SKAGIT REGIONAL PLANNING COUNCIL
MOUNT VERNON, WASHINGTON
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DIRECTOR

COMPREHENSIVE LAND USE PLANNING ALTERNATIVES FOR THE SKAGIT RIVER FLOODPLAIN AND RELATED UPLANDS

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PREFACE

This planning study represents a unique approach to flood disaster planning in that it examines the consequences of containing development in lieu of the time honored approach of containing the flood.

The results have proved to be equally unique in that some of the alternatives offer approaches that not only appear to be practical solutions to the flood problem but offer improvements which preserve the agricultural economic base of the area, maintain the lifestyle of the residents, and enhance the general attractiveness and overall quality of the area for business and commerce.

Tnis planning study also approaches the final output in a unique manner. All to often, Comprehensive Planning Studies prepare and document one plan representing one solution which may be the superior technical solution but which does not reflect the most acceptable compromises. The pressure of time and contract schedule may also force adoption of the one plan without due consideration. The result of this approach is often that the plan is recognized as being ill-conceived, is not implemented, and planning in general is branded as being a waste of time and money.

To prevent these possibilities from occurring in the Skagit Region, the output of this planning study is four potential plans -- giving a wide range of possibilities for discussion, comparison, and compromise. Furthermore, it is the recommendation of the staff that these alternatives be considered for a period of at least one year before one of the alternatives, or a derivation, or a completely new plan is proposed for adoption.

FOREWORD

The Skagit River Floodplain forms one of the most perplexing barriers to development in the Skagit Region. It is not wise to plan for new development in non-flood protected areas. This means new development should locate in the upland and floodsafe areas of the region.

The primary task of this report was to determine what areas were suitable for development and how much development should be anticipated. This report answers those questions and refines the planning alternatives available for the Skagit River Floodplain and Related Uplands.

The review of this project with legislative bodies has been a continuous and ongoing procedure since the development of the first tentative proposal to initiate this project. The Skagit Regional Planning Council, which is composed of nine member agencies, has been the primary review body of this project. The members of the Planning Council are: Port of Skagit County, Port of Anacortes, Public Utility District #1, City of Mount Vernon, City of Sedro Woolley, City of Burlington, City of LaConner, City of Anacortes, and Skagit County.

The status of this project was reviewed at each regular meeting with the representatives of the member agencies of the Regional Planning Council. This monthly review was the major source of contact with the various legislative bodies throughout the regional planning area.

Additionally, the various agencies and legislative bodies were represented on the Technical Advisory Committees which reviewed the alternative land-use models and the goals and objectives as they were developed.

The elements of the planning alternatives were discussed and reviewed with the various City Planning Commissions, City Councils, and the County Board of Commissioners.

The result of this planning process has been to continue the ongoing process of developing regional solutions to regional problems. The spirit of cooperation among agencies will facilitate the implementation of the various and diverse elements of this report.

This spirit of cooperation will expedite the implementation of the numerous and valuable reports and studies completed by the various agencies within the Skagit Regional Planning area.

To receive the greatest benefit in reading this report, it is recommended that the reader make frequent and regular use of the map book that accompanies this report. The maps, combined with the data in this text, have their greatest value when used together.

SUMMARY

The planning alternatives described and evaluated, as well as the data presented in this report, is a valuable planning tool for Skagit Regional decision makers. Like any tool, it should be used frequently and carefully so that it will remain in good working condition.

The five primary conclusions reached in this report are as follows:

1) Existing urban areas should be protected from 50 year frequency floods.
2) Development of the unprotected floodplain area should be curtailed.
3) The existing and future agricultural use of the floodplain should be provided with at least 20 year flood frequency protection.
4) New development should be directed to the floodsafe and upland areas of the Skagit Region.
5) The rural lifestyle available in this area and its attendent recreational opportunities should be preserved.

The results of earlier Comprehensive Planning efforts, and the development of the planning alternatives outlined and recommended in this report have contributed to the necessary groundwork for a meaningful comprehensive plan.

The next step and the most critical step in the continuing development of a Comprehensive Plan for the Skagit Region is <u>time</u>. The various legislative bodies, planning commissions, and interested citizens groups must have and take advantage of time to reach a successful conclusion as to which pattern of development best serves this area.

It is suggested that a one year period be used to digest and evaluate the planning alternatives outlined in this report, and the alternatives proposed for the cities. The alternative land-use plans in this report can be critically analyzed, thoroughly reviewed, and hopefully a consensus can be reached as to which alternative is best suited to the Skagit Region.

During the next year, by means of numerous meetings and the thorough distribution of information about these alternative plans, the decision makers will reach a conclusion as to which of the alternatives presented in this report most nearly meet the existing and anticipated developmental needs of the Skagit Regional Planning area.

The recommendations and conclusions outlined elsewhere in this report and in numerous other documents mentioned within this report should be used as the basis upon which this region can pursue a meaningful and publicly satisfactory plan of development that will maintain the livability of the Skagit Region for current and future residents.

PHYSICAL CHARACTERISTICS

An inventory of the physical characteristics of an area is the starting point of a planning study. Just as a mountain climber would not attempt a serious climb without first examining the terrain over which he must climb, the planner must examine the physical environment before he can actually begin to develop planning alternatives.

The physical environment is a complex of many interrelated elements. Often times action upon one seemingly isolated element has subsequent impacts upon other elements. Thus, it is important to know these elements and their relationships with other elements, including man.

The Physical Characteristics portion is composed of the following chapters:

1) Geology
2) Soils
3) Septic Suitability
4) Slope

GEOLOGY

1. INTRODUCTION

The study area consists of two general geologic regions. The western part is in the Puget Sound trough of the Pacific Border Province, which consists mainly of the extensive delta and floodplain of the Skagit River, alluvial flats, glacial outwash plain, and a few lateral or frontal moraines. The elevation of these lowlands ranges from sea level to approximately 400 feet, with the exception of a few monadnocks rising higher. Most of Skagit County lies in the Northern Cascades region of the Sierra-Cascade Province. The Cascade Mountains consist of ancient sediments, strongly folded, generally metamorphosed, and intruded by granite batholiths. The summit elevation of this mountainous region ranges from 6,000 to 8,000 feet, with some peaks rising even higher. Glaciation has left its mark, characterized by the extreme ruggedness of much of this area. The forces of glaciation and heavy annual snowfall still have a great influence, especially in the higher elevations above 5,000 feet.

The Skagit River, which is the second largest river in the state, (the Columbia River being the only one larger) is the backbone of much of the study area. Its system drains much of the county, with the main tributaries being the Sauk, Cascade, Suiattle, and Baker Rivers.

The Samish River drains the northwestern corner of the county. The Nooksack River drains a mountainous section in the north-central part. The southern edge is drained by Pilchuck Creek and Deer Creek and the North Fork of the Stillaguamish River.

2. CLIMATE AND PRECIPITATION

The climate of the study area is typical of the marine west coast type. This is due both to its latitude and its location with respect to Puget Sound. Large bodies of water, such as Puget Sound, tend to influence temperature conditions on adjacent lands. This influence, caused by the water's ability

TABLE 1
CLIMATOLOGICAL DATA

PART A PRECIPITATION

AVERAGE MONTHLY PRECIPITATION IN INCHES

STATION	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Total
Anacortes	3.40	2.53	2.39	1.52	1.27	1.51	.78	.87	1.45	2.68	3.48	3.82	25.70
Burlington	4.30	3.63	3.18	2.27	2.06	2.07	.86	1.34	2.16	4.29	4.32	4.80	35.78
Concrete	8.80	7.03	6.76	4.12	2.87	2.75	1.30	1.50	3.57	7.03	9.10	10.33	55.21
Marblemount Ranger Station	11.05	9.19	7.06	5.11	3.26	3.05	1.57	2.23	4.10	8.52	10.38	11.08	77.05
Mount Vernon 3WNW	3.78	3.07	2.72	2.45	1.78	1.63	.81	1.62	2.09	3.67	4.12	4.27	32.01
Sedro Woolley IE	5.57	4.33	4.05	3.30	2.56	2.78	1.33	1.38	3.01	4.91	5.87	6.38	46.07

Period of Record – 1931 - 1965

PART B TEMPERATURE

MEAN DAILY MAXIMUM & MINIMUM IN DEGREES FAHRENHEIT

STATION	Jan.				Feb.				March				April				May				June			
	Ave. Max.	Ave. Min.	Highest	Lowest	Ave. Max.	Ave. Min.	Highest	Lowest	Ave. Max.	Ave. Min.	Highest	Lowest	Ave. Max.	Ave. Min.	Highest	Lowest	Ave. Max.	Ave. Min.	Highest	Lowest	Ave. Max.	Ave. Min.	Highest	Lowest
Anacortes	44.5	34.8	65	6	47.9	36.3	69	9	52.0	39.5	73	19	58.7	42.5	78	29	64.6	46.2	81	36	68.7	50.0	91	38
Concrete	42.4	30.9	65	0	47.6	32.6	74	1	53.7	35.4	30	11	62.7	39.8	91	25	69.2	45.5	96	32	72.6	59.7	101	35
Mt. Vernon 3WNW	45.4	32.4	65	-4	49.1	35.0	70	8	51.9	36.1	67	23	58.3	39.4	76	28	65.4	43.6	89	32	69.6	48.5	90	39
Sedro Woolley I.E.	44.3	31.7	67	-2	48.6	33.4	69	-1	53.4	35.9	75	8	60.5	39.7	82	25	66.7	44.1	90	29	69.9	48.9	96	34

STATION	July				Aug.				Sept.				Oct.				Nov.				Dec.			
Anacortes	72.4	52.4	92	44	71.7	52.4	95	45	67.4	50.0	88	38	59.2	46.1	77	26	50.8	40.2	67	13	47.0	37.9	62	18
Concrete	78.1	52.7	102	38	77.9	52.6	102	41	72.8	49.5	102	34	72.6	44.3	86	21	49.9	37.4	77	7	44.2	34.1	63	10
Mt. Vernon 3WNW	75.1	49.3	93	38	74.1	49.3	98	37	69.0	45.8	85	30	60.0	42.2	76	28	50.1	36.0	62	20	47.0	34.9	65	3
Sedro Woolley	74.9	50.1	94	37	74.7	49.9	90	36	69.4	47.4	91	31	61.0	42.6	83	20	51.2	36.8	71	3	46.4	34.4	74	4

to gain and lose heat more slowly than land, has the effect of moderating the climatic situation. This is characterized by warm winters with great amounts of cloud cover, and cool summers.

This phenomenon is altered by the "rainshadow" of the Olympic Mountains. The western part of the study area is typified by this belt of dry climate due to its location to the lee side of the Olympic Range.

Climate and precipitation are also affected by the orographic mechanism of the Cascade Mountains. The closer one travels to the mountains, the more effect this phenomenon has on increasing the amount of precipitation and cooling the air. The prevailing westerly winds of the region flow over the Cascades. As the air rises on the windward side of the range, the clouds tend to stack up, and are cooled by the decrease in pressure of the atmosphere. If cooling is sufficient, precipitation will result.

3. THE FLORA AND FAUNA

The study area has an abundance of fish, wildlife, and natural vegetation, which are common throughout the Puget Sound Lowlands and Cascade Mountains. For more specific information on species, habitat, distribution, propagation, harvest, et. al., see Appendix XI of the Puget Sound and Adjacent Waters Study, completed by the Pacific Northwest River Basins Commission in 1970.

Conifers commonly occurring in the area include Douglas Fir, Red Cedar, Western Hemlock, Sitka Spruce, and Western Yew.

3A. Deciduous Trees

The most dominant deciduous trees include Big Leaf Maple, Vine Maple, Red Alder, and several species of Willow. Other less common trees include Western Paper Birch, Black Cottonwood, Pacific Dogwood, Hazelnut, Elderberry and Oceanspray.

3B. The Understory

The understory of the great forests of the area are usually densely covered by a variety of shrubs and plants, the most common of which are Salal, Oregon Grape, Wild Blackberry, Wild Rose, Western Thimbleberry, Snowberry, Salmonberry, Red Huckleberry, and Blackcap Raspberry.

Ferns and mosses are found in abundance. The most common ferns are the Sword Fern and the Bracken Fern. Less common is the Maiden Hair Fern.

3C. Water Tolerant Plants and Grasses

Water tolerant plants and grasses include Douglas Spirea or Hardhack, Tules, Sedges, Skunk-cabbage and Cattails.

3D. Acid Tolerant Plants

Acid Tolerant plants include Sphagnum Mosses, Labrador-Tea and Cranberry.

3E. Larger Fauna

Some of the larger fauna include the Black Bear, Raccoon, Mink, River Otter, Civit Cat or Spotted Skunk, Coyote, Red Fox, Dog, Bobcat, Cougar or Mountain Lion, Muskrat, Beaver, Mountain Beaver, Porcupine, Snowshoe Hare, Elk, Black-tailed Deer, Mountain Sheep and Mountain Goat.

3F. Sea Mammals

Whales and porpoises of the area include the Striped Porpoise, Killer Whale, Blackfish, Harbor Porpoise, and Humpback Whale. Other sea mammals include the Sea Otter and the Harbor Seal.

3G. Edible Birds

Edible birds noted in the area include the common Mallard, Widgeon or Bald Pate, Green Winged Teal, Pintail, Shoveller, Canvasback, Redhead, Scaup or Bluebill, Goldeneye, Bufflehead or Butterball, Scoters, Mergansers or Sawbills, Canadian Goose, Lesser Snow Goose, White-fronted Goose, California Quail, Oregon Ruffed Grouse and Snipe.

3H. Fishes

Fishes include the five species of salmon: the Spring, King, Chinook or Quinault, the Sockeye, Red or Blueback, the Humpback or Pin, the Silver or Coho, and the Dog or Chum Salmon. The Steelhead is also important. Other important fishes are the various types of Trout, Sole, Rockfish, Herring and Smelt.

3I. Shellfish

Shellfish of the area include Sea Urchins, Small Chiton, the Giant Chiton, Native Oyster, Purple Snail, Edible Mussel, Cockle, Butter Clam, Rock Clam, Horse Clam, Geoduck, Bent Nose Clam, Barnicles, Dungeness Crabs, Red Crabs and Ghost Shrimp.

4. GEOLOGIC FACTORS AFFECTING LANDFORMS

The various kinds of landforms of an area, the shapes of the mountains and valleys for example, are determined by a combination of geologic factors acting in concert, including: 1) climate; 2) the composition, structure, and attitude of the rocks, and 3) elevation above the base level of erosion. The active working forces are water, ice, wind, and gravity. The landscape is dynamic and changing, with material being removed from one place and deposited in another. The rates of denundation and deposition change in short cycles from season to season, and in long cycles from one geologic epoch to another.

5. MOUNTAIN FORMING

The mountainous sections of the planning area were probably once an ocean bottom, as was much of our present land area throughout the earth. The sea remained long enough to deposit great depths of mud and silt, which in turn captured the remains of the ocean's animals. Their fossils are frequently found in shale and limestone.

Next came tremendous but incredibly slow upheavals. Materials of the ocean bottom arched and cracked. It was at this time that the Cascades made their ascent as great masses of tilted and twisted rock. The northern Cascades, of which part of the planning area is a portion, is a rough, complex uplift of igneous rock, intermingled with the sedimentary deposits. A gigantic mass of once-fluid granitic rock formed massive batholiths. When it solidified and pushed upward the sediments under which it rose were mildly distorted, much rock was metamorphosed and then torn asunder by faulting and erosion. Later in the uplift period were formed the volcanoes which now appear on the crest of the range.

These phenomena all occurred during what is known as the Cascade Revolution. The range itself was only a minor part of a large uplift area. This Revolution lasted a long time, beginning in the Miocene Age and ending in the Pleistocene.

These mountains owe most of their characteristic ruggedness to the actions of the Pleistocene Glaciation stages, and the erosive forces of the rivers and streams which followed. The varying degrees of suseptibility to these erosive forces by the different types of rocks have caused the variety and the rugged beauty of these landforms.

6. GLACIATION

During the Pleistocene Ice Age, the climate experienced a severe cooling trend. This was accompanied by an increase in snowfall in high latitudes and high altitudes, which resulted in the formation of large continental glaciers in Canada which spread southward across the U.S. - Canadian border. The immense size of these ice sheets is almost unfathomable. They literally dwarf the small alpine glaciers which can be seen in the Cascades today. The ice which filled the western section of the study area was only a part of a lobe of a still larger glacier complex in British Columbia. This mass of ice, at one time, was over a mile thick above Bellingham. The deposits of rock fragments also show that such immense glaciers occupied the lowland not only once, but at least four times and perhaps more. The periods were separated by warmer intervals, climatically similar to the present.

It is the result of the scouring force of these glaciers, especially the last or Fraser Glaciation, with a combination of other forces including the uplifting of the Cascades and the effects of the Skagit River System, that produced the lowlands and influenced much of the landforms of the entire study area.

7. GEOLOGY OF SPECIFIC AREAS (See Map A in the Map Section of this report)

7A. South Skagit Floodplain

As can be seen in the accompanying map, this section of the floodplain is influenced greatly by the Skagit River and the previous scouring effects of the Pleistocene Glaciation. It consists mainly of Alluvium (Qa). This material is mostly unconsolidated silt and gravel valley fill with some clay. It also includes low-level terrace, marsh, peat, artificial fill, and glacial deposits.

This alluvium is a product of post-glacial stream erosion and deposition. The Skagit River, starting in the Cascades, emerges onto the lowlands where it discharges its load of silt and sand. As the river drops its sediment, deltas are built seaward, gradually extending the land westward as portions of the troughs are filled with silt and sand. The Skagit River has been building its large delta and floodplain westward for the past 10,000 years.

There is an exception to this generally flat alluvium floodplain in the Pleasant Ridge/LaConner/Fish Town Area. Where the advancing front of the Skagit Delta encountered islands such as this, they were surrounded by sediments and are now seen as hills rising above the flat floodplain.

The Pleasant Ridge area is composed of younger glacial drift (Qgit). This consists of till, a hard blue-gray to gray concrete-like mixture of clay, silt, sand, and gravel which was deposited as an end of recessional moraine. It is principally Wisconsin in age.

The LaConner area, although very close to Pleasant Ridge, is somewhat different in its geologic composition. The area consists of upper jurassic-lower cretaceous sedimentary and volcanic rocks (JK). More specifically, these are sedimentary and volcanic rocks that are undivided. Some of these include graywacke, argillite, siltstone, slate, volcanic rocks, phyllite, greenschist, and greenstone. It is reasonable to believe that this area underwent some uplifting before the Pleistocene Glaciation, between the Jurassic and Cretaceous periods.

The Fish Town area is composed of Oligocene non-marine rocks (ØC). These consist of andesite conglomerate, tuff beds, and mud-flow material.

7B. Burlington/Bayview Proper

The Burlington area also is in the Skagit Floodplain, and is typified by an abundance of alluvium and flat topography. An exception to this, however, is the Bayview area. It is composed of the same younger glacial drift (Qgit) that is found in the Pleasant Ridge area. This hill is the product of glacial depositional action in the Pleistocene epoch.

The only other exceptions to the flat floodplain are the hills in and near the city of Burlington. These are composed of pre-tertiary sedimentary and metasedimentary rocks that are undivided. This includes graywacke, argillite, phyllite, chert, talc, graphic schist, and some faulted in blocks of serpentinite and greenstone.

7C. Bow/Alger/Samish Proper

The southern portion of this area including Bow, Edison, Blanchard, and Allen is part of the Samish River Floodplain and Delta. It is a northern extension of the Skagit Floodplain, and is characterized by the alluvium (Qa) mentioned earlier. Bayview, with its glacial drift, extends into this portion of the area. Samish Island, connected now to the mainland, is composed mainly of this glacial drift also. This portion of the island probably was uplifted and the later depositional action of the glaciers left glacial drift around it.

The Bow Hill area consists mainly of younger glacial drift (Qg), that is undivided. This would include till, outwash and associated deposits, and sorted and unsorted sand, gravel, silt, and clay. It also includes some alluvium (Qa). Thus, Bow Hill might be considered the product of glacial and related actions. The Samish River, running through parts of this area, has been able to cut into the sides of this hill, due to its vulnerable under-structure. This has formed a rather narrow flat valley with some strong meander scarps in some places.

