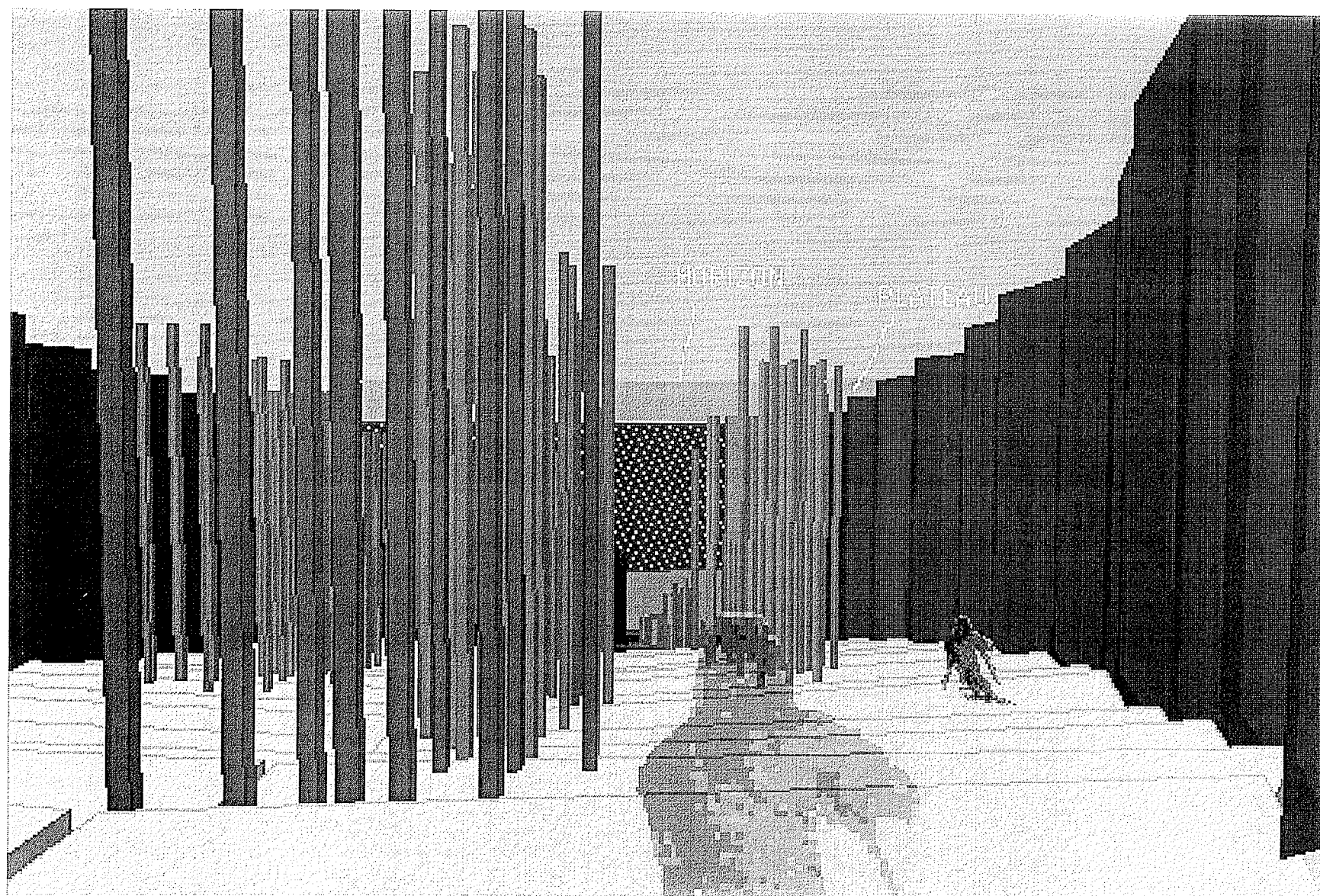


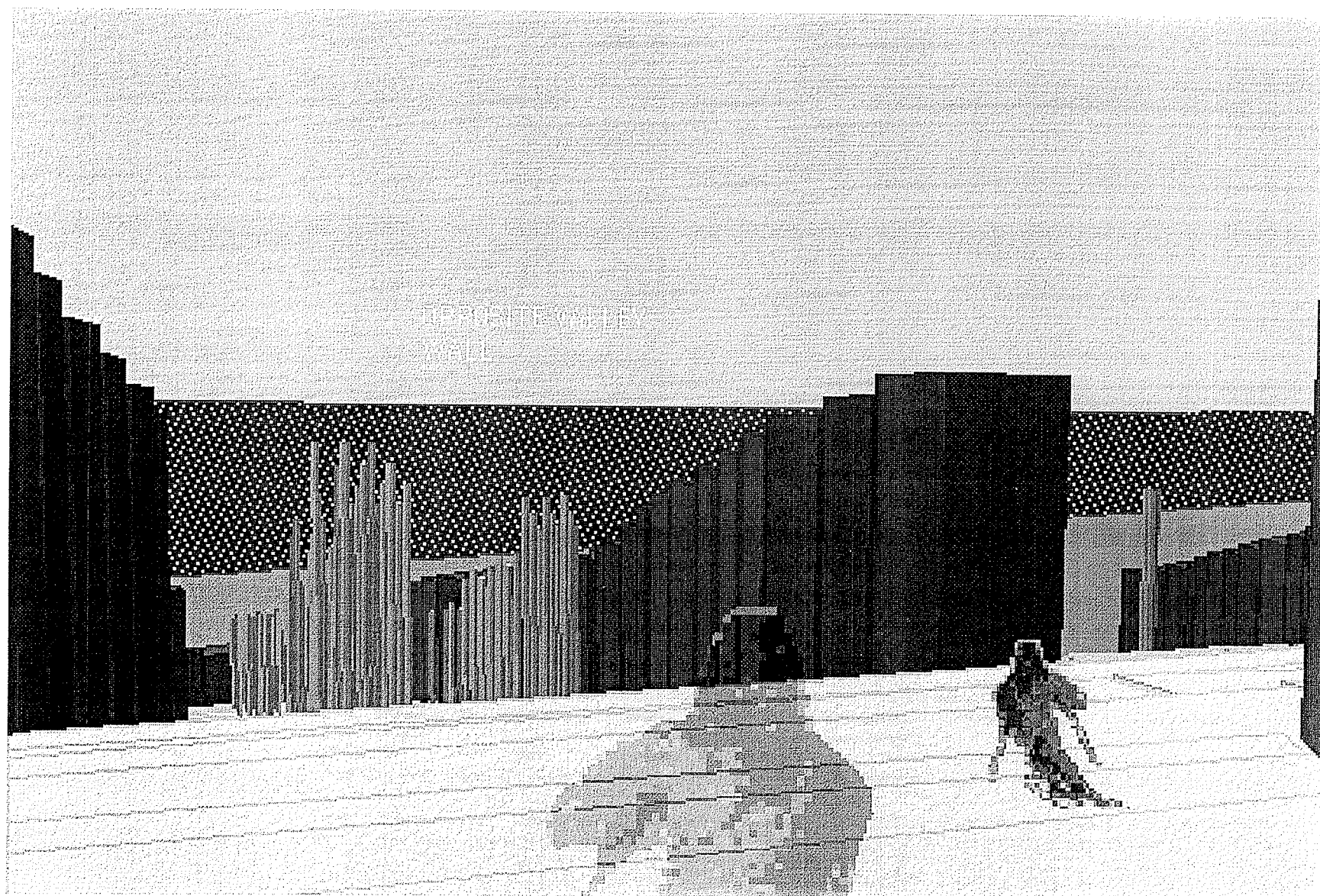


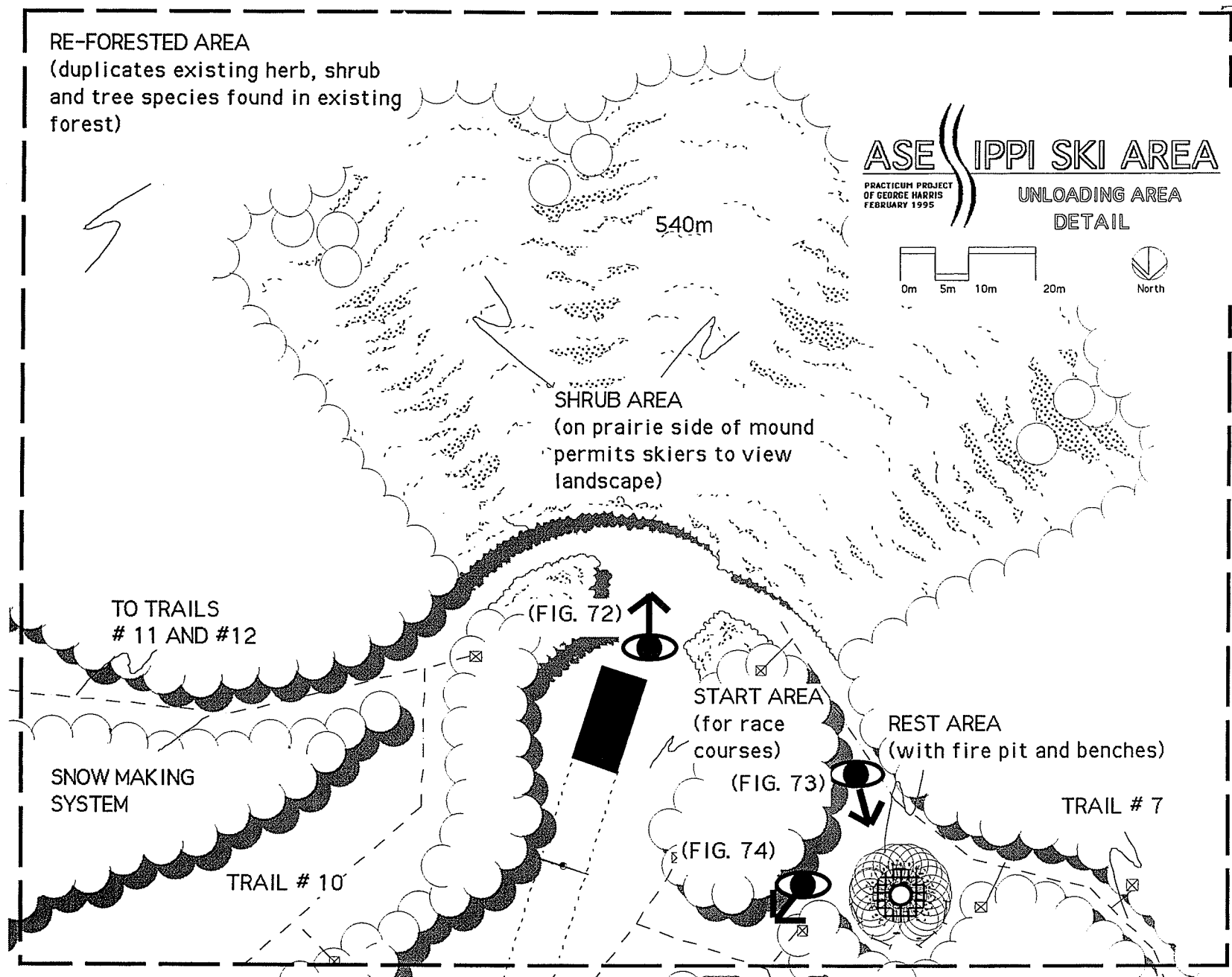