The Chuckanut Hill area, near Alger, is an arm of the Cascades that extends westward into the lowlands. It consists of pre-tertiary sedimentary and metasedimentary rocks (PT), paleocene-cretaceous non-marine rocks (TKC), and upper jurassic-lower cretaceous sedimentary and volcanic rocks (JK). These include resistant ridge-forming sandstone, interbedded with erodible siltstones and shales.

7D. Sedro Woolley Proper

The hills east of Alger are also a part of the Chuckanut extension, being composed of the same pre-tertiary sedimentary and metasedimentary rocks (PT). The hills through which the Samish River meanders consist of younger glacial drift (Qgl). The valley itself is an example of an abandoned outwash channel. It was made by a large melt-water stream in late Pleistocene time, probably during the Sumas Stade.

The portion of this area near the city of Sedro Woolley is mostly under the influence of the Skagit River. It has the characteristic flatness and alluvium understructure or substratum.

South of Sedro Woolley is Clear Lake. The hills around it show the signs of upheaval and glaciation, being of both pre-tertiary sedimentary and metasedimentary rock (PT), and younger glacial drift (Qgl).

7E. Mount Vernon Proper

The western part of this area, including the western part of the city of Mount Vernon, is influenced by the Skagit River. West of Mount Vernon the Skagit opens into its wide expansive floodplain. Obviously, alluvium (Qa) is the prominent understructure here.

The hills in the eastern section of the city and around Conway consist of younger glacial drift (Qgl). The understructure and their fairly gentle slopes are products of the glaciation. Between these two areas, however, lies a group of much more resistant hills. This area includes Little Mountain and Devils Mountain which consists of pre-tertiary sedimentary and metasedimentary rocks (PT), and paleocene-cretaceous non marine rocks (TKC). This same formation runs eastward to include the area around Big Lake, Devils Lake, and Lake McMurray. These lakes were probably all glacial in origin.

The Walker Valley is an example of a glaciated valley, the west side of which contains pre-tertiary sedimentary and metasedimentary rocks (PT), while the east side is mostly younger glacial drift (Qgl).

7F. Middle Skagit River Area

The Skagit River meanders through the Middle Skagit Area constantly using it natural forces to change the form of the land. This is done by deposition, erosion, and flooding.

This area of the river has a multitude of bends, some of which are near towns. During enlargement of a bend, the river channel shifts toward the outer part of the bend, leaving a strip of relatively flat land, or floodplain, on the inner side of the bend. The floodplain is built of bars composed largely of sand and gravel brought as bed load scoured from the outsides of bends immediately upriver. Inundation of the floodplain from time to time allows finer silt and clay to settle out over the surface, adding to the floodplain height and covering the coarser alluvium beneath. As lateral cutting by the river continues, the floodplain strips grow wider and presently join to form continuous belts along either side of the river. The cutting and filling proceeds to such an extent that the channel migrates here and there across the entire floodplain.

7G. Upper Skagit River Area

This area is also mainly defined by the course of the Skagit River. The valley floor generally consists of glacial drift that is undivided. This includes glacial and glacialfluvial sand, gravel, and till. It also includes alpine glacier outwash and till, as well as some recent alluvium. This tells the story of the area fairly well, having been the result of much glacial activity at one time.

However, other geologic conditions, such as the mountains bordering the river valley, show the effects of the work of other forces in the past. The area to the north of Van Horn and Rockport is composed largely of carboniferous-permian sedimentary and volcanic rocks (CPM) which can be considered as a clue to its volcanic and mountain building history. The same can be said for the area around Marblemount. Here much of the understrucutre is pre-upper jurassic pre-carboniferous metamorphic rocks of the low grade zone (PJPH), pre-carboniferous intrusive rocks (PCg), tertiary-cretaceous granitic intrusive rocks (TKg), and smaller portions of pre-tertiary ultra-basic intrusive rocks (PTb).

8. PLANNING IMPLICATIONS

The earth is a dynamic, changing mass of mineral matter. This has worked to our advantage in terms of the vast amount of resources made available by the many earth processes. It works to our disadvantage in that a geologic formation will probably not have the same engineering properties everywhere. This limits and varies the development capabilities of an area and it is these limitations and variations which must be explored and tested thoroughly before development proceeds. Therefore, in planning for the maximum beneficial use, or for multiple uses, it is necessary to know what the earth materials are, how they react to loads and other stresses, whether they are permiable or impermiable, whether they contain materials of value such as water or construction materials and whether they can support urban related development, agriculture, animal, or forest industries. There are some questions whose answers should be sought, such as: How stable is the land?;

Are there active faults or slides in the area?; What are the possibilities of slides given a certain development?; What are the rates of erosion and deposition? Information is needed on the regimen of rivers and streams: What are the flood cycles, and where are the areas subject to flooding? It is in attempting to answer questions such as these that savings in life and health, as well as dollars will be realized. People will not be hurt or killed, and their property damaged by floods, slides, earthquakes, and other similar disasters. In the case of floods, for example, the study of the geology of an area will, in part, help determine the floodplain, and as a result, the proper management of that floodplain can be determined.

The configuration or topography of the land on Batholiths varies according to texture and composition of the rock and whether or not the mass has been subjected to faulting. Where the rock is uniform and free of strong faults it is eroded into a maze of canyons and ravines which follow no predominant trend. As a result, the drainage pattern is dendritic (no predominant directional orientation) and is composed of insequent streams (growth controlled by unsystematic properties of slope and rock resistance), just as for horizontal sedimentary strata. Certain areas of metamorphic rocks, such as gneisses and schists, also develop a dendritic drainage pattern of insequent streams because the variations in rock texture and composition seem to have little influence upon valley development.

Where faulting has occurred, making a series of intersecting zones of crushed and weakened rock, the drainage follows the fault line and forms a rectangular pattern. The streams are of subsequent type because they developed in zones of weakness. In regions of this type, topography is a reflection of different rates of denundation of parallel belts of metamorphic rocks, such as schist, slate, quartzite, and marble; marble tends to form distinctive valleys; slate and schist make belts of medium to strong relief; quartzite usually stands out boldly and may produce conspicuous hogback ridges.

These geological considerations have a great effect on not only the density of development, but also the spatial array of that development to the land itself. Ground configuration and substratum determine how both the structures and their services (water, sewer, roads, etc.) are dispersed over the land. Historically, flat areas such as valley and river basins have been very susceptible to a grid pattern or development. This makes it easy to administer the land and to provide the necessary services, but all too often the resulting development has been regarded as monotonous, ugly, and depressing. The existence of a variety of landforms and resources in an area provide a natural base with which to plan a development pattern that enhances these attributes rather than ignoring them. The upland areas of Skagit County are well endowed with these attributes. Such things as a variety of hills and gullies, streams, lakes, trees, and spectacular views should be considered as design resources which are non-renewable if not used in a proper design context.

9. MAN'S RELATIONSHIP TO THE EARTH PROCESSES

Man, a most influential geological agent, works directly and purposefully to alter the earth in ways that are beneficial to his culture. By doing so, however, he triggers secondary and tertiary changes that are not planned, and may or may not be beneficial.

Most of the movements of the surface caused by internal crustal processes are natural, and cannot be affected by man's activities. Man can only be wary of these forces and acknowledge their power over him. Geologists, working closely with soils engineers and civil engineers, should not have to condemn areas but rather make the builder aware of geologic conditions which require special engineering design to make the site safe for construction.

In terms of man's impact on the environment, the most important forces that should be understood are those external crustal processes such as landslides, mudflows, creep, collapse, and subsidence. Although man is not the only triggering agent of natural phenomena, he does have a way of destroying the natural equilibria, often unconsciously. Slides can often occur through excavation of the foot of a slope, as illustrated in the accompanying graphics. This happens not only with regard to buildings, but also when constructing roads, bridges, dams, and other forms of activity involved with altering the equilibria. Excavation should always follow a thorough study of its ramifications. Here it should be noted that slope, type of soil, surface drainage, and ground water as well as the substratum material, are often interrelated with respect to surficial earth movements. For example, a city near Seattle recently bought a stream canyon for a park. Above the park site an area was cleared for a new subdivision. When the heavy rains fell, the increased amount of cleared land caused an overabundance of run-off. Proper dispersion of this surface drainage was not provided and it concentrated in the park canyon. As a consequence, the erosive forces of the surging water destroyed a great deal of the park land at a cost to the taxpayers. Loss of vegetation, leveling of the land, slope, soils, and geology were all related to the problem, but went unnoticed, causing an eventual economic loss. These interrelationships are seen further in other elements of the study.

Collapse or subsidence of the surface of the earth occurs when subsurface supporting material is removed. This can happen naturally when soluable subsurface formations are dissolved or leached away by ground water. However, it can also occur when man has pumped large volumes of fluids from weakly consolidated sediments, and where he has mined mineral deposits without leaving sufficient support in the workings to maintain the surface. Such subsidence has happened, for example, in large areas throughout California.

The load-bearing capacity of the understrucutre and the soil is another important element in the consideration of various forms of development. A table showing the allowable bearing capacities of various material is included in this section.

There are other elements that are related to the geology of the study area, such as: corrosion potential, plasticity, shrink/swell potential, permeability, and others. These are more clearly related to soils and will be examined in that section.

The following table depicts some of the natural earth processes that should be considered in an area.

Table 2

MOVEMENTS OF THE LAND SURFACE

1. Movements of the surface caused by internal crustal processes
   A. Tectonic Movements
      1. Sudden changes of level accompanied by earthquakes resulting from rapid displacements along faults.
      2. Gradual changes in level due to slow but persistent creep along faults.

   B. Movements resulting from volcanism

      Changes in the land surface due to volcanic explosions and eruptions, but excluding changes in configuration of the surface due to accumulation of lava and volcanic ejecta.

   C. Isostatic Movements

      Gradual changes of level due to loading and unloading of segments of the crust.

2. Movements of the surface caused by surficial processes
   A. Mass movements on slopes

      Rockfalls, landslides, mudflow, and soil creep

   B. Collapse or subsidence of the surface

      Collapse of the surface where underlying rocks have been removed by solution, common in limestone terranes, or where supporting subsurface materials have been withdrawn through man's activities.

   C. Movements due to volume changes in surficial materials

      Changes in moisture content; freezing and thawing

   D. Movements of surficial earth materials in water, ice, and wind transportation systems.

      Sediments carried by rivers and streams or moved by wave and current action; sediments moved by glaciers; fine sediments carried by wind.

Table 3

ALLOWABLE BEARING CAPACITIES OF EARTH MATERIALS

	MATERIALS	ALLOWABLE BEARING CAPACITY, TONS/FT^2
1.	Medium-soft clay	1.5
2.	Medium-stiff clay	2.5
3.	Sand, fine, loose	2.0
4.	Sand, coarse, loose; compact fine sand; loose, sand-gravel mixture	3.0
5.	Gravel, loose; compact coarse sand	4.0
6.	Sand-gravel mixture, compact	6.0
7.	Hardpan and exceptionally compacted or partially cemented gravels or sands	10.0
8.	Sedimentary rocks, such as hard shales, sandstones, limestones, and siltstones, in sound condition	15.0
9.	Foliated rocks, such as schist or slate, in sound condition	40.0
10.	Massive bedrock, such as granite, diorite, gneiss, and trap rock, in sound condition	100.0

10. EXPLANATION OF ROCKS OF THE STUDY AREA

10A. Sedimentary and Metasedimentary Rocks

These are rocks composed of particles derived from previously existing rock that have come to rest after being transported by streams, ocean or wave currents, wind, or ice. Thus, a series of muds, clays, sands or gravels might be deposited upon an ocean or lake bottom, or upon land if the material is deposited from streams, winds, or glaciers. Rocks of any origin may be the parent material for sediment, which is soft at first, but in time becomes hardened into rock. Metasedimentary rocks are those metamorphic rocks derived from sedimentary rocks. These types of rock include limestone for use in the manufacture of Portland Cement or as a flux in iron smelting. Also, some important deposits of lead, zinc, and iron ore occur in Sedimentary rocks. Perhaps the greatest mineral resources occurring in Sedimentary strata are coal and petroleum.

Map Symbol (See Map A in the Map Section of this report)

Qa Alluvium - Mostly unconsolidated (not a compacted mass) silt, sand, and gravel valley fill, with some clay, mostly deposited by stream or river currents, and glacial movements; includes low-level terrace, marsh, peat, artificial fill and glacial deposits. (geologic age -- recent)

Qg Glacial Drift, Undivided (whole masses) - Glacial and glacial-fluvial sand, gravel, and till; includes alpine glacial outwash and till as well as some recent alluvium. (geologic age -- pleistocene)

Qgl Younger Glacial Drift, Undivided (pleistocene) - Till outwash and associated deposits; sorted and unsorted sand, gravel, silt, and clay. Includes some alluvium.

Qglt Till - Hard, blue gray to gray concrete-like mixture of clay, silt, sand, and gravel deposited as end or recessional glacial moraines (an irregular, rubbly heap or till remaining after a glacier recedes).

Qgl0 Advance and Recessional Outwash (glacial), Stratified Drift, and Associated Deposits -

Primarily silt, sand, and gravel, with some clay and alluvium. An outwash plain is formed of stratified drift left by braided streams flowing from the ice. Their deposits are actually great alluvial fans upon which are spread layer upon layer of sands and gravels. The adjective "glacialfluvial" is often applied to stream-laid stratified drift.

Ø Oligocene Marine Rocks - Massive tuffaceous (fine-grained, light gray rock composed of compacted volcanic ash) and non-tuffaceous sandstone and siltstone grade into one another and are distinguished much as coarse sandpaper is distinguished from very fine. The grains may be of any durable mineral.

Øc Oligocene Non-Marine Rocks - Andesite conglomerate (a mixture of gravel and sand cemented into hard rock), tuff beds, and mudflow material.

Tk_c Paleocene, Cretaceous Non-Marine Rocks - Brown-gray to light gray, medium to coarse-grained massive crossbedded arkose with interbedded conglomerate and siltstone.

Pt Pre-Tertiary Sedimentary and Metasedimentary Rocks, Undivided - Graywacke, argillite, phyllite, chert, talc, and graphic schist. Some faulted in blocks of serpentine and greenstone.

Jk Upper Jurassic - Lower Cretaceous Sedimentary and Volcanic Rocks, Undivided - Graywacke, argillite, siltstone, slate, volcanic rocks, phyllite, greenschist, and greenstone.

CPm Carboniferous - Permian Sedimentary and Volcanic Rocks - Cherty and slaty argillite, siltstone, graywacke, chert, greenstone, tuff, andesite, spilitic volcanics.

CPs -- Predominantly sedimentary rocks. Graywacke, argillite, and slate, includes minor marble, siltstone, arkose, conglomerate, ribbon cherts, and volcanic rocks. Some Devonian (age) rocks.

10B. Extrusive Igneous Rocks

These are molten masses which reach the ground surface, flowing from a pipe or crack and pouring out upon the ground, then quickly solidifying into a hard rock. Volcanoes and lava flows are the principal products of igneous rock intrusion. These rocks take two forms: a) fluid magma flows in the form of thin tongues or sheets, called lava flows, and b) solid or near solid pieces blown violently from volcanic vents and collectively termed volcanic ejecta.

Map Symbol

Ptv Pre-tertiary Volcanic Rocks, Undivided - Andesite and basalt flows, and greenstone; includes minor interbedded limestone, arkose, quartzite, and chert beds.

CPmv Carboniferous and Permian Volcanic Rocks - Predominantly altered andesite, basalt, and diabage, with interbedded chert and argillite. Includes some tuff, greenstone, and spilitic volcanic rocks; Northern Cascade Mountains.

10C. Metamorphic and Intrusive Igneous Rocks

Metamorphic rocks are those igneous and sedimentary rocks that have been altered by the tremendous pressures and high temperatures that accompany mountain-building movements of the earth's crust. Intrusive igneous rocks are formed when molten masses do not reach the surface, but solidify in spaces that they have made by pushing the surrounding rock apart, melting, or dissolving it. They do, in fact, intrude or invade the previously formed rock. Regions of intrusive igneous and metamorphic rock are often rich in mineral wealth. Where igneous intrusion occurred repeatedly, metallic ores were deposited. Metamorphic rocks, such as slates, quartzites, marbles, and schists, are not likely to contain metallic ores of importance, unless intrusive rocks have penetrated them.

Map Symbol

Tg Tertiary Granitic Rocks - Granite quartz monzonite, quartz diorite, grand diorite, and trondhjemite.

Td Tertiary and Dunite Intrusive Rocks - An intimite mixture of saxonite and dunite, partly serpentinized.

bi Basic Intrusive Rocks, Undivided - Predominantly gabbro; includes some serpentine. Age undetermined.

Tkg Tertiary-Cretaceous Granitic Intrusive Rocks - Granodiorite, trondjhemite, and quartz diorite. Late cretaceous and/or early tertiary.

Mzg Mesozoic Granitic Rocks, Undivided - Granite, quartz monzonite, quartz diorite, granodiorite, and trondjhemite.

Pjph/ Pjgs Pre-Upper Jurassic Metamorphic Rocks of Low Grade Zone - Greenschist, phyllite, and slate; includes some limestone, quartzose, schistose metaconglomerate, breccia and igneous rocks (Pjgs - greenschist of central Whatcom and Skagit County)

Pjgn Pre-Upper Jurassic Gneiss - Biolite, quartz, diorite, trondjhemite, and hornblende gneisses, many of which are migmatitic; includes small granite bodies locally.

Pjsc Pre-Upper Jurassic Metamorphic Rocks of Medium and High Grade Zones - Schist amphibolite, and minor lime silicate rocks marble, quartzite, and metaconglomerate.

Table 4

DIVISIONS OF GEOLOGICAL TIME

	Era	Period		Approximate Age in Years
	Cenozoic Era (or period)	Quaternary	Recent Pleistocene or Glacial	
		Tertiary		60 million
	Mesozoic Era	Cretaceous		
		Jurassic		
		Triassic		200 million
	Paleozoic Era	Permian		
		Pennsylvanian Mississippian	Carboniferous	
		Devonian		
		Silurian		350 million
		Ordovician		
		Cambrian		520 million
The Preeambrian	Proterozoic Era	Keweenawan		
		Huronian (Animikie)		
	Archeozoic	Timiskaming		
		Keewatin		3 billion

Historical Interpretations

The reconstruction of past geologic events is aided by recognition of rock types, structures, and unconformities, and especially by recognition of any organic remains preserved in rocks.

Table 5

PLEISTOCENE SEQUENCE IN THE PUGET LOWLAND

Geologic Climate Units		Stratigraphic Units	C^{14} Age*
Fraser Glaciation	Sumas Stade	Sumas Drift	10,000 11,000
	Everson Interstade	Everson Glaciomarine Drift	13,000
	Vashon Stade	Vashon Drift	
	Evans Creek Stade	Evans Creek Drift	18,000
Olympia Interglaciation		Quadra Sediments Kitsap Formation	23,000 27,000
Salmon Springs Glaciation		Salmon Springs Drift Possession Drift	35,000 47,000 50,000
Puyallup Interglaciation		Puyallup Formation Whidbey Formation	Older than 50,000
Stuck Glaciation		Stuck Drift Double Bluff Drift	
Alderton Interglaciation			
Orting Glaciation		Orting Drift	

*Age data based on theory

SOILS ANALYSIS

1. SOILS OF STUDY AREA - GENERAL OVERVIEW

An extensive soil survey was conducted by the U.S. Department of Agriculture, Soil Conservation Service, and its results were published in 1960.

The soils of the study area consist of two main groups: 1) alluvial, or bottomland, soils, and 2) upland soils. The alluvial type soils are found in the Skagit River Valley and Delta. These soils are considerably more fertile and productive than the upland soils. They are of primary importance in maintaining the agricultural base of the county. However, many of these soils are poorly drained due to lack of relief or impervious underlying strata, and sometimes require artificial drainage to maintain productivity. Upland soils tend to be shallow. Some series are underlain by cemented hardpans, and others by porous gravelly materials.