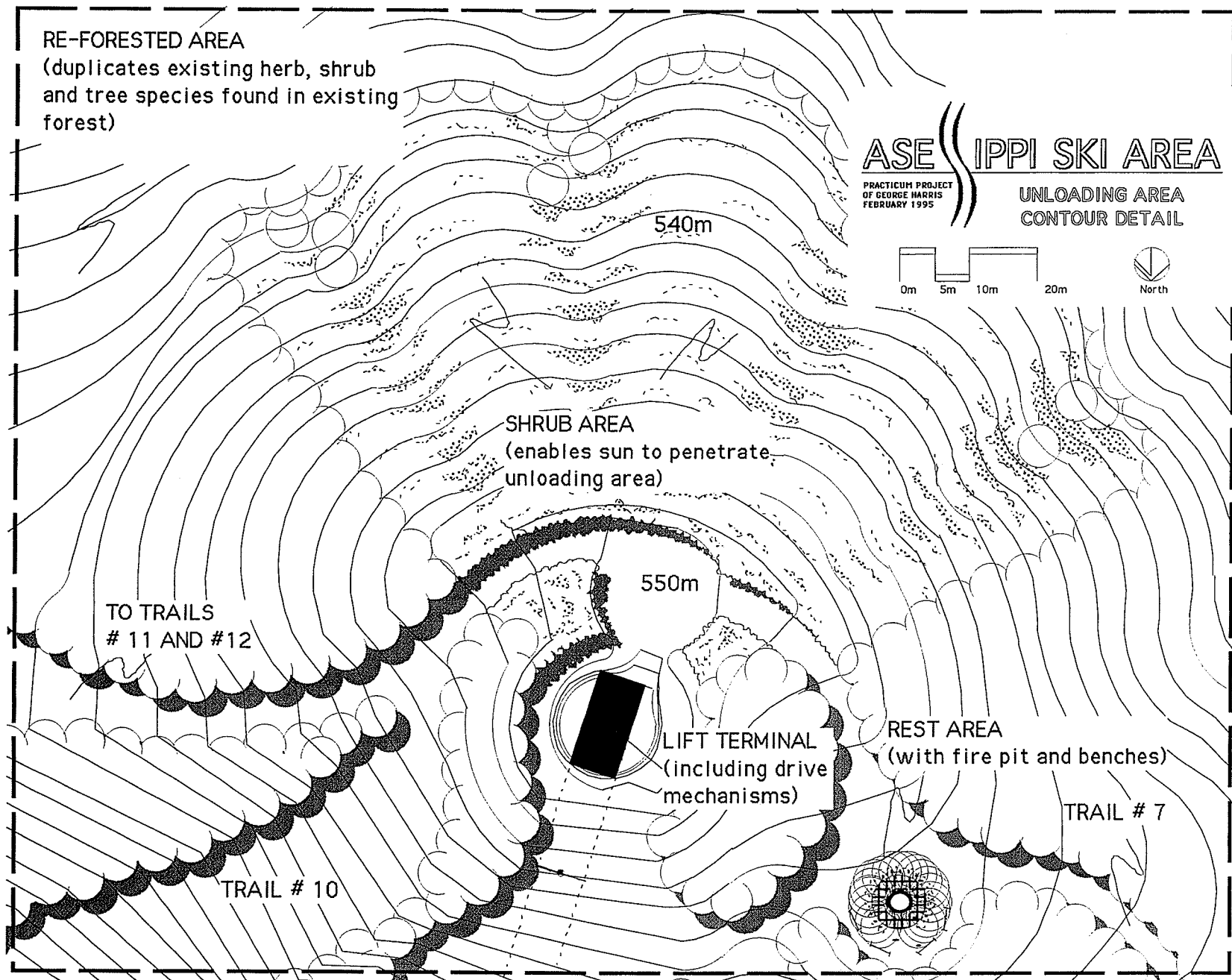






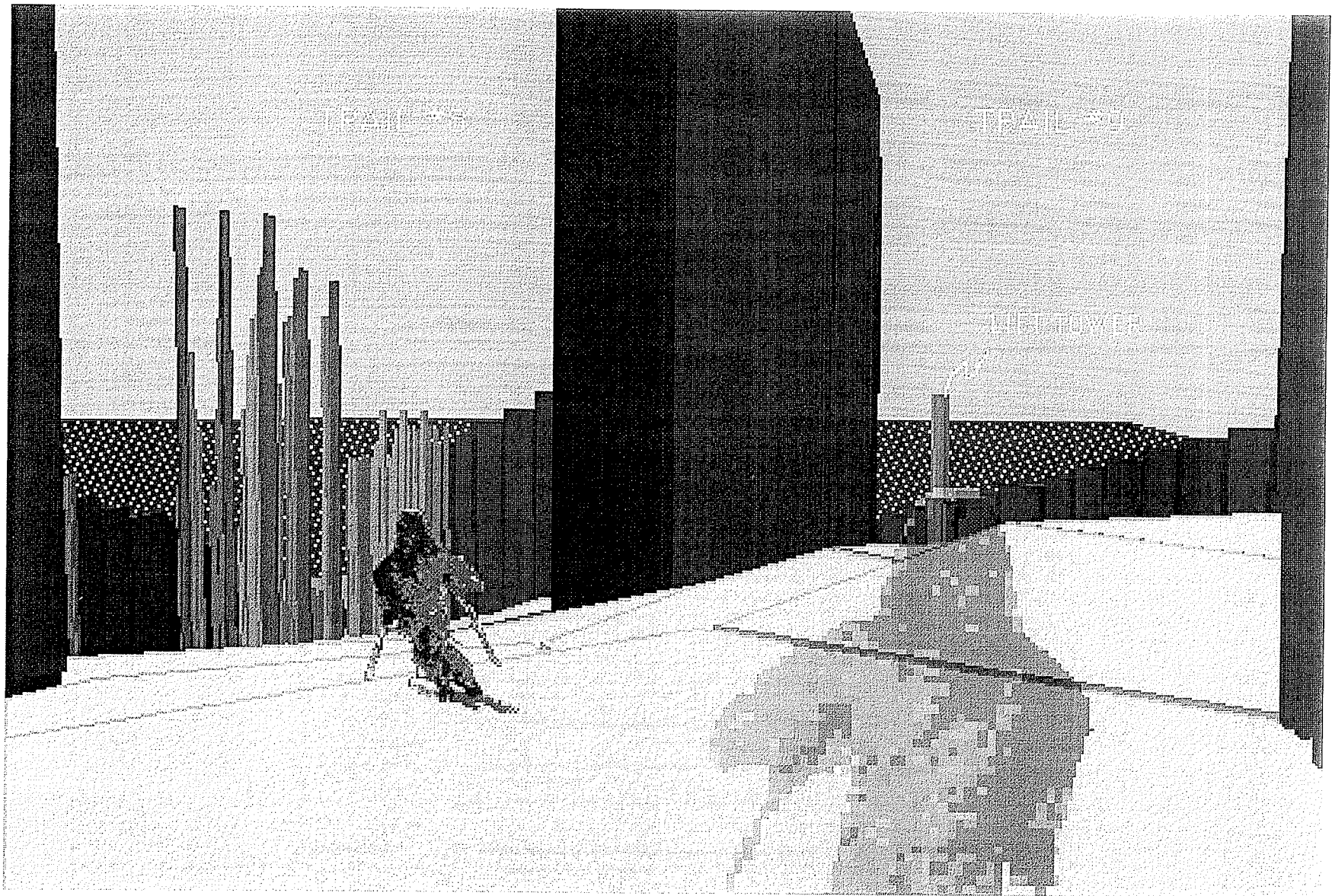