Some of the elements of geology will naturally relate to this soils element as well. It is interesting to compare the soils of an area with its underlying substratum. By doing this, one can sometimes determine the type of parent material of the soil and better understand its subsequent history.

2. SOIL FORMING PROCESSES

There are many types of processes and influences that act together to form a soil. These are known as soil formers. Some of these are passive conditions and others are active agents.

2A. Passive Soil Formers

The first of the passive soil formers is parent material. This is the residual or transported overburden of disintegrated rock making up the bulk of the soil. Certain of the original rock forming minerals have been thoroughly changed chemically into new compounds and reduced to colloidal size. However, the parent material alone does not necessarily determine the kind of soil that is present. On the other hand, soils of the same major groups may be found to overlie two different types of overburden or bedrock. The three kinds of parent material in Skagit County are: 1) glacial drift; 2) residuum from bedrock, and 3) alluvium.

Young soils that have not had enough time to develop and some limestone areas where the influence of the rock is especially strong, are exceptions to the general rule that soil type is independent of parent material origin.

Another passive soil former is landform or ground surface configuration. Soil is thinner on steeper slopes. This is a result of the more accelerated surface erosion by runoff and the less water penetration occurring on steeper slopes. Flat uplands areas tend to build up thick soil because the products of weathering tend to remain in place. Flat bottom lands likewise have thick soils but they are poorly drained and dark colored. Here, constant saturation retards the decay of vegetation and permits organic matter to accumulate. Gentle slopes where drainage is good, but erosion is slow, are considered the norm for soil formation. Slow, continuous erosion is a normal geologic soil process whereby the removal balances the formation of new soil from the parent material. Erosion becomes harmful to the soil only when greatly accelerated.

The slope aspect or direction of exposure of the surface to the rays of the sun is another soil forming influence of landform. This factor creates differences in dryness, moisture, and vegetation, all of which have an effect on soils.

A third passive factor in soil formation is the time involved in maturing the soil. A soil is said to become mature when it has been acted upon by all the soil forming processes for a sufficient amount of time to have developed a profile that changes only minutely with further passage of time. Soils evolving from recently deposited river alluvium or glacial till are referred to as young soils.

2B. Active Soil Formers

The most important active soil former is climate. Climate has a direct influence on soil formation through its effect of weathering of rocks, the removal and deposition of materials by water, wind, and glaciers, and the moisture in the soil. It also influences the soil through its effect upon vegetation.

The weathering process consists of decomposition and disintegration by frost action, hydration, solution or leaching, and oxidation. Wind also aids in soil development, but to a lesser degree than the rest. Some phases of the weathering process such as precipitation create chemical solutions which react with certain components of the parent material.

Plants and animals also aid soil formation through their decomposition into the soil. Earthworms, insects, and burrowing rodents mix and turn over the soil, and afford percolating water better transit through it.

2C. Soils and Earth Movements

The problems related to certain earth movements also affect soils. On many slopes the surficial material is in transit downgrade at an extremely slow rate. This is called creep. Creep is particularly important when considering development because the rate of movement is so slow that it may not be detected until its effects on structures call attention to it. Thus, railway tracks, highways, parking lots, retaining walls, tunnels, and even buildings themselves built in or on creeping slopes may be thrown out of line or destroyed.

The properties of the soil have much to do with the amount of creep that takes place in a given area. Naturally, the gravitational effects of increased slope steepness also tend to intensify the amount of creep. The erosive effect of such processes have been examined in another section of the study.

Other earth movements related to soil are rapid flow, mud flow, landslides, and overland flow. These are discussed in greater detail in other sections of this study. However, it is important in terms of soil suitability to be aware of the properties of soil that help accelerate these phenomena. Such characteristics as texture, shrink/swell potential, plasticity, resistence to erosion, permeability, shearing strength, and others, combined with slope percent, amount of precipitation, and the characteristics of the substrata are all related to earth movements.

3. SOIL CHARACTERISTICS

Soil properties such as size of the constituent particles, shape of the grains, mineral composition, the amount of organic material, the amount and composition of contained fluids, permeability, plasticity, shrink/swell potential, and corrosivity all have an influence on how a certain soil is classified.

3A. Plasticity

Fine grained soils are often analyzed to determine their plasticity. Plasticity is usually expressed in terms of Atterberg limits. These limits define the change in strength of a fine grained soil with changes in water content. The liquid limit is expressed in terms of the water content at which soil cohesion (resistance to shear) approaches zero; water content is a maximum at this limit. The plastic limit is expressed in terms of the water content at which a soil becomes plastic. The difference between the two limits, a measure of the range of water content over which the soil behaves plastically, is the plasticity index.

3B. Shrink/Swell

Fine grained soils also differ in their potential volume changes from dry to wet (shrink/swell potential). Tests include measurement of volumetric shrinkage, linear shrinkage, and absorption (swell). Volumetric shrinkage is the decrease in volume as water content is reduced from any given amount to the shrinkage limit (the water content below which the soil ceases to shrink on drying). Linear shrinkage is the decrease in one dimension of a soil mass as water content is reduced to the shrinkage limit.

TABLE 1

SOIL CHARACTERISTICS

Soil Series or Land Types	Topographic Position	Area Acres	Extent %	Surface Soils: Textures	Surface Soils: Water Intake Rates (in./hr.)	Subsoils: Textures	Subsoils: Consistence	Subsoils: Permeability (in./hr.)	Subsoils: Reaction pH	Substrata: Parent Material	Substrata: Consistence	Substrata: Permeability (in./hr.)	Substrata: Reaction pH	Resistance to Erosion	Water Holding Capacity (inches)	Shrink/Swell Potential	Susceptibility to Frost	Shearing Strength	Corrosion Effect
Alderwood	Upland terrace	25,965	4.4	Loam, grav. sandy loam, grav. loam, silt loam, fine sandy loam, loamy sand	0.2-0.75	Gravelly sandy loam	Very friable	0.8-2.5	5.6-6.0	Sandy & grav. glacial basal till	Firm, hard when dry, cemented	0.05-0.2	5.6-6.5	Low to moderate	3.3-6.0	Low	Slight to high	High	Moderate
Belfast	Bottomlands	940	.2	Silt loam, fine sandy loam & sandy loam	0.2-0.6	Silt loam or loam	Friable	0.2-0.8	5.6-6.5	Silt loam, loam, or sandy loams	Friable	0.2-0.8	5.6-6.5	Low to moderate	6.0-7.4	Low to high as sand increases	Slight to very high	Very low to high depend on amount of sand	Low to moderate
Bellingham	Terrace basins	3,360	.5	Silty clay loam, clay loam, silty clay, clay, silt loam, loam & fine sandy loam	0.1-0.3	Silty clay loam, silty clay or clay	Firm, sticky & plastic	0.05-0.2	5.6-7.3	Clay & sandy clay	Firm, sticky & plastic	Less than 0.05	6.6-7.3	Low to moderate	5.5-6.5	Moderate to high	Moderate to high	Very low to moderate	Very high to moderate
Bow	Upland terrace	31,265	5.2	Silt loam, grav. silt loam, grav. loam, clay loam, silty clay loam & stony silt loam	0.2-0.6	Loam & fine sandy loam	Firm, sticky & slightly plastic	0.05-0.2	6.1-6.5	Silty clay or clay glacial till	Hard, sticky & plastic	Less than 0.05	6.6-7.3	Moderate	4.3-6.0	High	Moderate to high	Moderate very low	High to moderate
Casey	Upland terrace	910	.1	Gravelly sandy loam, gravelly fine sandy loam, sandy loam, silt loam & gravelly loam	0.2-0.75	Gravelly sand	Friable	2.5-5.0	5.6-6.0	Gravelly clay loam, grav. silty clay, or grav. sandy loam glacial basal till	Hard, strongly cemented	Less than 0.05	7.3-7.6	Low to moderate	3.3-6.0	Low to moderate	Slight to high	Moderate to high	Moderate
Carbondale	Terrace & bottomland basins	325	-.1	Muck	0.2-0.4	Peat, woody	Fibrous	0.05-2.5	5.1-5.5	Sedimentary peat, sand, silt or clay	Hard when dry	Less than 0.05	5.1-5.5	Low	4.4-12.0	Very high	Low to high	Very low	Very high
Cathcart	Upland	10,510	1.6	Loam, gravelly loam, gravelly silt loam, stony loam, fine sandy loam, clay loam	0.2-0.5	Gritty loam	Hard	0.8-2.5	5.6-6.0	Sandy loam, grading to sandstone at about 4 feet	Hard	0.05-0.2	5.6-6.0	Low to moderate	6.0-10.0	Low	Moderate to high	Moderate to high	Moderate
Coastal Beach	Beach areas	405	.5	Sands & gravelly, stony or cobbly sands	0.5-1.1	Sands & gravelly, stony or cobbly sands	Loose	5.0-10.0	5.6-6.0	Sands & gravelly, stony or cobbly sands	Loose	5.0-10.0	5.6-6.0	Low	3.0-4.0	Low	None	High	Low to moderate
Cokedale	Alluvial floodplain	2,520	.5	Silty clay loam, silt loam, loam & sandy loam	0.1	Silts and fine sands	Firm, non-sticky	0.05-0.2	5.6-6.0	Sand, fine sand, fine sandy loam, or clay loam stratified alluvium	Loose to firm	Variable 0.05-2.5	5.6-6.0	Low	8.0-10.0	Low to moderate	None to very high	Low to high	Moderate
Corkindale	Upland	765	.1	Loam	0.4-0.75	Gravelly	Friable	0.8-2.5	5.1-5.5	Gravelly sand glacial outwash	Loose	5.0-10.0	5.1-5.5	Low	4.0-5.5	Low	Slight	Low to moderate	Low to high

				Surface Soils		Subsoils				Substrata									
Soil Series or Land Types	Topographic Position	Area Acres	Extent %	Textures	Water Intake Rates (in./hr.)	Textures	Consistence	Permeability (in./hr.)	Reaction PH	Parent Material	Consistence	Permeability (in./hr.)	Reaction PH	Resistance to Erosion	Water Holding Capacity (inches)	Shrink/Swell Potential	Susceptibility to Frost	Shearing Strength	Corros. Effect
Coveland	Upland	1,300	.2	Gravelly loam, grav. silt loam, or stony silt loam	0.2-0.5	Gravelly sandy loam, or sandy clay loam	Hard, slightly sticky to sticky & plastic	0.05-0.2	6.1-6.5	Clay loam, sandy clay, or clay	Extremely hard, very sticky & very plastic	Less than 0.05	6.6-7.3	Low to moderate	5.0-7.0	Moderate to high	High	Very low to high	Low to high
Everett	Upland terrace	8,910	1.5	Gravelly sandy loam, cobbly sandy loam, stony sandy loam, grav. loamy sand, stony loamy sand, loam	0.4-1.1	Gravelly & very gravelly loamy sands	Loose	5.0-10.0	5.6-6.0	Gravel & sand ablation till	Loose	5.0-10.0	5.6-6.0	Moderate to very high	4.0-6.0	Low	None to slight	Moderate to very high	Very l to mod ate
Fidalgo	Upland	4,985	.8	Rocky loam	0.25	Rocky sandy loam or rocky loam	Firm	0.8-2.5	5.1-5.5	Serpentine bedrock	Very hard	Less than 0.05	---	Moderate	3.3	Low	Moderate	Low to moderate	Low to high
Giles	Upland	2,045	.3	Silt loam, loam & fine sandy loam	0.3-0.5	Silt loam & silty clay loam	Firm	0.2-0.8	5.6-6.0	Fine sand, sands or grav. sands	Compact	0.8-2.5	5.6-6.0	Low	4.8-8.0	Moderate	Slight to moderate	Low to high	Low to moderat
Gilligan	Upland terrace	2,355	.4	Gravelly loam, loam, silt loam	0.3-0.5	Micaceous silt loam	Firm	0.2-0.8	5.1-5.6	Micaceous sandy loam	Loose	0.8-2.6	6.1-6.5	Moderate	8.0	Low	Moderate	Low to high	Low to moderat
Greenwater	Upland terrace	4,310	.7	Loamy sands, sand & sandy loam	over 0.55	Loamy sand	Firm	5.0-10.0	5.1-5.5	Coarse sands	Loose	5.0-10.0	5.6-6.0	Moderate	4.0	Low	Slight	Moderate to high	Low to high
Meisler	Upland	1,730	.4	Grav. loam, shaly loam, stony loam	0.25-0.5	Shaly loam	Friable	0.2-0.8	5.6-6.0	Shaly argillite or schist, bedrock at about 32"	Hard	0.05-0.2	6.1-6.5	Low	8.5	Low	Moderate	Moderate to high	Low
Newda	Beach deposits	40	-.1	Silty clay loam, loam loamy sand, grav. sandy loam, sand	0.25-1.0	Sands	Loose	0.2-0.8	7.0-7.5	Beach sands	Loose	5.0-10.0	7.0-7.5	Low	4.0-5.5	Low	Slight	Moderate to high	Very low to moder ate
Indianola	Upland terrace	1,710	.3	Fine sandy loam, loamy sand, sandy loam, loamy fine sand, silt loam & loam	0.3-1.1	Loamy fine sand, fine sand, loamy sand	Loose	2.5-5.0	4.5-6.6	Sands & loamy sands glacial ablation till	Loose	5.0-10.0	6.1-6.8	Low	4.0-5.8	Low	Slight	Moderate to high	Low to high
Klaus	Upland terrace	8,450	1.3	Grav. loam, grav. sandy loam	0.5-1.1	Grav. loam	Very friable	2.5-5.0	5.1-5.5	Very grav. sands & loamy sands	Loose	5.0-10.0	5.6-6.5	Moderate	3.3-4.5	Low	Slight	Moderate to very high	Very low to high
Kline	Alluvial bottomlands	2,045	.3	Silt loam, loam, grav. loam & sandy loam	0.2-1.0	Loam, silt loam or sandy loam	Firm	0.8-2.5	5.1-5.5	Sandy loam, grav. sandy loam, or loamy fine sand	Very friable	2.5-5.0	5.6-6.0	Moderate	3.6-5.4	Low	Slight	Moderate to very high	Low to moderate
Lummi	Bottomlands, floodplains	1,890	.3	Silty clay loam, silt loam, fine sandy loam	0.15-0.5	Silty clay loam	Hard, sticky & plastic	0.05-0.2	6.1-6.6	Silts & clay stratified	Hard, sticky & plastic	0.05-0.2	6.1-6.5	Low	6.5-10.0	Very low to high	Moderate to high	Low to very high	High
Lynden	Upland terrace	4,040	.5	Loamy sand, sandy loam, grav. sandy loam, loam grav. loam	0.2-1.0	Loamy sand	Loose	2.5-5.0	5.1-5.5	Loamy sands, ablation fill	Loose	6.0-10.0	5.6-6.0	Low	5.7-10.0	Low	None to slight	High	Low
Made Land		630	.1																
Marblemount	Upland	70	-.1	Stony loam	0.2-0.5	Stony loam	Friable	0.8-2.5	5.6-6.0	Granite or granodiorite	Indurated	Less than 0.05	----	Moderate	4.8	Low	High	High	Low to moderate

				—	[illegible]	Stony loam	Friable	0.8-2.5	5.6-6.0	Granite or granodiorite	Indurated	Less than 0.05	----	Moderate	4.8	Low	High	High	Low to moderate
				Surface Soils		Subsoils				Substrata									
Soils Series or Land Types	Topographic Position	Area Acres	Extent %	Textures	Water Intake Rates (in./hr.)	Textures	Consistence	Permeability (in./hr.)	Reaction PH	Parent Material	Consistence	Permeability (in./hr.)	Reaction PH	Resistance to Erosion	Water Holding Capacity (Inches)	Shrink/Swell Potential	Susceptibility to Frost	Shearing Strength	Corrosion Effect
Mukilteo	Upland terrace	545	.1	Peat, woody peat, sedge	0.3-0.5	Peat, woody peat, sedge	Fibrous	0.8-2.5	5.1-7.0	Peat, woody, sedge or sedimentary basal till, sand, gravel clay	----	0.05-0.2	5.1-7.0	Low	5.0-12.0	High	Very low	----	----
Neptune	Bottomland	15	-.1	Sandy loam, grav. sandy loam (shells)	0.5-1.0	Loamy sand	Loose	2.5-5.0	7.3-7.6	Coarse sand	Loose	5.0-10.0	7.3-7.6	High	5.6-6.0	Low	None	Very high	Very low to low
Nooksachamps	Alluvial floodplain	1,520	.2	Silt loam, & silty clay loam	0.1-0.5	Silty clay loam, silt loam, & sandy loam, stratified	Plastic	0.2-0.8	6.1-6.5	Silty clay, or clay alluvium	Very sticky, very plastic	Less than 0.05	6.6-7.3	Low	6.5-10.0	High	High to very high	Very low to moderate	Low to high
Norma	Terrace basin	1,145	.2	Loam, clay loam, sandy loam, fine sandy loam silt loam, silty clay, loam	0.2-0.5	Silty clay, sandy clay loam, loamy sand, or sandy loam	Firm to weakly iron cemented	0.05-0.2	5.6-6.0	Stratified fine sandy loam, sandy loam, loam, or grav. sandy loam	Firm to weakly cemented	Variable 0.05-2.6	6.1-6.5	Low to moderate	4.3-6.5	Low to moderate	Moderate to high	Low to high	Very low to low
Ose	Upland	5,895	1.1	Silt loam	0.2-0.5	Loam or silty clay loam	Compact	0.2-0.8	5.1-5.5	Silty clay loam over argillite bedrock	Very hard	0.05-0.2	5.1-5.5	Low to moderate	5.0-7.0	Low	Moderate to high	Low to high	High
Pilchuck	Alluvial floodplains	6,720	.9	Fine sand, sand, grav. sand, loamy sand, fine sandy loam, grav. loamy sand, loamy fine sand	0.4-1.1	Loamy sands or grav.	Loose	6.0-10.0	6.6-7.3	Sands, grav. sands, or very grav. sands	Loose	Over 10.0	6.6-7.3	Low to moderate	2.4-5.7	Low	Slight	Low to high	Very low to low
Puget	Alluvial floodplain	27,015	4.5	Silty clay loam, clay loam, loam, silt, loam clay, silty clay, fine sandy loam, very fine sandy loam	0.1-0.75	Silt loam, silty clay, loam, or clay	Firm, hard, sticky plastic to very plastic	0.2-0.8	5.1-5.5	Silty clay loam, or clay	Firm, hard, very sticky, very plastic	0.05-0.2	5.1-5.5	Low to moderate	8.5	Low to high	Moderate to very high	Very low to high	High to very high
Puyallup	Alluvial floodplains	43,235	7.4	Sandy loam, fine sandy loam, silt loam, loam, very fine sandy loam, loamy fine sand, silty clay loam	0.2-0.75	Fine sandy loam, very fine sandy loam	Loose	0.8-2.5	6.1-6.5	Fine sandy loam to fine sand	loose	5.0-10.0	6.1-6.5	Low	5.0-8.0	Low to moderate	Slight to high	Very low to high	Low to moderate
Rifle	Upland & terrace basins	1,680	.3	Peat, woody peat, sedge	0.3-0.5	Peat, woody peat, sedge	Fibrous	0.8-2.5	5.1-7.0	Peat, woody, sedge or sedimentary basal till, sand, gravel or clay	----	0.05-0.2	5.1-7.0	Low	5.0-12.0	----	----	Very low	High to very high
Riverwash	Floodplains	2,765	.5	Sand, gravel & cobbles	5.0-10.0	Sand, gravel & cobbles	Loose	6.0-10.0	6.1-6.5	Gravel & cobbly sands	Loose	5.0-10.0	6.1-6.5	High	2.5	Low	None	High	Low to moderate
Rough broken land	Upland	22,540	3.8	Sandy loams, grav. sandy loams, loams, grav. loams	0.2-0.75	Grav. loams, loams, sandy loams, grav. sandy loams, stony loams, stony sandy loams	Friable hard to loose	0.2-0.8	5.6-6.0	Variable grav. or stony loams, sandy loams, or sands; on bedrock or glacial ablation or basal till	Variable very hard to loose	0.2-0.8	5.6-6.5	Low to moderate	2.5-8.0	Moderate	High	Very low to moderate	Variable