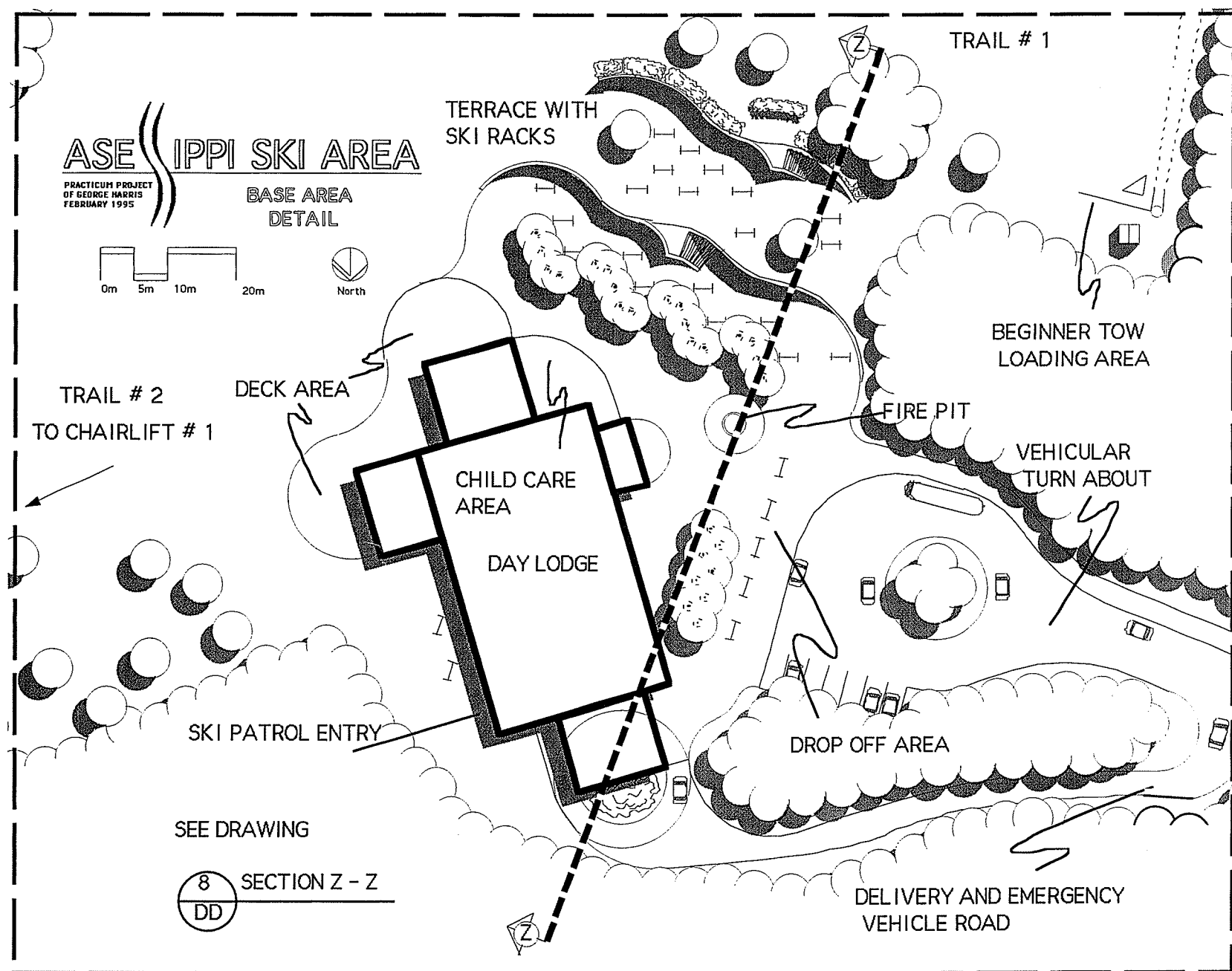