				Surface Soils		Subsoils				Substrata									
Soil Series or Land Types	Topographic Position	Area Acres	Extent	Textures	Water Intake Rates (in./hr.)	Textures	Consistence	Permeability (in./hr.)	Reaction PH	Parent Material	Consistence	Permeability (in./hr.)	Reaction PH	Resistance to Erosion	Water Holding Capacity (inches)	Shrink/ Swell Potential	Susceptibility to Frost	Shearing Strength	Corrosion Effect
Rough Moutainous	Upland	271,755	45.6	Loams, stony rocky, & cobbly loams, & rock outcrop	0.2-0.5 or 0.0	Variable rocky, stony & cobbly	Firm to very hard	Variable 0.05-2.5	5.1-5.5	Loam or bedrock of basalt, argillite, sandstone, granite	Very hard	Variable 0.0-2.5	----	Low to moderate	0.0-6.0	High	High	Moderate to high	Low to moderate
Rough rocky land	Upland	12,185	2.0	Stony & rocky loams, or sandy loams	0.2-0.75	Variable stony & rocky loams or sandy loams	Variable	Variable 0.05-2.5	5.1-5.5	Variable stony or rocky loams over glacial ablation or basal till or bedrock	Loose to very hard	Variable	5.1-5.5	Variable	2.5-5.0	----	----	----	Variable
Samish	Alluvial floodplain	2,000	.4	Micaceous silty clay loam, silt loam	0.1-0.5	Silt loam or silty clay loam	Firm	0.2-0.8	5.6-6.0	Micaceous silty clay	Firm plastic	0.05-0.2	5.6-6.0	Low	7.0-10.0	Low to moderate	High	Very low to moderate	Moderate
Sauk	Upland terrace	445	.1	Loam	0.2-0.5	Fine sandy loam, loam	Firm	0.8-2.5	4.5-5.0	Sand or loamy sand, low terrace	Loose	2.5-5.0	5.6-6.0	Low	8.0-10.0	Low	Slight	Low to moderate	Low to high
Saxon	Upland terrace	1,130	.2	Silt loam	0.2-0.5	Silty clay loam, laminated	Firm	0.2-0.8	5.1-6.5	Silty clay loam & silt loam	Compact hard	0.05-0.2	5.6-6.5	Low to moderate	4.8-6.4	Moderate	High	Low to moderate	Moderate to high
Semiahmoo	Upland terrace & bottomlands basins	230	-.1	Muck	0.3-0.5	Peat, sedge	Fibrous soft	0.8-2.5	5.6-6.0	Peat, sedge or sedimentary, very soft to liquid	Sedge, fibrous, soft	Variable	6.1-6.5	Low	10.0-12.0	Very high	High	Very low	High to very high
Semiahmoo (shallow)	Upland terrace & bottomlands basins	945	.2	Muck	0.3-0.5	Muck or sedge peat	Fibrous soft	0.8-2.5	5.6-6.0	Compact sands, grav. sands, silt, or clays	Hard	0.05-0.2	5.1-7.3	Low	3.5-5.0	Very high	High	Very low	High to very high
Skiyou	Upland terraces	7,135	1.2	Grav. loam	0.2-0.5	Grav. loam	Friable	0.2-0.8	5.1-5.5	Grav. sandy loam, glacial basal till	Very compact strongly cemented	0.05-0.2	6.1-6.5	Low	3.5-5.0	Low	None	Moderate	Moderate to high
Skykomish	Upland terrace	3,000	.5	Cobbly sandy loam, stony loam, grav. sandy loam, stony sand, grav. sand, grav. loam	0.4-1.1	Grav. or stony sandy loam, or sands	Loose	5.0-10.0	5.6-6.0	Sands, gravels & cobbles glacial ablation till	Loose	Over 10.0	5.6-6.0	Moderate to high	2.8-3.5	Low	None	Very high	Very low to moderate
Snohomish	Alluvial basin	1,210	.2	Silt loam, loam, fine sandy loam, silty clay loam, silty clay, loamy fine sand	0.1-0.5	Silty clay	Firm, sticky & plastic	0.05-0.8	5.6-6.5	Woody, sedge, moss & sedimentary peats	Soft	0.2-0.8	6.6-6.5	Low to moderate	5.5-10.0	High	High	Very low	High to very high
Squalicum	Upland terrace	10,705	1.8	Grav. silt loam, silt loam, stony silt loam	0.2-0.5	Silty clay loam containing gravel & a few cobbles	Firm	0.2-0.8	5.1-5.5	Grav. sandy clay with gravel stone & boulders glacial basal till	Hard, weakly	Less than 0.05	5.1-5.5	Low	4.8-6.0	Moderate	High	Low to moderate	High
Sultan	Bottomland floodplains	2,710	.5	Silt loam, loam, clay loam, fine sandy loam, loamy sand	0.1-0.8	Silt loam	Slightly hard, friable slightly sticky to plastic	0.2-0.8	5.6-6.0	Very fine sandy loam grading to loamy fine sand, stream alluvium	Soft, very friable, non-sticky & non-plastic	0.8-2.5	6.1-6.5	Low	8.0-10.0	Low to moderate	Moderate	Low to moderate	Slight to high
Sumas	Bottomland basin	16,075	2.7	Silty clay loam, silt loam, fine sandy loam.	0.1-0.5	Clay	Plastic	0.2-0.8	6.1-6.5	Fine & medium sands, alluvium	Loose	0.2-0.8	6.1-6.5	Low	10.0-11.0	Moderate	High	Very low to high	Moderate to high

sandy loam, & loamy sand | sands, alluvium | to high | to high

Soil Series or Land Types	Topographic Position	Area Acres	Extent %	Surface Soils: Textures	Surface Soils: Water Intake Rates (in./hr.)	Subsoils: Textures	Subsoils: Consistence	Subsoils: Permeability (in./hr.)	Subsoils: Reaction PH	Substrata: Parent Material	Substrata: Consistence	Substrata: Permeability (in./hr.)	Substrata: Reaction PH	Resistance to Erosion	Water Holding Capacity (inches)	Shrink/Swell Potential	Susceptibility to Frost	Shearing Strength	Corrosion Effect
Tanwax	Upland basins	240	-.1	Colloidal peat	0.1-0.4	Colloidal or sedimentary peat	Very soft, spongy	0.05-0.2	5.1-5.5	Colloidal peat	Soft & spongy	Less than 0.05	4.5-5.5	Low	5.0-7.0	High	Slight to high	Very low to high	High to very high
Thornton	Upland basins	1,310	.2	Clay, silty clay loam	0.1-0.25	Clay	Very hard, exceedingly greasy, moderately plastic	Less than 0.05	6.1-6.5	Silty clay loam, alluvial materials from talc & micaceous rocks	Hard, slightly sticky & slightly plastic	Less than 0.05	6.1-6.5	Low	3.5-4.5	High	Very high	Low to moderate	Low to very high
Thurmond	Upland terrace	15,206	2.6	Grav. loam, grav. sandy loam	0.3-0.75	Grav. loam to grav. sandy loam	Firm, friable	2.5-5.0	6.6-6.0	Grav. sandy loam grading to sandy grav. with schist, shaly & flaggy fragments. Glacial ablation till from micaceous schist rocks	Loose	5.0-10.0	6.6-6.0	Very high	6.0-6.0	Low	None	Very high	Low to moderate
Tidal Marsh	Tidal basins	3,860	.6	Variable sands, silts clays & organic materials	0.2-0.5	Sands, silts & clays	Very soft & spongy	0.05-0.2	7.3-7.6	Sands, silts clay & organic materials	Very soft & spongy	0.05-0.2	7.3-7.6	Low	4.2-6.6	High	High	Very low	Low to very high
Tisch	Upland basins	230	-.1	Silt loam, or silty clay loam	0.1-0.4	Silty diatomaceous earth	Firm, hard, sticky & slightly plastic	0.05-0.2	5.6-6.5	Fine sand, alluvial material	Firm	0.05-0.2	5.6-6.5	Low	5.0-6.0	Low	High	Low to moderate	Very high
Wickersham	Upland terrace alluvial fan	3,360	.5	Shaly loam, shaly silt loam	0.4-0.75	Shaly loam	Friable firm	2.5-5.0	5.6-6.0	Shaly loam, alluvial fan material from mica schist & argillite bedrock	Friable	2.5 5.0	6.1-6.5	Moderate to high	3.5-5.7	Low	Slight	Moderate to high	Low
Woodinville	Bottomland floodplain	235	-.1	Silt loam	0.2-0.4	Silty clay loam, silty clay & clay laminated	Firm, slightly sticky & slightly plastic	Less than 0.05	6.1-6.5	Silty clay, clay & peat, laminated	Firm, slightly sticky & slightly plastic	Less than 0.05	6.1-6.5	Moderate	5.0-8.0	High	Moderate	Very low	High

3C. Corrosion

Generally speaking, corrosion is a slow wearing away or decomposition that proceeds from the surface inward. With regard to metallic objects, such as pipe and cable, corrosion is a chemical or electrochemical process. A metallic object can eventually be "eaten away" or corroded through contact with soluble acids and electric currents in the ground. Corrosion rates or corrosivity is much greater in some materials than in others. The moisture content of the soil sometimes has a great effect on the rate at which this phenomena occurs.

Some of the planning implications that evolve from these various characteristics will be studied in greater detail later in this section.

4. PROPERTIES OF MAJOR SOILS GROUPS

A description of the major properties of each soil of the study area is needed to gain a clear understanding of the various capabilities of each. Due to certain limitations in this study, only the major soils series can be examined. If further information is needed on any aspect of soils, The Soils Survey for Skagit County, developed by the Department of Agriculture, and Exhibit 1 of Appendix XIV of the Puget Sound and Adjacent Waters Study, by the Puget Sound Task Force and Pacific Northwest River Basins Commission, have both explored the subject of soils quite extensively and can be of great assistance in this area. Table 1 at the end of this section tabulates the various important soil properties.

5. SOILS SUITABILITY (Planning Implications)

Soils have a wide range of uses due to the many differences in their characteristics. Thus, a soil might be suitable for farming and completely unsuitable for urban related development. A guidance system for proper use of soils has been developed using a series of ratings by various indicators. Property losses, health hazards, and high construction costs may be minimized by carefully considering these various ratings and selecting sites on soils with the fewest limitations for designated uses. The reduction of erosion and sediment hazards may also be reduced.

5A. Buildings

The properties of a soil are very important when considering the construction of any structure. Soils best suited for supporting most structures are very deep, well drained, permeable, level to gently sloping, free from flooding, with a low slide potential. The bearing capacity of the soil is of the utmost importance for both safety and economic reasons. The capacity of various soils to support loads varies considerably. The bearing strength of individual soils may also vary significantly under different moisture and slope conditions. Many soils are stable when dry but tend to lose this quality when saturated with water. The shear strength, consistency, and water intake and holding capacity can give one a rough index as to a soil's bearing strength.

Soils that flood have severe limitations. Periodic flooding becomes a very serious health and safety hazard, as well as causing costly damage to buildings. Floods can also be damaging to crops, but this is more of an economic loss than a safety or health hazard. However, it should be remembered that soils formed on bottomlands are the product of the flood waters. It is known that soils of bottomlands along rivers and streams are likely to be flooded, some more frequently than others. Thus, to stop this periodic flooding for all time, may cause the eventual deterioration of these soils.

5B. Vegetation and Landscaping

Vegetation is important to soil because of its ability to absorb moisture, and lend stability through its root system. Sometimes a slide or creep can be stopped or slowed by the addition of vegetation. The type of soil often determines the amount of plant life it can sustain. The degree of wetness on many soils influences the desirability of the site for landscaping. Poorly drained soils need surface or subsurface drainage to remove excess water. The better drained soils are more conducive to the growth of grasses and shrubs used for landscaping.

5C. Septic Tanks

The suitability of a soil as a means of underground disposal of sewage through the use of a septic tank is extremely important when considering areas of development, especially residential. The topic of septic suitability will be explored in detail in a separate section of this study.

5D. Parks and Playgrounds

Although parks and playgrounds can be used on a variety of soil types that are seemingly unsuitable for other purposes, there are certain properties that lend themselves to the construction of better park facilities. Properties considered in rating a soil for such uses are drainage, texture, flooding texture, depth to bedrock or cemented basal till, and permeability as it pertains to sewage disposal. Thus drainage, and to a lesser degree, slope, are the important factors with respect to this use. Golf courses, generally speaking, have the same type of limitations, although poorly drained soils may be tolerated if the area is of small size and not located in a strategic place. Soils with moderately fine and fine textured layers often present problems because they remain wet for longer periods after rainfall than the coarser textured soils.

5E. Solid Waste Disposal

Sanitary landfills can become a health hazard if the soil characteristics of the site are not suitable. Limitations of soils for sanitary landfills are determined by the individual characteristics and qualities of drainage, slope, texture, depth and flood hazard. Surface drainage should be handled so as to prevent sedimentation into nearby waters. The soils that seemed to be best suited for this type of use are well drained, free from flooding, are more than 15 feet to bedrock, and have coarse to medium textures. More complete information on solid waste disposal is contained in the Solid Waste Management Plan for Skagit County, developed by the Skagit County Planning Department.

5F. Utilities

Utilities require certain soil types in order to be physically or economically feasible. All soils require care in excavation, just as all forms of construction, including roads, bridges, tunnels, ditches, and channels. Care in examining the amount of clay, percent of slope, and other characteristics could save time and expense when considering such utilities. Proper drainage is required to protect against erosion and landslides.

The type of soil is also important when considering underground utilities, such as water, sewage, drainage, and underground wiring. Structural materials corrode when buried in the soil, as mentioned earlier in this section. A given material will corrode in some soils more rapidly than others. This corrosiveness affects concrete as well as steel.

5G. Cemeteries

Soils for cemetery sites are rated by their stability, drainage, depth to bedrock, or cemented glacial till, slope of land, and flood hazard. The soils best suited for cemetery purposes are deep, well drained, and moderately coarse to moderately fine textured. Freedom from overflow is an important factor here also. Seepage from areas lying at higher elevation can also present some problems.

5H. Industry

Finding good industrial sites that are harmonious with social, economical, and environmental elements is often a monumental task. Soils can present a major hindrance to the location of an industry, although these problems are sometimes less serious than with other uses. Thus, more latitude is given in rating soils for industrial purposes. Soils have been rated to indicate intensity of limitations caused by instability of soils with reference to their load carrying capacity, shrink/swell potential, drainage, and susceptibility to flooding. Soils best suited for industrial sites are those which have high load carrying capacities, and occur on gentle to nearly level slopes. These soils should also have good drainage or be provided with good drainage to eliminate the possibility of contaminating other areas.

5I. Agriculture - Pasture - Forestry

The importance of these uses in Skagit County cannot be over emphasized. For this reason these subjects will be examined in greater detail later in this section.

6. SOIL SUITABILITY TABLE

In the pages that follow this section, Table 2 has been prepared using

TABLE 2

SOILS SUITABILITY

Legend:

A: Slight Limitations C: Severe Limitations
B: Moderate Limitations D: Very severe limitations

Soil Series or Land Types	Buildings	Septic Tanks	Parks	Golf Courses	Sanitary Landfill	Cemeteries	Sewage Lagoons	Industry	Suitability as a Source of: Topsoil	Sand	Gravel	Roadfill	Dikes or Levees	Reservoir Area	Piping hazard
Alderwood	A to B except (D) stony loam	D	A	A to B except (D) for stony loam	D cemented till	C	D	A	Fair to good	Good to poor	Very poor to not suitable	Fair to good	Good when compacted	Good to poor	High hazard
Belfast	D flood hazard	B	B	B	D	D	D	C	Good	Poor to not suitable	Not suitable	Very poor to good depending on amount of sand	Very poor to fair	Poor to good	Low to high hazard
Bellingham	D high shrink/swell	D	D	D	D	D	D	C	Fair to good	Not suitable	Not suitable	Very poor to very suitable as clay increases	Very poor to fair	Very poor to fair	Low to high high hazard
Bow	C to D poor drainage high shrink/swell	D	C	B to C	D	D	B	C	Fair to good	Not suitable	Not suitable	Very poor to fair	Very poor to good	Good	Low to high hazard
Cagey	B to C	D	A	A	D cemented glacial till	D	A	C	Fair	Not suitable to poor	Not suitable to poor	Good	Poor to good	Poor to good	Low to very high
Carbondale	D wet	D	D	D	D	D	D	C	Good	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable	Not suitable
Cathcart	C	D	A to B	A to B	D	D	D	A to B	Fair	Poor	Not suitable	Good	Poor to good	Good	Moderate low to high
Coastal Beach	C	D	A	D unstable	D	D	D	C	Not suitable	Poor to fair	Not suitable	Good	Not suitable	Not suitable	Very high
Cokedale	D flood hazard	D	B	B	D	D	D	D	Good	Not suitable	Not suitable	Fair to good	Poor	High hazard	High
Corkindale	A	A	A to B	A to B	A	A	D	A	Good	Fair	Fair to poor	Good	Poor to good	Poor	High
Coveland	D high shrink/swell	D	D	D	D	D	C to D	C	Poor to good	Not suitable	Not suitable	Not suitable to fair	Very poor to good	Very poor to very good	Low to high
Everett	A to B	A	A to B	A to B	A	A	D permeability	A	Not suitable to fair	Not suitable	Good to excellent	Good	Fair to good	Not suitable	High to very high
Fidalgo	B to C	D bedrock	B to D	B	D	D	D	B to D	Fair	Not suitable	Not suitable	Fair	Fair	Fair	Low to moderate
Giles	A to B	A	A	A	A	A	B	C shear strength	Good	Not suitable	Not suitable	Fair to good	Poor to good	Not suitable to good	Low to high
Gilligan	A	A	A	A	A	A	D piping hazard	C	Very poor to fair	Poor	Poor	Fair (schist)	Poor to good	Not suitable to fair	High to very high
Greenwater	B	A	B to C	A	A	A	D	B	Poor	Good	Poor	Good	Poor to good	Unsuitable	High to very high
Keisler	C to D	D	A	A	D	D	D	A	Fair	Poor	Poor	Good	Poor to good	Fair to very	Mod. low to high
Nevda	D very wet	D	D	D	D	D	D	D	Unsuitable to fair	Very poor	Unsuitable	Good	Poor to good	Unsuitable	High to very high

Soil Series or Land Types	Buildings	Septic Tanks	Parks	Golf Courses	Sanitary Landfill	Cemeteries	Sewage Lagoons	Industry	Suitability as a Source of Topsoil	Sand	Gravel	Roadfill	Dikes or Levees	Reservoir Area	Piping Hazard
Indianola	B	A to B	A to B	A	A	A	D	A	Fair to good	Good	Unsuitable	Good	Poor to good	Unsuitable	High to very high
Klaus	B	B	A	A	A	A	D	A	Very poor	Very poor	Very poor	Good	Good	Unsuitable	High to very high
Kline	D	D	B	B	D	D	D	D	Good to very poor	Very good	Unsuitable	Good	Good	Unsuitable	High to very high
Lummi	D flooding, wet	B	D	D	D	D	D	C	Poor to fair	Unsuitable to fair	Unsuitable	Unsuitable to good	Very poor to good	Very poor to good	Low to very high
Lynden	B	A	A	A	A	A	D	A	Very poor to fair	Excellent	Unsuitable to very poor	Good	Good	Unsuitable	High to very high
Marblemount	D	D	C	D	D	D	D	B to C	Fair	Poor	Unsuitable	Good	----	Unsuitable	High to very high
Mukilteo	---	---	---	---	---	---	---	---	Good	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Very high
Neptune	D Flood hazard	B	B	B	D	D	D	D	Unsuitable	Very poor	Unsuitable	Good	----	Unsuitable	Very high
Nooksachamps	D flood hazard	D	D	D	D	D	D	D	Fair to good	Unsuitable	Unsuitable	Very poor	Very poor to good	Good	Low to high
Norma	D wet	D	D	B	D	D	D	C	Fair to good	Poor	Unsuitable	Very poor	Poor to good	Poor to good	Low to high
Oso	B	D	A	A	D	C	D	B	Good	Unsuitable	Unsuitable	Fair to good	Poor to good	Poor to good	High
Pilchuck	D flood hazard	B	C	C	D	D	C	D	Poor to fair	Fair to good	Unsuitable to poor	Good	Poor	Unsuitable	High to very high
Puget	D flood hazard	D	B	C to D	D	D	D	D	Fair to good	Unsuitable	Unsuitable	Unsuitable to good	Very poor to good	Good	Low to high
Puyallup	D flood hazard	D	B to C	B	D	D	D	C to D	Fair to good	Unsuitable to fair	Unsuitable	Fair to good	Very poor to good	Unsuitable to very good	Mod. low to high
Riffe	D	D	D	D	D	D	D	C	Good	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Very high
Riverwash	D flood hazard	D	D	D	D	D	D	D	Unsuitable	Very poor	Excellent	Good	Poor	Unsuitable	High
Rough Broken Land	D	D	D	D	D	D	D	D	Fair	Unsuitable	Unsuitable	Poor	Unsuitable	Poor to good	High
Rough Mountainous	D	D	A	D	D	D	C to D	B	Unsuitable	Unsuitable	Unsuitable	Good	Unsuitable	Unsuitable	Variable
Rough Rocky Land	D	D	D	D	D	D	D	D	----	----	----	----	----	----	----
Samish	D	D	B	B	D	D	D	C	Good	Unsuitable	Unsuitable	Very poor	Poor	Fair	Low to high
Sauk	A	A	A	A	A	B	B	A	Fair	Poor	Very poor	Good	Poor to good	Poor to fair	High
Saxon	B to D	D	A	A	D	D	D	B	Fair	Unsuitable	Unsuitable	Poor	Poor to good	Poor	Low to high
Semiahmoo	D wet	D	D	D	D	D	D	C	Good	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Unsuitable	High
Semiahmoo (Shallow)	Same	Same	Same	Same	Same	Same	Same	Same	Same	Same	Same	Same	Same	Same	Same
Skipopa	B	D	A	A	C	C	C	B	Very poor	Unsuitable	Poor	Fair	Poor to good	Poor to good	High
Skykomish	B	A	A to C	A to B	A	A to B	D	A	Unsuitable	Unsuitable to fair	Fair to excellent	Good	Good	Unsuitable	High
Snohomish	D flood hazard	D	D	B	D	D	D	C	Fair to good	Unsuitable	Unsuitable	Unsuitable	Unsuitable to fair	Unsuitable	Very high
Squalicum	C to D	D	A	A	D	D	C to D	C to D	Good	Unsuitable	Unsuitable	Poor	Poor to good	Fair to good	Low to high

Soil Series or Land Types	Buildings	Septic Tanks	Parks	Golf Courses	Sanitary Landfill	Cemeteries	Sewage Lagoons	Industry	Suitability as a Source of: Topsoil	Sand	Gravel	Roadfill	Dikes or Levees	Reservoir Area	Piping Hazard
Sultan	D	D	B	B	D	D	D	C	Fair to good	Unsuitable	Unsuitable	Very poor to good	Poor to good	Poor to good	High
Sumas	D flood hazard	D	B	B	D	D	D	C	Poor to good	Unsuitable to good	Unsuitable	Unsuitable to good	Poor to good	Unsuitable	Low to high
Tanwax	D wet	D	D	D	D	D	D	C	Fair	Unsuitable	Unsuitable	Unsuitable	Unsuitable	----	----
Thornton	D	D	D	D	D	D	D	C	Very poor to fair	Very poor	Unsuitable	Fair to poor	Fair to good	Fair to good	High
Thornwood	A	A	A	A	A	A	D	A	Unsuitable to poor	Very poor	Fair	Fair	Good	Unsuitable	Very high
Tidal Marsh	D	D	D	D	D	D	D	D	Very poor	Unsuitable	Unsuitable	Unsuitable	Unsuitable	Unsuitable	High
Tisch	D	D	C	C	D	D	D	C	Poor to fair	Unsuitable	Unsuitable	Good	Very poor to poor	Fair to good	Low to high
Wickersham	B	A	A	A	A	A	D	A	Fair	Unsuitable	Very poor to fair	Poor to fair	Good	Unsuitable	High to very high
Woodinville	C	D	C	C	D	D	D	C	Fair	Unsuitable	Unsuitable	Unsuitable	Poor to good	Poor to fair	High

Prepared from Puget Sound & Adjacent Waters Study and Soil Conservation Soils Survey information from the Puget Sound and Adjacent Waters Study, and Soil Conservation Service Soil Survey to show the specific uses discussed before and the corresponding suitability of each soil to these uses. It is meant to serve as a quick reference to the general possibilities of each major soil group. The seemingly wide ranges in some of the ratings are due to the differences occurring within the various textures of each soil group. This illustrates the need for a thorough investigation of a soil in a certain locality to determine the extent of its particular capabilities before development is allowed to begin.

It should also be mentioned that this table does not take into account other factors that are related to land-use suitability, such as slope and geology. The particular land uses shown in the table are aggregated into general use categories (i.e. agriculture, industry, residential, etc.) and applied to a map. This map and the tables provide a helpful guide for the preliminary investigation of land-use soil suitability of an area.

7. AGRICULTURE, PASTURE, FORESTRY AND SOIL SUITABILITY

The soils of the study area differ widely in terms of suitability for agriculture, pasture or forestry. The Soil Conservation Service's soil survey has examined these areas extensively. It has classified the soils of the county by two general groups: capability groups and management groups.

7A. Capability Groups

Capability grouping is a system of classification whereby eight classes are used to show the suitability of soils for crops, grazing, forestry, and wildlife. It is a practical grouping based on the needs and limitations of the soils, the risks of damage to them, and also their response to management. The soils survey goes into some detail, breaking down the major soils groups by texture and slope. As explained before, this planning study is approaching the subject of soil in more general terms, and thus, lists only major soils groups, and their range of capability classes.

The capability classes and subclasses in Skagit County are defined as follows:

Class I Deep, nearly level, fertile silt loams, and loams; suitable for tilled crops and other uses; few or temporary limitations.

Class II Soils that have moderate limitations if tilled; suitable for crops, pasture, and trees.

SubClass IIw--Nearly level, fertile soils that are moderately limited by floods, excess water from seepage, or high water table.

SubClass IIs--Deep soils that are limited by moderate fertility and moderate capacity for holding moisture available.

Class III Soils that have moderately serious limitations and require careful management if tilled; suitable for crops, pasture, and trees.

SubClass IIIw--Slowly permeable soils that require improved drainage if used for tilled crops.

SubClass IIIs--Soils that are limited in use because of shallowness, low fertility, or little capacity for holding moisture available.

Class IV Soils that are suited to pasture or trees. They have serious limitations and should be tilled only occasionally.

SubClass IVe--Slowly or very slowly permeable sloping soils that are erodible if cultivated.

SubClass IVw--Shallow soils that are seriously limited in use because of excess water.

SubClass IVs--Soils that have limited use because of low fertility, shallowness, low permeability, or little capacity for holding moisture available.

Class V No soils of this class in Skagit County. These are droughty, wet, low in fertility, or otherwise unsuitable for cultivation.

Class VI Soils generally suited to pasture or trees, but not suited to tilled crops.

SubClass VIe--Moderately steep soils that are generally suited to pasture and trees; erodible if cover is not maintained.

SubClass VIs--Soils that are only moderately well suited to pasture and trees because of low fertility and little capacity for holding moisture available.

Class VII Soils that may be used for pasture or trees, but have severe hazards; not suited to tilled crops.

SubClass VIIe--Soils on steep slopes that are erodible if good cover is not maintained.

SubClass VIIs--Soils on steep slopes that are erodible if good cover is not maintained.

Class VIII Soils that will not produce vegetation of any kind in commercial quantities.

7B. Management Groups

The other soil classification system used by the soils survey in detail is management groups. The soils of the area are placed in these groups on the basis of characteristics that determine their similarity in use suitability and management needs. Suitable crops are given along with suggested fertilization and other management.

Here, too, it is necessary to be more general than the soils survey, and present only the major soils groups.

Management Group 1 - This group consists of gravelly, moderately textured, droughty soils, underlain by glacial till. Suitable crops are grasses and grass-legume mixtures (largely for pasture), clovers and vetches, oats for hay, and strawberries.

Management Group 2 - This group consists of medium textured, well-drained soils underlain by bedrock. Suitable crops are grasses and grass-legume mixtures (largely for pasture), clovers and vetches, oats for hay, and strawberries.

Management Group 3 - This group consists of moderately coarse textured, and medium textured, somewhat excessively drained soils underlain by loose glacial drift. Not suitable for rotation crops. Cleared areas should be kept in permanent pasture of grass and legumes. Some low lying areas may be suited to hay.

Management Group 4 - This group consists of coarse, moderately coarse, and medium textured, somewhat excessively drained soils underlain by loose glacial outwash. Suitable crops are grasses and grass-legume mixtures (largely for pasture), clovers and vetches, strawberries, and forest. Some limited use for cultivated crops.

Management Group 5 - This group consists of medium textured, well drained to poorly drained soils underlain by fine textured glacial till or glacial lake materials. Suitable crops are grasses and grass-legume mixtures, clovers and vetches, oats for grain or hay. The coveland and saxon soils are suited to peas, wheat, potatoes, and strawberries.

Management Group 6 - This group consists of medium textured, predominately well drained to moderately well drained soils of the terraces underlain by glacial outwashes. Suitable crops are grasses and grass-legume mixtures, clovers and vetches, alfalfa (not suitable for corkindale soils), oats for hay or grain, strawberries, and raspberries.

Management Group 7 - This group consists of poorly drained soils that need artificial drainage. Suitable crops are grasses and grass-legume mixtures, and oats for hay or grain. Permanent pasture is the best use for Bellingham clay.

Management Group 8 - This group consists of somewhat excessively drained to moderately well drained alluvial soils with alluvium substrata. They are occasionally flooded and can be irrigated. Pilchuck soils on nearly level slopes are very droughty and frequently flooded. Suitable crops are grasses and grass-legume mixtures, clovers and vetches, alfalfa, oats for hay or grain, strawberries, peas, potatoes, raspberries, and vegetable seed crops.

Management Group 9 - The soils of this group are improved by artificial drainage. They are poorly drained soils derived from alluvial materials. Suitable crops are grasses and grass-legume mixtures, clovers and vetches, alfalfa, small grains for hay or grain, strawberries, potatoes, peas, and vegetable seed crops.

Management Group 10 - The soils of this group need artificial drainage. They are poorly drained soils derived from alluvial materials. Suitable crops are grasses and grass-legume mixtures, clovers and vetches, small grains for hay or grain, peas, strawberries, vegetables for seed-turnip, cabbage, beets, spinach, and rutabagas (grown mostly on Puget and Sumas soils), and potatoes (commercial or seed). Permanent pasture belt for Hovde and Thornton soils.

Management Group 11 - The soils of this group need artificial drainage. They are very poorly drained organic soils. Suitable crops consist of grasses and grass-legume mixtures, oats for hay, blackberries, boysenberries, loganberries, youngberries, blueberries, vegetables, and potatoes. Cranberries are the only crop suitable for greenwood peat. The tanwax peats are best for permanent pasture.

Management Group 12 - This group consists of hilly, steep, or stony soils. These soils are suited only to forest. The miscellaneous land types are not suited to forest. Coastal beach and riverwash materials can be used for construction.

7C. Agriculture Suitability Table

These groups, combined with other data, are listed in Table 3 at the end of this section. One of the elements of this table shows the average yields to be expected over a period of years. Column A depicts the yields to be expected under common management practices, while Column B represents yields to be expected under soils conservation services management practices. The table also lists capability classes and management groups for each soil. The last two columns rate the potential for pasture and forest.

8. SOILS MAP

A generalized soils map (C) of the study area is presented in the Map Section of this report. It shows only the general soils relationships to specific areas. The more precise data of the Soil Conservation

Service should be used for specific purposes. However, one can compare the soils of this map with the various tables provided and get a reasonable idea of the overall soil suitability of an area.

TABLE 3

AGRICULTURAL, PASTURE, FORESTRY, AND SOIL SUITABILITY

Legend:

A: Yields to be expected under management most commonly practiced.
B: Yields to be expected under better than average management.

Soil Series or Land Types	Clover & Grass Hay A Tons	Clover & Grass Hay B Tons	Oat Hay A Tons	Oat Hay B Tons	Oats A Bu.	Oats B Bu	Wheat A Bu.	Wheat B Bu.	Peas (Green) A Lb.	Peas (Green) B Lb	Potatoes A Lb.	Potatoes B Lb.	Strawberries A Lb.	Strawberries B Lb.	Capability Class	Management Group	Pasture	Forest
Alderwood	15	13 1/2	16 3/4	21 1/4	155	185	---	---	---	---	---	---	11,400	13,600	IIIw, IVs, VIe, VIIe	1, 12	Not suitable to fair	Poor to good
Belfast	3 1/4	4 1/7	3 1/2	4 2/3	75	85	40	50	2,700	3,500	---	---	3,900	4,500	IIs	8	Very good	Excellent
Bellingham	17 2/3	20	18	21 1/2	250	290	---	---	---	---	---	---	---	---	IIIw, IVw	7	Good to very good	Poor to fair
Bow	26 3/4	32 3/4	24 1/4	30	445	610	---	---	---	---	---	---	---	---	IVe, IVs, IVa, VIe, VIIe	5, 12	Not suitable to good	Fair to good
Cagey	8 1/3	10 1/2	9 1/6	9 2/3	90	110	---	---	---	---	---	---	9,200	11,000	IIIs, IVs	1	Fair	Good
Carbondale	7	8 1/2	6 1/2	8	155	175	---	---	---	---	---	---	---	---	IIw, IIIw	11	Excellent	Good
Cathcart	7 3/4	10	7 1/4	9	150	195	---	---	---	---	---	---	---	---	IIIs, IVs, VIe, VIIe	2, 12	Fair to good	Good to very good
Coastal Beach	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIII	12	---	---
Cokedale	16	22	17 1/4	24 1/2	365	415	---	---	11,200	14,400	---	---	17,800	19,800	IIw, IIIw	10	Very good to excellent	Good to very good
Corkindale	---	---	3 1/2	4 1/3	---	---	---	---	---	---	---	---	---	---	IVs, VIs, VIIe	6, 12	Fair	Very good
Coveland	14 1/4	17 3/4	14 1/2	18 1/4	175	235	---	---	---	---	---	---	---	---	IIIs, IIIw	5, 8	Very good	Good
Everett	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIs, VIIe	3, 12	Poor	Poor to fair
Fidalgo	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIs, VIIe	12	---	Fair to good
Giles	10 1/2	12 1/4	10	13 1/2	220	280	---	---	---	---	---	---	9,500	11,100	IIIs, IVs	6	Very good	Excellent
Gilligan	10	11 3/4	9	12	200	250	---	---	---	---	---	---	9,400	10,700	IIIs	6	Very good	Excellent
Greenwater	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIs	4	---	Fair to good
Greenwood Peat	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VII	11	---	---
Heisler	---	---	---	---	---	---	---	---	---	---	---	---	---	---	IVs, VIe, VIIe	2, 12	---	Good to very good
Hovde	---	---	---	---	---	---	---	---	---	---	---	---	---	---	IVc	10	Poor	---
Indianola	3 1/2	4 3/4	1 1/2	1 3/4	---	---	---	---	---	---	---	---	---	---	IVs, VIs, VIIe	3, 12	Poor to fair	Fair to good
Klaus	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIe, VIs	2, 12	Fair	Good
Kline	14 1/4	18 1/2	15 1/2	20 2/3	325	375	---	---	---	---	---	---	17,700	20,700	IVs	8	Very good	Very good
Lummi	5 3/4	8 1/4	6 1/2	8 1/2	150	170	---	---	---	---	---	---	---	---	IIIw	10	Excellent	Poor
Lynden	9 1/2	11	9 1/2	11	---	---	---	---	---	---	---	---	12,400	14,600	IIIs, IVs	4	Poor to fair	Good
Made Land	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIII	12	---	---
Marblemount	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIe	12	---	Very good
Mukilteo Peat	5 1/2	6 1/2	5 1/3	6 1/2	135	155	---	---	---	---	---	---	---	---	IIw, IIIw	11	Very good	Poor
Neptune	---	---	---	---	---	---	---	---	---	---	---	---	---	---	IVs	8	Good	Poor

Soil Series or Land Types	Clover & Grass Hay A Tons	Clover & Grass Hay B Tons	Oat Hay A Tons	Oat Hay B Tons	Oats A Bu.	Oats B Bu.	Wheat A Bu.	Wheat B Bu.	Peas (Green) A Lb.	Peas (Green) B Lb.	Potatoes A Lb.	Potatoes B Lb.	Strawberries A Lb.	Strawberries B Lb.	Capability Class	Management Group	Pasture	Forest
Nooksachamps	6 1/4	8 1/2	7	9	155	185	---	---	6,600	8,600	---	---	---	---	IIw	10	Excellent	Good
Norma	11	12 3/4	10 1/2	12 3/4	---	---	---	---	---	---	---	---	---	---	IIIw	7	Very good	Good
Oso	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIe, VIs, VIIe	2, 12	----	Very good
Pilchuck	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIs	6	Poor	Poor
Puget	14 1/2	17 1/3	14 1/2	17 1/3	330	370	210	260	13,000	16,000	990	1,190	14,700	15,800	IIs, IIw	9, 10	Very good to excellent	Very good
Puyallup	13	15 3/4	13	15 3/4	185	240	165	230	10,800	12,800	760	910	14,630	16,200	IIs, IIIs	3, 9	Very good to excellent	Very good
Rifle Peat	6	8	5 1/2	7 1/2	145	165	---	---	---	---	---	---	---	---	IIw, IIIw	11	Excellent	Good
Riverwash	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIII	12	----	----
Rough Broken Land	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIIe	12	----	Fair
Rough Mountainous Land	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIIe	12	----	Very good
Rough Rocky Land	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIIs	12	----	Variable
Samish	6 1/4	8 1/4	6 1/4	8 1/4	145	165	---	---	3,300	4,200	---	---	3,500	3,800	IIw	10	Very good	Good to very good
Sauk	5 1/3	6	5	7	---	---	---	---	---	---	---	---	---	---	IIIs	6	Good	Excellent
Saxon	---	---	---	---	---	---	---	---	---	---	---	---	---	---	IIIs, IVe, VIe	5, 12	Good	Excellent
Semiahmoo	6 1/2	8	6	7 1/2	145	165	---	---	---	---	---	---	---	---	IIw, IVw	11	Excellent	Poor
Skiyou	3 1/4	4 1/4	3 3/4	4 3/4	---	---	---	---	---	---	---	---	---	---	IVs, VIe, VIIe	1, 12	Fair	Fair to good
Skykomish	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIs	4, 12	Poor	Fair
Snohomish	7	8 1/2	7 1/2	9	165	185	105	130	6,700	6,700	480	580	---	---	IIw	10	Excellent	Very good
Squalicum	5	6 1/2	5 3/4	7 1/4	70	85	---	---	---	---	---	---	---	---	IVs, VIe, VIIe	1, 12	Fair	Good
Sultan	12 1/2	16	13	15 1/2	235	265	140	185	13,000	17,200	725	875	15,200	16,900	I, IIs, IVs	9	Very good to excellent	Very good to excellent
Sumas	14 2/3	17 1/3	14 2/3	17 1/3	325	365	205	255	14,400	18,700	980	1,180	14,900	16,300	IIw	10	Excellent	Very good
Tanwax Peat	---	---	---	---	---	---	---	---	---	---	---	---	---	---	IIIw, IVw	11	----	Poor
Thornton	---	---	---	---	---	---	---	---	---	---	---	---	---	---	IVs	10	Fair	Fair
Thornwood	3	4	---	---	---	---	---	---	---	---	---	---	---	---	IVs, VIIe	3, 12	Poor to fair	Good
Tidal Marsh	---	---	---	---	---	---	---	---	---	---	---	---	---	---	VIII	12	Poor	Poor
Tisch	---	---	---	---	---	---	---	---	---	---	---	---	---	---	IIIw	7	Good	Poor
Wickersham	8 1/2	10 1/2	9	11 1/2	---	---	---	---	---	---	---	---	---	---	IIIs	8	Good to very good	Good
Woodinville	3 2/3	4 1/2	3 3/4	4 1/2	80	90	50	65	3,400	4,200	230	280	---	---	IIw	10	Excellent	Good

Data used from Soil Conservation Service Soils Survey, 1960.