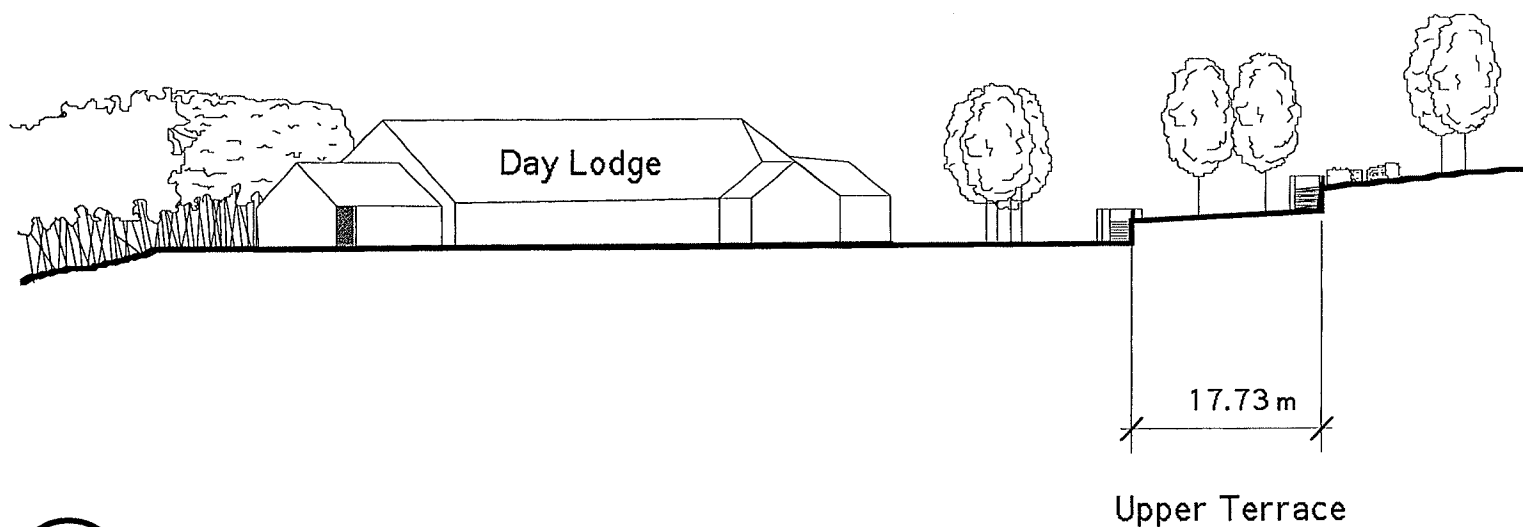
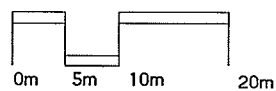