SEPTIC SUITABILITY

1. INTRODUCTION

Septic suitability is a term used to define the conditions pertaining to a certain area with respect to individual sewage disposal systems or septic tanks. The suitability of an area is usually thought of in terms of degree (i.e. good, moderate, poor, very poor, etc.). The information presented in this section is an attempt to give a generalized picture of the septic suitability of the study area. Every site proposed for development should be tested thoroughly. Thus, relying on the map and tables accompanying this section is not conclusive assurance that a specific site will meet the septic tank requirements set forth by the state sanitary waste disposal regulations. Additional information on septic suitability is available through the County Health Department and the State Department of Social and Health Services.

2. PLANNING IMPLICATIONS

The primary reason for strict regulations concerning the use of septic tanks is because of the potential health hazard involved if a system fails. For this reason, septic tanks are considered to be an interim solution to the problem of sewage disposal. Septic tank failures are caused by a variety of factors, including the physical characteristics of an area (soil, slope, high water table, etc.), inadequate attention by homeowners, poor design or installation, or merely that the natural life of the drainfield is ended. If a soil is too cemented and will not drain well, the chance of discharge from the septic tank reaching the surface presents a serious health hazard to the owner and his neighbors. The failure of the effluent to filter down through the soil properly also presents the problem of it flowing overland onto other property, or possibly discharging into a stream, lake, or other body of water. Congruently, if the soil is too permeable, the filtering process that the effluent undergoes may be insufficient, causing pollution of the groundwater, which, in turn, affects surface water. It can be seen that if these failures were to occur in number they would affect a widespread area.

The suitability of soils for the use of septic tanks as a means of sewage disposal is an important locational factor in the planning process. Sewer systems cannot always be provided to a given area at a certain time, usually because of economic reasons. Distance is also an important economic factor in relation to sewer systems. There might be too great a distance between the outer extremities of existing facilities and a new development which delay the extension of these services.

3. SUITABILITY CRITERIA

The actual suitability of the soil for septic tanks depends on a number of criteria. The following are taken primarily from the new proposed State Board of Health Regulations for individual sewage disposal systems:

3A. Soil permeability

The soil must be permeable; that is, water should filter through it at a reasonable rate which does not cause the water to eventually reach the surface. The various percolation rates and their degree of acceptance are defined in the new state regulations.

3B. High water table or floodplain

The existence of a seasonal high water table or the danger of flooding exclude the use of septic tanks in an area. According to state regulations, "No individual sewage disposal system shall be located in an area where surface water will accumulate." The state regulations also say, "No part of a septic tank system shall be constructed in a location subject to flooding." This is meant to include any area within the 50 year floodplain.

3C. Soil Depth

The new state standards also spell out the fact that the minimum amount of suitable soil or substratum shall be no less than three feet in depth. That is, over and above the other criteria, an area must have a minimum of three feet between the bottom of the disposal field and the maximum seasonal ground water elevation or impermeable layer, to qualify as suitable for septic tank use.

3D. Slope

Slope is also an important locational factor with regard to septic tanks. There seems to be a point at which the construction of a good functioning system becomes a very difficult task. This is centered around the problem of overloading the lower portions of the drainfield when a steep slope is involved. Other problems occur in excavation and construction. For the purposes of this study, any slope over 15% was considered to present severe limitations with regard to the proper construction and functioning of a septic tank system.

4. SEPTIC TANK DESIGN

Although specific design criteria for individual sewage disposal systems are not generally considered in a comprehensive planning effort, mention of some of these may be helpful in understanding the locational criteria and their ramifications. Design criteria generally follow the "Manual of Septic Tank Practice" of the Public Health Service, except where changes by succeeding regulations have been made.

Initially, a septic tank is designed to receive all sanitary sewage from the building served and industrial wastes are usually prohibited from being discharged into this type of system.

The size of the effluent absorption area is determined by the results of the percolation tests performed, together with an evaluation of soil data, drainage conditions, and other pertinent data. This area should be selected and maintained so that it is free from encroachment by buildings or by trees or shrubbery whose roots may cause clogging of the system. The area should also be free from vehicular traffic as well as pavement. The depth for approved seepaged pits is not in excess of ten feet below finished grade, and should not be used for disposal of septic tank effluent.

As per the new state regulations, septic tanks serving a single family residence should meet or exceed the following capacities:

Number of Bedrooms	Liquid Capacity of Tank Gallons
2 or less	750
3	900
4	1,000
Each additional bedroom add	250

Two compartment tanks are considered to be superior to the single tank form. Septic tanks and dosing tanks are constructed of corrosive resistant material and are designed to be watertight. They may be constructed of poured in-place concrete, precast reinforced concrete, concrete blocks with mortar joints, or other materials that are approved by a health officer. Other design factors that should be considered here are the provision of suitable baffles and/or tees to prevent floating solids from leaving the tank and cleanouts for easy removal of the tank contents.

5. SEPTIC SUITABILITY MAP (See Map D in the Map Section of this report)

The septic suitability map is a graphic interpretation of the acceptibility for septic tanks of various areas in the county, using the table at the end of this section as a reference. It must again be emphasized that this is a generalized map. The accompanying table may also be considered generalized. They do, however, give an initial insight into the septic suitability of a general area. The only way to attain accurate information as to the suitability of a specific area is to perform a series of tests at that site during the time of greatest precipitation.

Land areas were classified in one of four categories: A. possessing only slight limitations with regard to septic suitability; B. possessing moderate limitations; C. being of a variable nature (primarily with regard to soil depth and slope), and D. possessing severe limitations.

This map, combined with other physical, social, and economic characteristics, can help determine the best possible location for various land-uses in Skagit County.

Table 1

GENERAL SEPTIC SUITABILITY OF SKAGIT COUNTY SOILS

Legend:

(A) slight limitations (C) variable
(B) moderate limitations (D) severe limitations

Soil and Rating	Soil Depth Less Than 36 Inches	Hazard of Flooding or Highwater Table	Slow Internal Drainage or Permeability	Excessive Slope
All Alderwood (C)	Variable (20-36)	Some	Medium to cemented till; then very slow	Yes, when 15% and over
Belfast (D)		Yes		
All Bellinghams (D)	Variable (20-36)	Yes	Yes - very slow	
All Bows (D)	Variable (10-36)	Yes	Yes	Yes, when 15% and over
All Cageys (C)	Variable (20-60)	Some	Rapid to cemented till then very slow	
Carbondale Muck (D)	Variable (8-60)	Yes	Yes	
All Cathcarts (C)	Variable (0-60)			Yes, when 15% and over
Coastal Beach (D)	Yes	Yes Continual		
All Cokedales (D)		Yes		
Corkindale Loam (D)	Yes (15-24)			
Corkindale Loam (C) 8-15% slope	Variable (20-36)			
Corkindale Loam (D) slope 15% & over	Variable (20-36)			Yes, when 15% and over
All Covelands (D)	Variable (18-60)	Yes	Yes	
All Everetts (C)	Variable (20-36)	Some		Yes, when 15% and over
All Fidalgos (D)	Yes (10-24)			Yes, when 15% and over
All Giles (A)				
All Gilligans (C)	Variable (20-60+)			
All Greenwaters (A)				
Greenwood Peat	Yes	Yes	Yes	
All Heislers (A) 0-15% slope				When on 8-15% could cause rating of (B)
All Heislers (D) 15-30+% slopes				Yes, 15-30+%
Hovde Loamy Sand (D)	Yes (10-20)	Yes Continual	Yes	
All Indianolas (C)	Variable (20-36)			Yes, when 15% and over
All Klauses (C)	Variable (20-36)			Yes, when 15% and over
Kline Silt Loam (D)		Yes		
Kline Loam (D) 1-3% slope		Yes		

GENERAL SEPTIC SUITABILITY OF SKAGIT COUNTY SOILS

Soil and Rating	Soil Depth Less Than 36 Inches	Hazard of Flooding or Highwater Table	Slow Internal Drainage or Permeability	Excessive Slope
Kline Loam (B) 3-8%			Medium	
Kline Gravelly Loam (B)			Medium	
Kline Sandy Loam (A)				
All Lummis (D)	Variable (20-36)	Yes Continual	Yes - very slow	
All Lyndens (C)	Variable (20-36)			
Marblemount Stony Loam (D)				Yes (15-30%)
Mukilteo Peat (D)	Variable (20-36)	Yes	Yes	
Neptune Sandy Loam (D)		Yes		
All Nookachamps (D)	Variable (20-36)	Yes	Yes - very slow	
All Normas (D)	Variable (20-36)	Yes	Yes - very slow	
Oso Loam (B) 3-15% slope			Medium	
Oso Loam (D) 15-30%			Medium	Yes, 15-30+%
All Pilchucks (D)	Yes (10-20)	Yes		
All Pugets (D)	Variable (20-60)	Yes	Yes - very slow	
All Puyallups (D)		Yes		
Rifle Peat (D)		Yes	Yes - very slow	
Riverwash (D)		Yes		
Rough Broken (C)		Some	Variable	Yes, when 15-30+%
Rough Mountainous (C)	Variable (0-60)		Variable	Yes, when 15-30+%
Rough Rocky (D)	Yes (0-20)		Variable	Yes, when 15-30%
All Samishes (D)	Variable (24-36)	Yes	Yes	
All Sauks (B)			Medium	
Saxons (B) 3-15% slopes			Medium	
Saxons (D) 15-30%			Medium	Yes (15-30%)
Semiahmoo Muck (D)	Variable (20-36)	Yes	Yes - very slow	
All Skiyous (C)	Variable (20-36)		Medium to cemented till; then very slow	Yes, when 15-30+%
All Skykomishes (C)	Variable (20-36)			Yes, when 15-30+%
All Snohomishes (D)	Variable (20-36)	Yes	Yes	
All Squalicums (C)	Variable (20-36)		Medium to cemented till; then very slow	Yes, when 15-30+%

GENERAL SEPTIC SUITABILITY OF SKAGIT COUNTY SOILS

Soil and Rating	Soil Depth Less Than 36 Inches	Hazard of Flooding or Highwater Table	Slow Internal Drainage or Permeability	Excessive Slope
All Sultans (D)		Yes	Medium	
All Sumases (D)	Variable (10-60)	Yes	Yes - very slow	
Tanwax Peat (D)	Yes (10-20)	Yes Continual	Yes - very slow	
All Thorntons (D)	Yes (10-20)	Yes	Yes - very slow	
All Thronwoods (C)	Variable (20-36)			Yes, when 15-30+%
Tidal Marsh (D)	Yes	Yes Continual	Yes - very slow	
Tisch Silty Clay Loam (D)	Yes (10-20)	Yes	Yes - very slow	
All Wickershams (C)	Variable (20-36)		Medium	
Woodinville Silt Loam (D)	Variable (20-36)	Yes	Yes - very slow	

Developed with reference to the State Board of Health Regulations for individual sewage disposal systems, The Skagit County Soil Survey - Soil Conservation Service, and The Puget Sound and Adjacent Waters Study - Puget Sound Task Force--Pacific N.W. River Basins Commission.

SLOPE ANALYSIS

1. INTRODUCTION

Careful analysis of various slopes can be a significant factor in determining the proper use of a parcel of land. Two main elements of slope that must be considered when examining the possibility of development are its steepness (slope %), and its aspect (the orientation of a sloping ground surface with respect to geographic north).

2. SLOPE STEEPNESS

Slope steepness affects the rate at which precipitation is drained from the surface. On steep slopes surface runoff is rapid and water does not long remain available to plants. On gentle slopes, much of the precipitation can penetrate the soil and become available for prolonged plant use. The thickness of the soil may be lessened by the process of erosion. Thus, the characteristics of the soil itself may often be related to slope steepness.

3. SLOPE STEEPNESS AND ACCELERATED LAND EROSION

The occurance of certain geologic processes such as overland flow, earth flow, mud flow, landslides, rockfall, and soil creep are directly related to the steepness of the slope and thus effect the amount to which a certain piece of land can be developed. The eroding capacity of these processes increases directly with the angle of the slope.

Under stable, natural conditions, the erosion rate is slow enough that the soil is maintained, thus enabling vegetation to maintain itself. By contrast, the rate of soil erosion may be increased through man-made activities or rare natural events to result in a state of accelerated erosion, removing the soil much faster than it can be formed. This condition comes about most commonly from a change in the conditions of the vegetative cover and physical state of the ground surface.

4. SLOPE ASPECT

The second element of slope which may have an effect on its use is slope aspect. As stated earlier, this concept is involved with the direction in which the slope is facing. It has direct influence upon plants by increasing or decreasing their exposure to sunlight and prevailing winds. Upon divides, peaks, and ridge crests the soil tends to be drier because of rapid drainage and because the surfaces are more exposed to sunlight and to drying winds. Generally speaking, slopes facing the sun have a warmer, drier environment than slopes facing away from the sun. A good example might be the location of a ski area. Some slopes have more snow, due in part to their slope aspect.

Slope aspect affects light and shade, and heat and cold. This in turn has an effect on the architectural expression of a structure. For example, if an architect wanted a sunny open effect to be expressed in his building, he would choose the side of the hill that receives the most sunlight.

5. VIEW CHARACTERISTICS

5A. Planning and View

View can be a positive factor in the overall range of choices of housing facilities in an area. There are numerous areas within the county that provide breathtaking views of mountains, rivers, cities, islands, and the sound. Some areas contain a number of these views on the same piece of land. This is not to say, however, that all land having a view is automatically developable as residential property. There are many aspects involved when considering an area for potential residential view property. First, the demand for such property has to be appropriate. Secondly, some view property proposes severe limitations on building in terms of slope, soil suitability, septic suitability, and the provision of the necessary utilities such as water, roads, and sewers.

There are other subtle aspects involved in view property such as the balance between it and the other choices of housing types within an area. Another concern would be the actual design and layout of a proposed structure or structures, to afford not only a pleasing view setting for that development, but also one that is pleasing to present and future residents, as well as to the general public.

5B. Rating Views

View can be a very intangible phenomenon. A certain view may seem spectacular to one person, while to another person it hardly rates a yawn. Thus, it is a very difficult task to inventory, much less rate, various views.

Basically, when rating areas of view or view potential, four elements were considered. Areas rated as "one," or excellent, were those that possessed an excellent panoramic view. (It is realized here that "beauty is to the beholder," and some views with a lesser range or angle of vision are very spectacular). Views rated as "two," were considered to be good, but generally had a lesser angle of vision than views rated "one." Areas shown as "three" were considered to have good view potential, given proper design, location, and construction of the structures under consideration. Areas that were rated by a "four" were considered to have a fair view with limited vision and scope, generally focusing on a single proximate attraction.

Using this general rating scale, a map was prepared depicting areas of view, and their subsequent qualifications or restrictions. This map (Map F) is included at the end of this section.

6. SLOPE ANALYSIS OF THE STUDY AREA (See Map E in the Map Section)

The numerous mountains, hills, and valleys of Skagit County are a product of many forces over a certain expanse of time. However, the general shapes and slopes that have been created were probably most influenced by the last glaciation, the constant flow of the Skagit River System and the movements of the earth's crust. By analyzing and understanding these slopes, one can realize both their potentials and their weaknesses and the connection in the proper functioning of our ecosystem.

6A. South Skagit Floodplain

Slope Characteristics

The first, and probably most important area to be examined is the floodplain area. For ease in making this analysis more understandable, the Skagit and Samish Floodplains are broken up into three specific areas. The southern portion of the Skagit Floodplain will be the first to be examined. It covers approximately the area of Township 33N - 34N and Range 3E. This section of the floodplain is reasonably flat with a range of 0-3% slope over most of the land. However, there are areas of slope ranging from 3% to 15%, most notably the Pleasant Ridge area and the Fish Town area, near LaConner.

Planning Implications

When considering slope and its related aspects, some slopes tend to be more suitable to certain uses than others. The floodplain seems to be best suited for agriculture and other compatible uses such as pasture, recreation, open space, and forestry.

This is partially due to the amount of 0-3% slope that is on the floodplain, the fertile alluvium soils left there by the river, and the rather high water table that exists there. For the same reasons, extensive urban related development would be less satisfactorily located in this area. Drainage is rather poor in this area due to its nearly level slope, soil characteristics, and high water table. All of these, plus the constant danger of flooding, place a burden on the amount of development that can conceivably take place within the floodplain. The Pleasant Ridge and Fish Town areas do offer the possibility of some moderate intensity development. They contain some moderate slopes with good view characteristics. This view element should be included in the locational analysis of land uses, especially residential and recreational areas. There are many other areas in the study area with quite spectacular views that should be examined. One major problem that hinders development in many such areas is the poor septic suitability of the soils, the limited amount of sewers and the shrink/swell characteristics of the soil. The Water, Sewage and Drainage Plan for Skagit County, compiled by Stevens, Thompson, and Runyan in 1970 does call for sewage lines and treatment facilities in the Pleasant Ridge area. (See Map G in the Map Section)

6B. Burlington/Bayview Proper

Slope Characteristics

The area consisting of the northern half of Township 34N and the southern half of Township 35N of Range 3E and part of Range 4E is designated as Burlington/Bayview Proper. It is entirely in the floodplain of the Skagit and has much the same characteristics as the South Skagit Floodplain area. The Bayview area does have a plentiful amount of land having a moderate slope ranging from 3-15%.

Planning Implications

The views that the slopes in this area provide are a great asset to its potential. It too has septic suitability problems and is an area that was examined in the sewage plan mentioned earlier. Bayview provides an opportunity for development on the floodplain, but well above the dangers and problems that exist there.

6C. Bow/Alger/Samish Proper

Slope Characteristics

The Bow/Alger/Samish Proper area incorporates each of these specific vicinities into one general area. Its boundaries can be seen on Boundary Map (B). It is an area typified by a mixture of slopes. There are areas along the Samish River and its floodplain that are virtually flat. There are other areas, such as the Chuckanut Hills, the areas just north and east of Alger, Anderson Mountain, and in various places along the river, that are steep, with slopes of 30% or more. There are, however, areas of moderate slope scattered throughout this region. The Alger vicinity and southward has a good variety of slope configuration. The Bow Hill area probably has the most potential when considering the availability of land with suitable slope characteristics.

Planning Implications

The areas mentioned that have rather gentle slopes, especially the Bow Hill area, have a good potential for urban related development. The view potential is very good in some places. The 3-8%, and in some instances, the 8-15% slope categories are usually considered to be the best suited for urban related development. Naturally, there are other characteristics involved. Moderate slopes generally have the best drainage with the least possibility of erosion. The ramifications of the erosional process were explained earlier in this section. The capacity of the soil to support development can be greatly affected by the steepness of the slope. For example, it would be a rather difficult task to build a large structure, such as a sports arena, on a steep slope. In much the same respect, it would be equally as complex to put that sports arena on the floodplain due to other problems such as high water table and unsuitable soil to bear the structure's weight.

6D. Sedro Woolley Proper

Slope Characteristics

Most of the city of Sedro Woolley and the area directly west of it are in the Skagit Floodplain and consequently in 0-3% slope category. The areas north and south of the city, however, show a variety of slopes suitable for urbanization that are above the floodplain. The northern most segment of this area, north of Prairie is fairly steep, being mostly 30% or better.