ASE IPPI SKI AREA

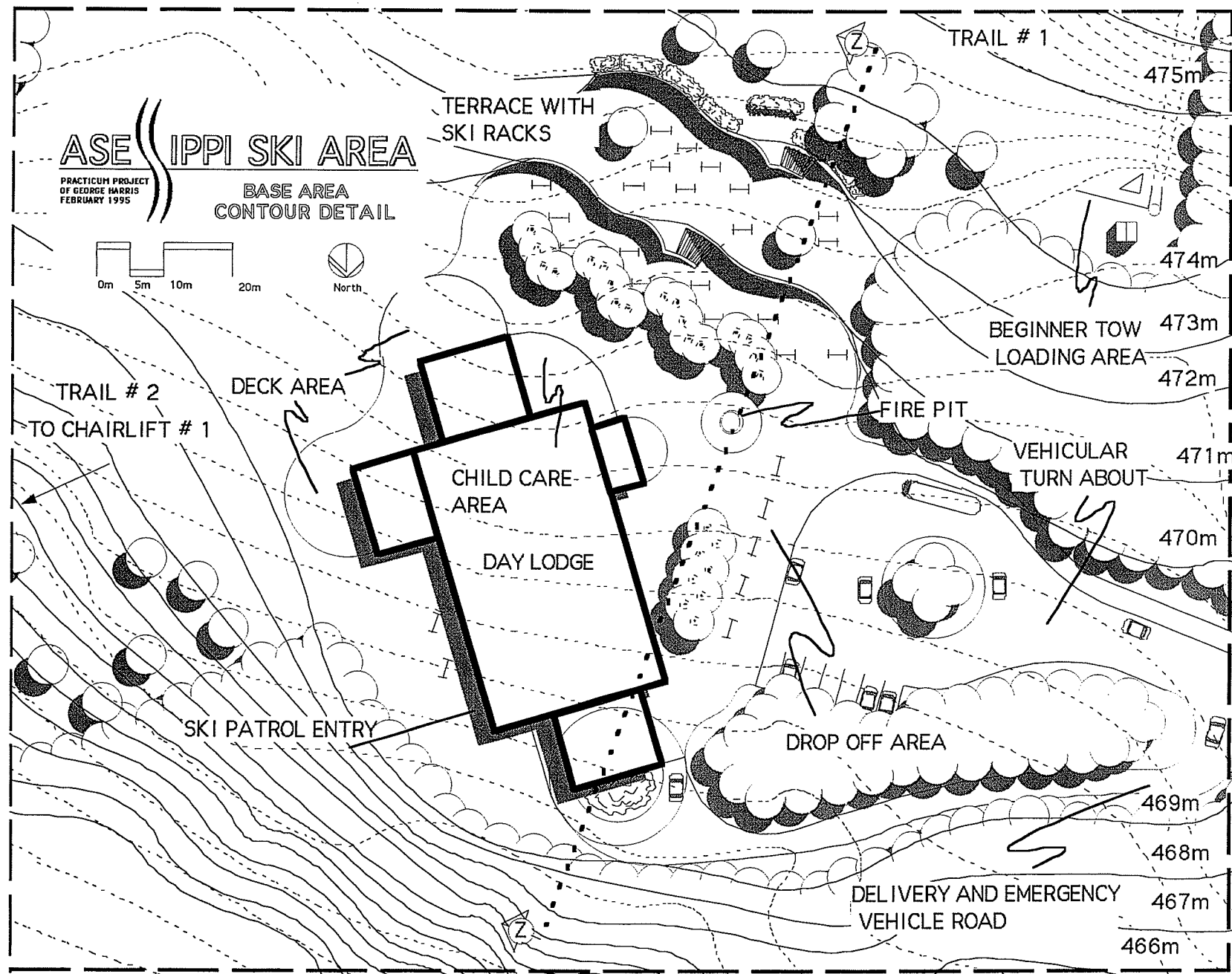
PRACTICUM PROJECT
OF GEORGE HARRIS
FEBRUARY 1995

BASE AREA SECTION Z - Z



8 SECTION Z - Z
DD

Fig. 77 Base area detail with contours.





6.1 CONCLUSION

Skiing is an interaction between the skier and the environment. This experience is primarily a spatial one, a perception of the space that surrounds the skier while in motion. This practicum project demonstrates that the spaces along a ski trail can be designed to enhance the skiing experience.

As the ski trail is made up of many spaces and is experienced by a skier in motion, each space is part of the cumulative effect of a sequence of spaces. This sequential effect is central to the ski experience and determines the character of a ski trail. The quality of a sequence of spaces is determined by orientation, the form of motion, the placement of objects, the skiers speed and the spatial form. In this project the spatial qualities including how the space is defined, the proportion and scale, the light, the texture and materials, the topography, and the activities that take place within the space have been manipulated to create a better skiing experience.

This project has been carried out using computer technology. The purpose was to determine whether computer technology could aid in the design process. In particular the practicum explored whether 3D computer modelling could be used to accurately portray the skiing environment and therefore be used to evaluate design interventions. The project was successful in utilizing 3D computer modelling which contributed significantly to design decisions. The project has also shown that with greater resources there is the potential for using more realistic computer simulation in the design of ski trails.

Many computer programs were used throughout the project. The geographic information system (GIS) mapping program is noteworthy as it was most beneficial in identifying, at an early stage, land suitable for skiing. GIS mapping allows the designer and developer to identify potential problem areas, positive attributes, and alternatives and provides a base of information for design.

In the detailed design of two trails the project demonstrates that vegetation can be used to define spaces. The edge condition created by planting trees at regular intervals along a trail, for example, has been used to effect the skier's perception of motion. This perception is enhanced through the light and shadow condition that this planting would create.

Vegetation was used to alter the proportion and scale of the spaces. Narrow corridors to large open rooms were carved from the existing forest to create a sequence of different spaces. The cumulative effect is rythmical whereby the skier experiences the alternating effect of enclosure and exposure.

Apart from vegetation, slope condition, as demonstrated, is another central component of trail design. The topography was altered to suit the designers intention for the trails, in some cases to make a trail appear longer and in others to conceal terrain from skiers views. Grading was also used to alleviate problem areas identified through the GIS mapping. The effect

of snow and surface condition on the skier's speed has also been taken into consideration in the design.

These principles were applied to the layout and design of the trails according to the metaphor of "discovery". The concept ties individual trails together into a combined skiing experience giving the ski area an added layer of meaning. From beginners discovering with the guidance of intention to experts discovering by chance, the metaphor of "discovery" has provided the framework for the layout and detailed design of the ski area.

It is clear from this project the importance of incorporating design principles with sound ecological practices. A landscape architecture approach to ski area development involves a sensitivity to the environment and a methodology, as described in this project, that takes ecological factors very seriously. Through proper mitigating factors many of the concerns over ski area development can be addressed.

Through the successful application of these design principles to the ski trails of this project, it is clear that an opportunity exists to introduce the practice of landscape architecture to ski area design. This practicum has relied heavily on research related, but not specific to, the activity of skiing such as time, space and motion studies of automobile drivers. If design is to be implemented effectively in ski areas further research will be needed including an examination of skier preference related to trail qualities and skiers perceptions of these qualities.



RESOURCES

- Brent D. Harley B.E.S., B.L.A., M.B.A. President of
S.E. Canada resort planners of Whistler,
B.C.
- Dan McNaughton M.L.A. Department of the Environment,
Government of Manitoba.
- Jim Buckingham M.Sc., B.Sc.(Hons.), Geology, Univer
sity of Manitoba. Design consultant
Asessippi Ski Association.
- Terry Jackson Director of Asessippi Ski Association.

REFERENCES**DEVELOPER'S RESEARCH**

- Buckingham, Jim, Plan for the Layout of Lifts, Trails and
Facilities for a Ski Area at Asessippi Provincial Park,
Manitoba (unpublished report, courtesy of author,
January 1991).
- Deversa Group Inc., Asessippi Market Study (unpublished
report, courtesy of the developer, February 1993).
- International Ski Federation, "Technical Specifications of
Freestyle Courses" and "Freestyle Course Standards
1993/1994" (information courtesy of Manitoba Ski
Federation, February 1993).
- MacPlan Environmental Services Ltd., Breeding Bird Survey
of the Proposed Asessippi Ski Hill Study Area (Unpub
lished report courtesy of the developer, August 1992).

- Manitoba, Department of Mines and Natural Resources,
Canada Land Inventory Project, Shellmouth Designated
Reservoir Area: Proposed Land-use Plan, by M. C.
McKay, et al (Winnipeg: Manitoba Department of
Mines and Natural Resources, 1969): 13-21.
- Manitoba, Department of Tourism, Recreation and Cultural
Affairs Parks Branch, Outdoor Recreation Master Plan
(Provisional) Asessippi Provincial Park (Winnipeg:
Manitoba Department of Tourism, Recreation and
Cultural Affairs, 1973).
- Matthews, D. R., Asessippi Market and Financial Assessment
(unpublished report, courtesy of the developer, Febru
ary 1992).
- , Asessippi Site Selection Factors (unpublished
report, courtesy of the developer, October 1993).
- North/South Consultants Inc. Asessippi Ski Area Environmen
tal Impact Assessment (Unpublished report, courtesy
of developer, November 1994).
- Ramsey, Charles George, Architectural Graphic Standards
American Institute of Architects and John Wiley and
Sons Inc., Somerset NJ, 1994.
- Skinner, Hugh of Skinner's Nursery Limited, Roblin,
Manitoba, "Botanical Survey of Area Proposed for Ski
Area in Asessippi Provincial Park" (Unpublished
report courtesy of developer, January 1992).
- Wickware, G.M., C.A. Zoladeski, R.A. Sims and I.A.G.Corns,
for Canada and Manitoba Departments of Natural
Resources, "Forest Ecosystem Classification for
Manitoba", Unpublished Field Guide, 1994.

SKIING REFERENCES:

- Banff Lifts Ltd. Mount Norquay Expansion Plan. Ottawa, Ont.: Government of Canada, 1988.
- Banff Lifts Ltd. Mount Norquay Long Range Plan. Ottawa, Ont. : Government of Canada, 1986.
- Barnhart, Terry R and David D. Leahy. "Thinking About Bases", Ski Area Management. (September 1985) : 81.
- Breuer, M and R.F. Gatje, "Flaine a Ski Resort Near Chamonix, France". Architectural Record. 146 (August 1967): 102-7.
- Buckingham, Jim. "A Primer on Trail Design for Smaller Ski Areas". (unpublished article, courtesy of author, March 1993).
- Christensen, Larry. "Computer Design Graphics" Ski Area Management. (November 1990) : 79-80.
- Dorward, Sherry. "Mountains As Integrated Systems" Ski Area Management. (January 1991) : 70-77.
- Erickson, Nils . "Computer Lift Analysis." Ski Area Management. (March 1979) : 80-81.
- Farwell, Ted. "Criteria for Ski Area Expansion". Seminar presentation to Canada West Ski Areas Association Annual Meeting, Fairmont Hot Springs, British Columbia. May 11, 1981.
- Farwell, Ted. "The Concept of Balance. Ski Area Design Analysis and The Mountain Design Process". (Unpublished. article, January 1988).

Grody, N.C. "Land Use For Skiing" Land Use Policy.
(February 1988) : 232-44.

Harris, George. "Beyond function: The design of Holiday
Mountain". Unpublished paper.

Johnson, Rosalyn and Jon Bryan Burley ."Snowy Range Ski
Resort" Landscape Architectural Review. (March,
1990.): 15-18.

Juul, Tore. The Architecture and Planning Of Ski Resorts In
France. England: Page Bros.Ltd, 1979.

Mathews, Paul . "Planned By Computers" Ski Area
Management . (September 1984) : 61-65.

National Forest Landscape Management Vol. 2, Chapter 7, Ski
Areas US Dept. of Agriculture Handbook #617.

Nordstrom, Ted. "Using CAD To Locate Lifts" Ski Area
Management . (May 1989) : 96-97.

Ontario Ski Council, Cross Country Ski Trail and Facility
Design Manual . Toronto : Government of Ontario
Press, 1982.

Perla, Ronald I . Avalanche Handbook, US Dept. of
Agriculture Handbook #489.

Sunshine Village Corp. Sunshine Village Long Range Plan.
Ottawa, Ont. : Government of Canada, 1989.