Planning Implications

The city of Sedro Woolley has a good chance of expanding northward out of the dangers of the flood area. The land north of Sedro Woolley has an abundance of suitable slopes, ranging primarily from 0 to 15%. The Samish River Valley opens up into quite an expansive and attractive area, easily accessible to Sedro Woolley. According to our information, flooding of the Samish this far up the river is fairly minimal.

It is regrettable that the sewage plan mentioned earlier did not take this area into account and thus it lacks both existing or proposed sewage facilities. Hopefully, this is something that would be examined in the future.

6E. Mount Vernon Proper

Slope Characteristics

Like the other major cities in the study area, most of Mount Vernon lies in the floodplain. The area around East Mount Vernon does have some slopes ranging from 0-15%. However, it appears the characteristics of the predominately Bow soil causes some complications for development. This is primarily centered upon the unsatisfactory shrink/swell characteristics of this soil group. Septic suitability can also be a problem in this soil. The degree of success in overcoming these complications is related to the application of the architectural and engineering elements of each specific development design.

The Big Lake area and the slopes surrounding Walker Valley all have a gentle 3-8% slope. Also, parts of the valley between Big Lake and Lake McMurray have a 0-3% or 3-8% slope.

The ridge running southward from Mount Vernon, including the area east of Conway, has some fairly moderate slopes, although it is intermittently steep in places.

Planning Implications

Taking into consideration only the dangers and complications of the floodplain, it would appear that Mount Vernon's potential growth area lies east of the present city. There is plenty of land available here with suitable slope characteristics. The variation in slopes would present a pleasing atmosphere in terms of design potentials. The soil problem has already been discussed earlier.

The corridor running south through Walker Valley, around Big Lake, to Lake McMurray, has areas where the slope suitability and view characteristics are good.

The view potential of part of the ridge running south from Mount Vernon is excellent. Residential development in this area is quite suitable. The area near Conway, especially eastward, also has good potential for urban development. The topography is such that it would lend itself to a variety of designs and functions. Some of the mountainous areas between and around Little Mountain and Devils Mountain are quite steep, thus excluding development on these slopes.

6F. Middle Skagit River

Slope Characteristics

This is approximately the area in and around the Skagit River Valley from Sedro Woolley to Concrete. East of Sedro Woolley the river valley forms a narrow swath of fairly level land with a slope range of approximately 0-3%. The slope of the hills on the south side of the river tends to be more abrupt than that on the north, generally being 30% or better. The hills on the north side of the river valley, especially near Sedro Woolley, have a fairly substantial amount of area with 3-15% slope.

Planning Implications

The flat portion of the river valley is within the flood danger area. This presents the same problems for development as stated earlier. The areas of moderate slope north of the river valley and closer to Sedro Woolley lend themselves to urban related development.

6G. Upper Skagit River

Slope Characteristics

Between Concrete and Rockport the steep hills rise closer to the river, reducing the width of the basin. From Rockport to Marblemount the valley becomes wider again.

Planning Implications

There is only a small amount of land available outside of the floodplain that has a slope suitable for extensive development and these areas are usually removed from the river and only marginally desirable. Much of the land is in the higher slope categories (15-30%

and 30%+). There are exceptions, especially when considering other elements of locational suitability. On the whole, however, the slopes tend to be too steep, unstable, and rugged for development. They seem to lend themselves more to recreational and resource needs, such as hiking, camping, forestry, power production and other related uses.

6H. Other areas

East of Marblemount, throughout the Mount Baker National Forest, the Cascade River area and the Sauk River area, the hills and mountains have a wide range of slopes. Because of heavy snowfall in the winter, heavy rain, wild streams and rivers, loose soil and areas void of sufficient vegetation combined with steep slopes, there are hazards of snow slides, rock slides, land slides and heavy erosion. This deters everything but the more passive type of recreational uses in most of these areas.

FLOOD CHARACTERISTICS

One of the primary purposes of this study was to analyze flooding and floodplain management as they relate to physical land-use planning. To accomplish this, it was necessary to thoroughly review the characteristics of flood in general as well as specifically within the Skagit Regional Planning area. Once developed, the data on flood characteristics, combined with the data on physical characteristics, developmental characteristics, and community facilities, was used to develop and evaluate alternative land-use models, and to develop alternative land-use plans for the project area.

The flood characteristics section of this report contains the following chapters:

1. General Flood Information
2. Historical Flooding
3. Economic Considerations of Flooding
4. Existing Flood Control Projects
5. Proposed Flood Control Projects
6. Federal Flood Insurance Program
7. The Federal and State Role in Floodplain Management
8. Floodplain Management

GENERAL FLOOD INFORMATION

1. PRECIPITATION

The greater the rainfall the greater the snow melt (warm temperatures would be a major factor); the greater amount of water a stream or river will have to cope with (depending on ground conditions).

As discussed elsewhere, (in a large river basin such as the Skagit) the location in which the precipitation occurs is important. If an amount of rainfall is spread throughout the basin the river has a chance to move the water downstream on all parts of the river. If the same amount of rain falls in one area the river must cope with the same precipitation concentrated in one spot. Flooding would be a greater possibility under the second alternative.

2. GROUND CONDITIONS

The amount of precipitation a river will handle is influenced by the ground conditions. Ground condition factors include degree of ground saturation and land use. If the ground is saturated with water before a significant rainfall, less infiltration and more runoff will occur than if the ground was dry.

The second ground condition factor is the type of land use that exists in the area. Basically, the greater the amount of impervious surface that covers the ground (i.e. roofs, roads, etc.) the more runoff, which means more water for the river to handle.

For a little clearer idea what various types of land use influences runoff, runoff coefficients are listed on the next page.

Table 1

RUNOFF COEFFICIENTS

Land Use	Runoff Coefficients
Commercial	0.85
Industrial Areas, Heavy	0.75
Trailer Parks	0.70
Apartment Dwelling Areas	0.65
Industrial Areas, Light	0.65
Residential, High Density	0.50
Suburban, Normal Residential	0.40
School Grounds with buildings	0.35
Playgrounds	0.25
Park and Cemeteries	0.20

Source: Recommended Procedures for Storm Drain and Road Culvert Design, King County Department of Public Works, revised November 1971.

A third factor is the permeability of the ground itself. Various soils are composed of different materials in different states of subdivision which determines how well water will go into the ground. For example, pea gravel will soak up water much more effectively than granite. The reason for this is that pea gravel has pores (spaces between the rocks) where water can seep down. Granite on the other hand, is solid, with very little pore space for water to seep through. The soils in this case are comparable to the land use mentioned previously. The less impervious soils (soils which water can seep into) will allow more water in the soil and have less runoff than a more impervious soil. Table 1, "Soil Characteristics," in the soil portion of this report, gives information on the permeability of various soils and the Soil Survey, by the Soil Conservation Service, gives soil information on surface runoff.

These ground condition factors influence flood flows in the following manner. With an increase of paved or covered surfacing in a river basin, the amount of runoff will increase. With an increase in runoff, the river will have to handle more water. Thus, a storm of a certain magnitude could cause a flood in the future where no flooding would now occur. Urbanization, with more paved surfacing may result in an increase in the probability of a flood occurring. The impact of urbanization, in all likelihood, would be very significant in the small stream basins of the area.

3. LAKES AND RESERVOIRS

If a lake or reservoir is saturated, less amounts of additional water could be handled from a storm.

4. STREAM CONDITIONS

The amount of additional flow a stream can handle is partly dependent on the amount of water already in the stream and the amount and type of vegetation on its banks. If a major storm comes when the stream flow is already high, flood flows may result.

Vegetation influences the stream flow and the erosion of the stream bank. If a river bank is covered with plants, erosion will be less a problem as the plant roots tend to hold the soil. With an increase in erosion, there may be considerable loss in bank material during high water or a flood. However, dead vegetation (such as tree limbs, etc.), may be close to the rivers edge. Because floods usually occur on a periodical basis, dead material may then have a chance to accumulate during times of normal flows. When a flood does come, all this debris will then be carried downstream causing more damage.

5. FLOW AT DAMAGE CENTER

Structures have an important effect on flood flows. Bridges, for example, have a twofold effect on flood flows. First, a bridge can create a closed channel in a river, which is a "top" over the river channel as illustrated.

Illustration

open channel closed channel

With a closed channel, only about 80 percent of an open channel flow can be handled because of top drag. (Howard Copp, ASCE, "Pullman Tackles Its Flooding Problems," Civil Engineering - ASCE, August 1972, p. 45)

Not only is there a reduction in flow capacity due to the "topping" of a channel by a bridge, but also by debris accumulating behind a bridge in two ways. First, the supporting columns of a bridge that extend into the river accumulate debris. The accumulation of debris and the columns, causes a disruption in the flow of the river, referred to as turbulence. This disruption backs up the water and increases the water elevation on the upstream side. The Memorial Highway Bridge at Mount Vernon illustrates this point during certain times of the year.

The second, and a potentially bigger problem, is the effect of a low bridge on flood flows. Besides the closed channel idea, which is mentioned above, a low bridge can hold back debris.

The debris behind a bridge will restrict the flow of water and back it up, acting as sort of a dam. There is a twofold danger to this situation. First, when the water backs up, the pressure against the bridge increases. The pressure may get so great that the bridge will wash out. When the bridge washes out, a second danger occurs--the debris and water are released, creating a even more dangerous situation on a river.

The bridges on the Skagit River are considerably higher than the 100 year flood elevation, however, according to stream profiles from the Corps of Engineers, Flood Plain Information Study. Several of these bridges do have piers extending into the water which can catch debris and back up water.

The Samish River is a different matter. The elevation of two bridges up to River Mile 12 (the extent of the Corps' study) are below stream profiles of significant flows (predicted flow when Skagit River is flowing at 270,000 c.f.s.). The approximate location of these bridges is River Mile 3.8 (Thomas Road) and River Mile 7.7 (a gravel road leading to U.S. 99).

Another concern is the use of fill material and buildings on the floodplain in a confined area. Fill material or buildings act as a barricade for water flow and also displace an area which water would otherwise occupy, thus increasing the height of the flood flows. The Federal Flood Insurance Agency has developed information on this subject which will be discussed later.

For the Skagit River Basin, this factor is critical above Sedro Woolley where the river flows in a definite vally which does not allow flood flows to spread out as it can in the delta area. In the delta region the area is large and it would take a large number of buildings and a large amount of fill to affect flows heights to any significant degree. The same comments could also apply to the lower Samish River Basin.

All of the above comments on some of the basic flood flow concepts apply in various ways to the flood problem in Skagit County.

HISTORICAL FLOODING

1. HISTORY

Throughout the years, major flooding has occurred in the Skagit River Basin. Table 1 shows the amount of discharge, gauge height at selected points, and dollar damages west of Sedro Woolley for major floods in the Skagit River Basin. The Corps of Engineers Technical Report of the Skagit River and United States Geological Survey Water-Supply Paper 1527, by James E. Steward and G. Lawrence Bodhaine, contain descriptions of several of these floods. The 1949 and 1951 floods have been omitted from the following description because they will be described in detail later:

1A. About 1815: Highest flood; gauge height of 20 feet at Diablo Dam; at Rockport the river was at least 15 feet above the flood mark of the 1917 flood; at Concrete a gauge height of 69.3 feet; at Sedro Woolley the flood exceeded the 1909 flood by 7 feet, covered the highest ground in the town with 1.5 feet of water, about 10 feet of water in present business district, and a gauge height of 63.5 feet.

1B. 1856: Second highest flood; Reflector Bar (Diablo Dam) gauge height of 18.5 feet; Concrete gauge height of 57.3 feet; Sedro Woolley gauge height about 60 feet.

1C. November 16, 1896: First major flood of valley since European settlement of the valley (about 1878); within 0.1 foot height of 1897 flood.

1D. November 19, 1897: From Birdsview east, the highest the river has ever been due to a warm chinook wind and heavy rain, the river rose suddenly and after 36 hours the rain subsided suddenly. Cascade, Sauk, and Baker Rivers were high and caused a peak on the Skagit at the mouths of each stream. Because of the sudden stopping of the rain, channel storage greatly reduced the crest as it was moving downstream. At Marblemount and Concrete the flood was 1.3 feet and 3.6 feet higher respectively than the 1909 flood.

1E. November 30, 1909: A series of low pressure storms moved through the area, with the last storm moving in on November 26 and lasted through November 29, dumping 8.3 inches of precipitation at Sedro Woolley. On the 26th and 27th the precipitation was in the form of snow above 2,500 feet. But on the 28th and 29th a warm rain melted snow up to 4,000 feet elevation. The result was the largest flood since the initiation of flood records. At the Reflector Bar (Diablo Dam), the crest was 2.4 feet higher than the 1897 flood. At Newhalem the gauge was 22.0 feet above the datum gauge. At Concrete, the gauge was 36.4 feet with water reaching the footing of a hotel near the cement plant. Down river the flood breached a dike near Burlington, pushing water over most of the land between Burlington and the Swinomish Channel. The gauge height at Sedro Woolley was 56.5 feet.

1F. December 30, 1917: This flood was remarkable for the length of time it remained high, rather than the crest, which was comparable to the 1896 flood and was 2.5 feet below the 1909 flood crest. At Sedro Woolley, the gauge was 54.1 feet.

1G. December 12-13, 1921: The weather in November of 1921 was below average temperatures and excessive precipitation. December was cold, but snowfall was less than average, much of which was melted off by excessive rain on the 10th and 12th. Between 6:00 P.M. of the 9th and midnight on the 12th, Silverton (in Snohomish County, east of Everett) received 14.2" of precipitation, David Ranch near Ross Dam received 10.2" and 3.4" fell at Sedro Woolley. Twenty-four hour maximums at these stations were 5.9, 5.0, and 2.0 inches, respectively. These conditions created the second largest flood on record and caused a dike break just above the Great Northern Railway Bridge between Mount Vernon and Burlington, dumping 60,000 c.f.s. of water into the Samish River Delta area.

Table 1

HISTORICAL DISCHARGE AND DAMAGES

	Concrete		Sedro Woolley		Mount Vernon		
Date	c.f.s.	Gauge	c.f.s	Gauge	c.f.s.	Gauge	Damages[2]
1815	500,000	56.6'	400,000	63.5'	---	---	$ ---
1856	350,000	44.6'	300,000	60.0'	---	---	---
Nov. 16, 1896	---	---	185,000	54.8'	---	---	28,853,000
Nov. 19, 1897	275,000	38.4'	109,000	54.9'	---	---	---
Nov. 16, 1906	---	---	108,000	54.7'	180,000[1]	---	28,622,000
Nov. 30, 1909	260,000	36.4'	220,000	56.5'	---	---	34,980,000[1]
Dec. 30, 1917	220,000	33.0'	195,000	54.1'	---	---	29,325,000
Dec. 12-13, 1921	240,000	34.9'	210,000	54.3'	150,000	---	32,850,000[1]
Feb. 27, 1932	147,000	39.9'	157,000	---	140,000	---	25,291,000
Nov. 13, 1932	116,000	35.6'	---	---	---	---	14,937,000
Dec. 22, 1933	101,000	33.6'	---	---	---	---	5,043,000
Jan. 25, 1935	131,000	37.9'	---	---	---	---	21,119,000
Nov. 27-28, 1949	154,000	40.8'	140,000[1]	---	114,000	34.21	14,340,000[1]
Feb. 10-11, 1951	139,000	38.9'	150,000[1]	---	144,000	38.85	26,270,000[1]

April 30, 1959	90,700[1]	---	92,000[1]	---	---	---	1,049,000
Nov. 24, 1959	89,300[1]	---	91,000[1]	---	91,600[1]	---	817,000

Full 120,000 acre-ft. storage at Ross Dam in 1953 partially effective in 1949 and 1951 floods.

U.S. Geological Survey Calculations - Except damage figures

[1]Corps of Engineers Preliminary Figures, updated from Puget Sound Adjacent Waters Study.

[2]See Appendix for calculation of Damage Figures.

2. TYPES OF FLOODS

The United States Geological Survey Water Supply Paper #1527 mentions two types of floods that have historically occurred in the Skagit Basin -- winter and summer type floods. The summer type flood is characterized by hot weather melting glaciers and snowfields in sparsely timbered or open areas. The discharge at a given point in time is not as severe as the winter flood, but it is of longer duration and greater total volume. This type of flood could create the problems of saturated storage facilities and dikes. Repair would be a greater problem than during the winter but as the list of historically significant floods of Table 1 suggests, most floods occur during the winter months.

Major winter flooding of the Skagit River occurs generally from November to February, although a winter type flood may occur as late as April, according to historical data. These major floods are characterized by unseasonally warm, moisture laden winds, which continue for an extended period. This type of wind is known as a "Chinook" wind and is caused by air currents blowing towards the center of a low barometric pressure area. The precipitation from these winds compounds the amount of runoff because not only must the precipitation be taken care of, but also the snow melt which the warm rain will produce in the mountainous areas must be taken care of.

According to the United States Geological Survey, flood profiles of winter floods are dependent upon the length of time the flood crest lasts and on the time of day the flood crests from the larger tributaries enter the main river channel. For example, the 1951 and 1949 floods are two extremes of possible flood profile, which may be encountered by flood control programs. The 1949 flood illustrates one type of flood profile, a short duration peak. The peak discharge near Concrete was 153,000 cubic feet per second (c.f.s.) which diminished to 114,000 c.f.s. near Mount Vernon. The weather combined with channel storage had a marked effect on this result. Precipitation records indicate that little rainfall occurred in the lower end of the basin (Table 2). Other records indicate that no snow was on the ground as far east as Diablo Dam, where temperature high's and low's were 58^{0} and 39^{0}, respectively.

Table 2

PRECIPITATION IN INCHES (1949)

Date 1949	Diablo Dam	Skagit Powerplant	Marble-mount	Concrete	Sedro Woolley
Nov. 23	2.00	1.03	0.65	0.43	0.09
24	1.50	.93	.60	.32	.37
25	1.67	.68	.75	1.17	.46
26	.95	4.21	2.57	1.43	.28
27[1]	4.05	.72	1.18	1.73	.32
28[2]	.71	.60	.81	.46	.29
29	.67	.46	.17	.20	.09

[1]Peak near Concrete

[2]Peak near Mount Vernon

Source: U.S.G.S. Water Supply Paper

Due to the low amount of precipitation and no snow in the lower end of the basin, the contribution of the tributaries in this area towards the total flow was probably minimal. Thus, natural channel storage facilities handled the Skagit crest as it came down river, thus possibly reducing the crest discharge from 153,000 c.f.s. to 114,000 c.f.s. The U.S.G.S. Report mentions that upstream storage reduced the peak by 45,000 c.f.s. at the Dalles, near Concrete.

The 1951 flood, on the other hand, was an example of a long duration flood. Although the peak discharge was smaller, the duration of high water was considerably longer than the 1949 flood. At Concrete, the crest reached a discharge of 139,000 c.f.s. (10 year flood frequency) compared with 153,000 c.f.s. (14 year flood frequency) in the 1949 flood. The difference though, can be seen when comparing the Mount Vernon discharge. For 1951, the crest reached 144,000 c.f.s. (15 year flood frequency) compared with 114,000 c.f.s. (5 year frequency) in 1949.

According to the Corps of Engineers figures, the duration of the 1951 flood was of significantly longer than was the 1949 flood. The 1951 flood maintained a flow rate of 120,000 c.f.s. or better for 22 hours as opposed to a duration of 14 hours for the 1949 flood.

One reason for the longer duration could be attributed to the weather patterns during the period. The U.S.G.S. Report mentions that on February 7, the snow depth was 15 inches, but on February 11, this was reduced to 5 inches. It was also reported that no snow was on the ground at or downstream of Concrete. The temperatures at Diablo Dam ranged from a minimum of 33^0 to a maximum of 53^0, slightly colder than the 1949 floods. Major rainfall during the period was not confined to the upper reaches of the Skagit River, as in the 1949 floods, but extended to the lower basin region as well (see Table 2).