-----"Land use planning and design for ski resorts, Northstar
at Tahoe, California; Kirkwood Meadows, California,
Elkhorn, Idaho". Architectural Record. 155 (January,
1974):141-56.

-----"Schuss Architecture". Progressive Architecture. 48
(July, 1967):138-51 .

-----"Ski-Run" Daniel, Mann, Johnson and Mendenhall
architects. Architectural Review. 135(February, 1964):
85-6.

THEORIES OF LANDSCAPE ARCHITECTURE:

Appleyard, Donald, Kevin Lynch and John R. Myer. The
View From the Road. Cambridge, Massachusetts: MIT
Press, 1964

Benson, Robert E. Attaining Visual Quality Objectives in
Timber Harvest Areas - Landscape Architects
Evaluation. United States Dept. of Agriculture, Forest
Service. Research Paper INT - 348, Aug. 1985.

Blum, Randolph F. Junkyards, The Highway and Visual
Quality. Washington, D. C. :U.S. Department of
Transportation, 1979.

Federal Highway Administration. Visual Impact Assessment
for Highway Projects. American Society of Landscape
Architects, 1979.

Gombrich, E.H. Art and Illusion. Princeton University
Press, 1969.

Halprin, Lawrence. Freeways. New York: Reinhold
Publishing Corp., 1966.

Harvard University, Landscape Architecture Research Office,
Highway Esthetics. Cambridge, Massachusetts:
Harvard University Press, 1968.

- Hawtree, F.W. The Golf Course: Planning, Design, Construction and Maintenance. New York: E.&F.N. Spon Ltd., 1983.
- Hornbeck, Peter L. and Garland A. Okerlund Jr., Visual Values for the Highway User. Washington, D. C.: U. S. Department of Transportation, 1976.
- Landscape Architecture Research Office. Visual Values For Highways vol.1. Cambridge, Massachusetts: Harvard University Press, 1970.
- Landscape Architecture Research Office. Visual Values For Highways vol.2. Cambridge, Massachusetts: Harvard University Press, 1970.
- Lof, R.J. and R.W. Alperi, and C.K. Taft. "Wind Effects On Ski Trails." Proceedings of the 29th Annual Eastern Snow Conference. Oswego, N.Y.: publ. unknown, 1972: 83-97.
- Lynch, Kevin. Managing the Sense of a Region. Cambridge, Massachusetts: Massachusetts Institute of Technology, 1976.
- Magill, Arthur W. Managed and Natural Landscapes: What do people like. United States Dept. of Agriculture. Research Paper PSW - 213, 1992.
- National Forest Landscape Management Vol. 1, US Dept. of Agriculture Handbook #434.
- Simonds, John Ormsbee. Landscape Architecture. New York, NY: McGraw-Hill Book Company, Inc., 1961.
- Thomsen, C.H. and A. Borowiecka. Winter and Play: Design Guidelines for Winter Play Environments of the Canadian Prairie. Ottawa: Canadian Mortgage and Housing Corporation, 1980.

Ward-Thomas, Pat ed. The New World Atlas of Golf. New York: Mitchell Brazely Publishers, 1976.

Passini, Romedi. Wayfinding In Architecture. N.Y: Van Nostrand, Reinhold Company Inc., 1984.

PSYCHOLOGY REFERENCES:

Bell, Paul A. and Jeffery D. Fisher and Ross J. Loomis. Environmental Psychology. Philadelphia, PA : W.B. Saunders Company, 1978.

Canter, David and Terrence Lee. ed. Psychology and the Built Environment. N.Y.: Halsted Press, 1974.

Hall, Edward T. The Hidden Dimention. New York: Anchor Books Doubleday and Company, Inc., 1982.

Higuchi, Tadahiko. The Visual and Spatial Structure of Land scapes. Cambridge: MIT Press, 1989.

Ittelson, William H. ed. An Introduction To Environmental Psychology. New York: Holt, Rinehart and Winston, 1974.

Proshansky, Harold M. and William T. Ittelson and Leanne T. Rivlin. ed Environmental Psychology. New York: Holt, Rinehart and Winston, 1976.

Zube, Ervin H. and Gary T. Moore. ed. Advances in Environment Behavior and Design. vol.3 Plenum Press, N.Y. 1991.

SNOW REFERENCES:

Buser, O. "Avalanche Predictions" Analns of Glaciology 13(May 1989): 31-34.

Ferrick, M. ed. "Modelling the Redistribution of Snow ..." Proceedings 49th Eastern Snow Conference (1992): 13-24.

Verge, R.W. and G.P. Williams. "Drift Control" In Handbook of Snow: Principles, Processes, Managements, and Use. D.M. Gray and D.H. Male (eds.). Toronto: Pergamon Press, 1981: 630-647.

Kurelek, William. A Prairie Boy's Winter. Montreal: Tundra Books, 1973.

COMPUTER USE REFERENCES:

Beilfuss, Charles W, and Roy R Guess. Development Of A Roadway Design/Graphics Interface System. Washington: National Research Council, 1990.

Muehrcke, Phillip C, and Juiliana O. Muehrcke. Map Use. 2nd ed. Madison, WI.: JP Publications, 1986.

Raper, Jonathon, ed. Three Dimensional Applications In Geographic Information Systems. London: Taylor and Francis, 1989.

INTERVIEWS:

Buckingham, Jim, Consultant (Ski Area Designer), March, 1993.

Later, Noel, Owner Operator of Holiday Mountain Ski Area, March, 1993.

Murray, Derek, Landscape Architect (Golf Course Designer) David Wagner and Associates, February, 1993.