Table 3

PRECIPITATION IN INCHES (1951)

Date 1951	Diablo Dam	Skagit Powerhouse	Marble-mount	Concrete	Sedro Woolley
Feb. 7	1.82	0.67	1.54	1.03	0.42
8	2.61	1.39	2.29	.80	.50
9	6.21	3.02	4.67	2.42	1.83
10[1]	3.76	5.77	2.67	1.10	1.11
11[2]	.61	2.89	.43	1.11	.28
12	0	T	0	0	0

[1]Peak near Concrete

[2]Peak near Mount Vernon

Source: U.S.G.S. Water Supply Paper #1527

As the result of the rainfall in the lower part of the basin, there was a longer cresting period due to the contribution of the tributaries in that portion of the river area. With the tributaries creating the initial high water, the river continued high with the addition of the water in the upper reaches of the Skagit River drainage area. Thus, one reason for the long duration flood was the weather pattern that preceeded the flood itself.

The effect of the long duration 1951 flood could be seen as the antithesis of the short duration 1949 flood. Natural storage facilities had only minor impact in reducing the discharge downstream for the 1951 flood. The reason, which may seem obvious, was as the water continued at a high level (due to the contribution of tributaries and the crest of the Skagit itself) the natural drainage areas became saturated. With the saturation of the natural storage areas, the water which normally should have been stored was forced downstream. The result was that the discharge increased rather than decreased (as in the case of the 1949 flood) as one went further downstream.

Two important ideas should be considered from this discussion. First, weather conditions play an important part in the creation of a flood. It is suggested that an examination of the climatic subsection in the geologic element of the study would be useful. Examining that subsection can give one an idea of the extremes encountered along the Skagit River, and a recognition of flood causing meterlogical patterns.

Second, flood projects must be flexible enough to meet the changing conditions that weather conditions could create, assuming that flood control projects are advocated. For example, increased storage may be rendered ineffectual due to saturation.

Also, a project may be ineffective due to wrong location for the current conditions. During the 1951 flood, a significant amount of water was introduced by tributaries between Sedro Woolley and Concrete, an area over which Ross or Upper Baker Dams would have no direct influence. If these sites were saturated at the time, flood control facilities west of Concrete would be needed. Thus, flood control facilities must be flexible enough not only to cope with differing flood profiles, but also to handle various points along the river where significant impact may occur; all of which could be traced back to the meterlogical patterns of the area.

3. STANDARD PROJECT FLOOD

The Corps of Engineers has determined that under the most severe combination of meterological and hydrological conditions, a standard project flood of 440,000 c.f.s. at Sedro Woolley would result. This flood is approximately 110 percent greater than the 1815 flood and 200 percent greater than the 1909 flood. It is the policy of the Corps of Engineers to try to provide flood protection at this level for urban areas, even though a reduced amount of flood protection such as 100 year protection could be permitted. The importance of this figure is that it give perspective to past floods and gives a standard to be attained to protect against not only potential property loss, but human loss as well. The largest flood recorded, the 1909 flood, would result in approximately $35 million in damages today, according to the Corps of Engineers, but the 1909 flood is only one half the discharge of the standard project flood. One can imagine the severity of such a flood and recognize its potential danger.

APPENDIX 1

1. DAMAGE ESTIMATES

Flood damage (updated to 1972 prices and conditions from 1966 prices and conditions) from the Puget Sound and Adjacent Waters Study.

Table

FLOOD DAMAGE

Date	Peak Flow-c.f.s. Concrete	1972 Figures
November 1909	260,000	$34,980,000
December 1921	240,000	32,850,000
November 1949	154,000	14,340,000
February 1951	139,000	26,270,000

ECONOMIC CONSIDERATIONS OF FLOODING

In this section, the costs of past floods and yearly flood losses have been discussed. These costs were broken down and described as to what the damages were. Finally, an estimate was made as to the value of present buildings on the floodplain plus what the "social" and "personal" losses would be for new developments.

The geographical area of concern for this section of the flood characteristics element is the area west of Sedro Woolley. The total valuation of this area has not been computed, due to the difficulty of establishing a value of the industrial developments. The average annual damages, using the discount rate established by the Puget Sound and Adjacent Waters Study in the floodplain of the Skagit River west of Marblemount is $4,766,000 (see Appendix 1). These damages are distributed as follows: 57% in agriculture ($2,716,620); 36% for buildings and equipment ($1,715,760), and 7% for other damages ($333,620).

The total costs of selected historical floods calculated in 1972 prices and conditions are as follows:

Table 1

COST OF HISTORICAL FLOODS

Storm	Peak Flow at Concrete (in c.f.s)	Recurrence Interval (years)	Damage (1972 Prices & Conditions)
Nov. 1909	260,000	100	$34,980,000
Dec. 1921	240,000	70	32,850,000
Feb. 1932	147,000	12	25,291,000
---	220,000	50	32,780,000
Nov. 1949	154,000	14	14,340,000
Feb. 1951	139,000	10	26,270,000

In discussing damage figures with the Corps of Engineers, it was determined that the damage figures were developed for each of the historical flows. These costs were then updated to present economic conditions, thus, representing the 1972 level of damages of a flood of similar proportions. The Corps of Engineers has developed a graph showing the relationship of damages and discharge.

The flood damage figures have been compiled for various floods by the Corps of Engineers and have been updated to 1972 figures, as indicated in the table on the following page.

On page 21 of the "Flood Plain Information Study Technical Report," the Corps of Engineers describe how these damages are incurred:

> "The greater part of past flood damage has been to land and crops in the lower valley. Major damage results from the drowning of grasses and other plants, loss of livestock, sheet erosion caused by overflow of fallow ground, leaching of fertilizer, infestation by weed seed, carrying away of fences, the deposition of sand, gravel, and driftwood, temporary loss of pasture because of ground saturation and loss of land through streambank erosion. When tidal dikes in the delta are breached by impounded floodflows, the resulting saltwater intrusion reduces productivity from one to three years."

> "Next in importance is damage to buildings, including shifting and settling of foundations, damp rot in timbers, buckling of floors and walls, shorting of electrical systems, the rusting and silting of vehicles, tools and appliances, and the soiling of furniture, rugs, and draperies. The contents of commercial buildings depreciate in value and losses in sales occur because of suspended operations."

> "The damage to levees by erosion and overtopping is significant. Highway and railroad embankments and shoulders suffer erosion, undermining of pavement, and temporary weakening as a result of subgrade saturation."

Although damages occur primarily in the area west of Sedro Woolley in the floodplain, they do not stop there but continue up the river valley. In the above Report, the Corps describes these upriver damages:

> "Upstream of Sedro Woolley much of the floodplain is uncleared or unsuitable for farming, but is an attractive location for

Table 2

FLOOD DAMAGE BY LOSS COMPONENT

No.	Item	Feb. 1932 Flood (157,000 cfs) 1/	Dec. 1921 Flood (210,000 cfs) 2/	100-year Flood (239,000 cfs) 3/
1	Flood fighting & restoration of levees, dikes tide gates, & drainage facilities	$ 414,772	$ 558,450	$ 601,656
2	Buildings & contents, yards, autos & refuse costs	4,031,385	8,603,415	10,126,710
3	Land & crops, & dairy losses	20,058,292	22,518,675	22,855,932
4	Power & telephone facilities	35,407	49,275	48,972
5	Railroads	45,524	131,400	202,884
6	Highway, roads, streets & sewers	698,031	962,505	1,136,850
	TOTALS	$25,282,000	$32,822,000	$34,974,000

1/ 140,000 c.f.s. at Mount Vernon gauge and 157,000 c.f.s. at Sedro Woolley
2/ 182,000 c.f.s. at Mount Vernon gauge and 210,000 c.f.s. at Sedro Woolley
3/ 223,000 c.f.s. at Mount Vernon gauge and 239,000 c.f.s. at Sedro Woolley

Note: Damages are for 1972 prices and upstream storage regulation development. Discharges indicated are recorded flows.

> summer home developments. Flood damages are increasing rapidly in these areas because the developments are located on reaches where the riverbank is low. The damages result from bank erosion and from overtopping of low riverbanks and low levees."

It must be noted that not all people are in agreement as to the type and amount of damage involved with the crops and farm land. Mr. Tony Harms, Soil Conservation Service, mentions that several years after the 1951 flood, a survey was taken to determine damages incurred by farmers due to the flood. It was determined from the responses that flood damage was minimal to the agricultural area. Two reasons could explain this. First, the amount of time passed since the flood could have minimized the amount of damages incurred in the minds of the farmers. The other explanation, that Mr. Harms suggested, is major flooding in the Skagit occurs during the winter months when most of the farm land is non-productive except for winter crops and pasture land.

Winter crops (blueberries, raspberries, and strawberries) comprise about 1,470 acres of a total 31,860 active agricultural acres in 1971 (Source: Preliminary figures of study by Skagit County Extension Service). Mr. Harms felt that the inactive crop land would not be damaged by floodwaters. This point of view was felt to be reasonable by others, including the County Extension Agent and the Director of the Northwest Extension Service and is supported by the fact that continued agricultural use of the highly flooded Nookachamps area is made. The only flood damage, he felt, would oe from dike breaks where the sandy material of the dikes would be spread out over the soil. Due to this situation, Mr. Harms felt that far more damage occurs during high water times in the late spring and early summer, when the river water is contained in the channels except for seepage through the soil under the dike.

The other major part of the flood damages is the livestock loss. During the month of August, the Emergency Management Training Division of the University of Washington conducted a flood simulation exercise. One situation that was covered was the problem of livestock. In discussing the problem, several persons mentioned that during the 1951 flood: 1) many farmers had emergency supplies for their livestock, and 2) due to the advance flood warning services, plenty of time was allowed for evacuation of livestock from low lying areas. The only livestock damage in 1951 was incurred by farmers who were warned but took no action to evacuate their livestock.

The important point is that the Corps total-damage figures could be questioned, as Mr. Harms did. Although no figures are available to determine the magnitude of the reduction of damages, the amount or percentage would definitely not be as high as projected by the Corps of Engineers (1963 prices - see Appendix 1) or what was determined for 1972 prices (see Table 8) if crop and livestock damages are substantially reduced. If the damages are not as great as the Corps has estimated, this would greatly reduce the benefits provided by flood control projects. With reduced benefits, the benefit-cost ratio would then be reduced. With a reduction in this ratio, marginal projects (or perhaps even those that are presently not marginal) may not be built by the Corps. Unfortunately, with insufficient data, this potential reduction in estimated flood damages cannot be determined.

One other important economic consideration for estimating flood damages is the value of certain development on the floodplain. There are two aspects to value of development that are important. First, a total value of the floodplain should be determined so that one knows what is at stake and what the value of tradeoffs are. Using the land use inventory that has been done by the Skagit County Planning Department, and combining it with the flood photomaps of the Corps of Engineers Technical Report, an estimate was made as to the amount of building development on the floodplain as shown on the following page.

Applying estimates on average building values for residential and commercial structures in the floodplain, it was determined that there is about $72,300,000 worth of improvements in 1972 prices and conditions.

Table 3

LAND USE BUILDING DEVELOPMENT IN FLOODPLAIN
(Section 4 and west)

			Area		
Land Use	Burlington	Sedro Woolley	Mount Vernon	County	Total
Residential					
Single-family	1,165	376	665	2,802	4,999
Multi-family	21	2	23	127	173
Mobile home	30	9	30	389	458
TOTAL	1,216	387	718	3,318	5,630
Commercial					
Goods	61	1	140	137	339
Services	68	1	128	148	197
Warehouse	26	6	11	88	131
TOTAL	155	8	279	372	667
Industry					
Heavy	3	9	1	13	26
Light	6	---	18	20	44
TOTAL	9	9	19	33	70

Source: Skagit County Planning Department

Table 4

VALUE OF BUILDING DEVELOPMENT IN FLOODPLAIN

	Burlington			Sedro Woolley		
Land Use	# of Bldgs.	Average Bldg. Value	Total Value	# of Bldgs.	Average Bldg. Value	Total Value
Residential	1,216	$ 6,077	$ 7,389,632	387	$ 8,310	$ 3,141,180
Commercial	155	24,828	3,848,340	8	26,922	215,376
TOTAL			$11,237,972			$ 3,356,556

	Mount Vernon			County		
Land Use	# of Bldgs.	Average Bldg. Value	Total Value	# of Bldgs.	Average Bldg. Value	Total Value
Residential	718	$ 9,277	$ 6,660,886	3,608	$10,843	$39,061,544
Commercial	279	28,144	7,852,176	372	19,329	7,180,388
TOTAL			$14,513,062			$46,251,932

TOTAL

Residential	$56,253,242
Commercial	19,106,280
	$75,359,522

One may note from the table on the preceding page that the total value of the building development in the floodplain at Mount Vernon is worth more than the development in Burlington. This may seem strange, until it is recognized that Burlington's residential development is worth more, but its commercial development is not as intense. Thus, two lines of argument could be put forth as to priority for flood control. One could argue that the Mount Vernon area should be given priority, as the greatest value of development exists there. On the other hand, another person could suggest that due to the amount of residential development in Burlington and the need residential has for flood protection, the effort should be concentrated on Burlington. This decision, as to flood protection priorities, should be made by the political process.

The second important aspect of value of economic development is to determine the potential costs of a flood to commercial, wholesale, and industrial establishments. This would give an idea of not only the present costs to firms, but also potential costs of new industries established on the floodplain.

In trying to assess the costs, an attempt was made to gather data which would include the full social costs instead of just one segment such as wages or profit. For this reason, the following types of data were used: commercial and wholesale--sales information and industrial--value added information. The data was furnished by the State Department of Commerce and Economic Development. Because the data was only to the year 1967, an update procedure was developed (see Appendix 2, for procedure and base data). The results are listed in the table below.

Table 5

TABLE OF SALES AND VALUE ADDED PER ENTERPRISE

	1972 Figures*
Value added per manufacture per year	$1,320,000
Sales per retail firm per year	205,000
Sales per wholesale firm per year	650,000

* Does not include Anacortes

From these figures the amount for each firm for each day can be computed. For this, an assumption was made that there are 260 production days in a year. The results are:

Sales--Value Added Per Day

Manufacturing: $\frac{\$1,320,000}{260}$ = \$5,076 value added per firm each day

Retail: $\frac{\$\ 205,000}{260}$ = \$ 789 sales per firm each day

Wholesale: $\frac{\$\ 650,000}{260}$ = \$2,115 sales per firm each day

These figures give an indication of the loss during a flood in terms of production. Additionally, the potential loss of wages was determined. This is necessary because the figures above indicate a yearly average, but production fluxuates from season to season. Most floods have historically occurred during the winter, thus another figure was needed to reflect the conditions this time of the year. Data was compiled from the Employment and Payrolls in Washington State, Fourth Quarter 1970 and First Quarter 1971, and reorganized to determine wages per firm for manufacturing, wholesale, and retail, with a breakdown for manufacturing. Table 6 on the following page shows the results. Appendix 1 gives the base data and explains the results, of this subsection.

Assuming 1) that warehouses deal in wholesale products; 2) that there is an equal loss of production for all areas in the floodplain, and 3) the flood occurred during a production day; the following average daily cost determination of a major flood could be made, using the present land use data.

From the data on the preceding page, the total loss of one days production for industries and retail-wholesale establishments would be approximately \$900,000 for one day. About \$125,000 would be lost in wages. One cannot, though, combine the two for an overall total loss. This would be a form of double counting, as some of the wages lost would also be counted in sales and value added lost. An examination of the table indicates that

Table 6

AVERAGE WAGES PAID PER FIRM PER DAY
ON MONTHLY AND QUARTERLY BASIS -- $

	1970 Oct.	1970 Nov.	1970 Dec.	1970 4th Qtr.
Manufacturing	$ 995.12	$817.42	$746.34	$854.83
Lumber & wood	575.28	541.44	439.92	512.92
Food & kindred products	1,036.00	504.00	476.00	692.96
Fabricated metals	389.52	375.06	375.06	364.25
Wholesale	308.97	274.64	274.64	291.67
Retail	118.02	118.02	118.02	110.14

	1971 Jan.	1971 Feb.	1971 March	1971 1st Qtr.	TOTAL
Manufacturing	$735.63	$ 770.66	$805.69	$768.54	$770.94
Lumber & wood	472.16	472.16	501.67	422.33	473.47
Food & kindred products	373.44	435.68	466.80	487.40	601.07
Fabricated metals	343.75	312.50	343.75	333.34	348.92
Wholesale	217.77	217.77	217.77	224.18	263.01
Retail	95.00	95.00	95.00	103.36	106.89

Table 7

POTENTIAL LOSS ESTIMATES - DAILY AVERAGE

	Number of Facil-ities	Sales/Value Added Per Firm Table	Total	6 Month Wages Per Firm Table	Total
Manufacture-Total	70	$5,076	$355,320	$770.94	$ 53,965.80
Burlington	9	5,076	45,684	770.94	6,938.46
Sedro Woolley	9	5,076	45,684	770.94	6,938.46
Mount Vernon	19	5,076	96,444	770.94	14,647.86
County	33	5,076	167,508	770.94	25,441.02
Wholesale-Total	131	$2,115	$277,065	$263.01	$ 34,454.31
Burlington	26	2,115	54,990	263.01	6,838.26
Sedro Woolley	6	2,115	12,690	263.01	1,578.06
Mount Vernon	11	2,115	23,265	263.01	2,893.11
County	88	2,115	186,120	263.01	23,144.88
Commercial-Total	339	$ 789	$267,471	$106.89	$ 36,235.71
Burlington	61	789	48,129	106.89	6,520.29
Sedro Woolley	1	789	789	106.89	106.89
Mount Vernon	140	789	110,460	106.89	14,964.60
County	137	789	108,093	106.89	14,643.93
Total potential loss of production			$899,856.00		
Total wages loss			124,655.82		

manufacturing suffers the greatest lost, both to society (total of $355,320) and to the personal wage earner (total of $53,965.80). In terms of the smallest loss, it depends on which way one wishes to look at it. On a sales basis, commercial would seem to be the least damaged, with a low of about $267,471. On the other hand, less wages are lost through wholesale establishments, with a low of about $34,454.31. These figures help give an idea of about how much loss would occur to current and potential new industries developed in the floodplain. It would be very expensive for industrial and commercial-retail establishments to develop in the floodplain area. To decide, though, which use would be optimum to develop in the floodplain would depend on more factors such as capital loss, ability to flood proof, materials contributing to debris, and alternative developable sites. For example, a certain manufacturer may want to establish in Skagit County. This plant requires direct access to huge amounts of water, level ground, and proximity to good roads. In addition, the plant requires heavy machinery to process large amounts of metal, all under one roof. Even though the value added and wage losses are the highest for this company, it may be better to situate it in the floodplain. The reasons: 1) higher development cost elsewhere; 2) the building could easily be flood proofed (industries generally can be elevated and flood proofed easier than commercial-wholesale or residential); 3) the heavy materials would not contribute to downstream debris as significant as logs from a lumber mill, and 4) low capital losses as heavy machinery would not float away as easy as furniture, nor would it be as susceptible to damage. For these reasons, economic factors cannot be considered alone in ascertaining what is the best use in the floodplain. Other factors are difficult to generalize, but in the subsection on Federal Guidelines that follows a suggested table has been produced to answer this problem. These factors may be used to help determine what existing and future development losses may occur during a flood.

Table 8

FLOOD DAMAGES DOWNSTREAM FROM SEDRO WOOLLEY
FOR SELECTED FLOODS IN SKAGIT RIVER BASIN

(1972 costs in parenthesis)

No.	Item	Feb. 1932 Flood (157,000 c.f.s.) 1/	Dec. 1921 Flood (210,000 c.f.s.) 2/	100-year Flood (239,000 c.f.s.) 3/
1	Flood fighting & restoration of levee, dikes, tide gates, & drainage facilities	$ 175,000 (1.64%) (414,772)	$ 234,000 (1.76%) (558,450)	$ 326,000 (1.72%) (601,656)
2	Bldgs. & contents yards, autos & refuse costs	1,692,000 (15.94%) (4,031,385)	3,477,000 (26.19%) (8,603,415)	5,481,000 (28.95%) (10,126,710)
3	Land & crops, & dairy losses	8,414,000 (79.31%) (20,058,292)	9,099,000 (68.55%) (22,518,675)	12,369,000 (65.34%) (22,855,932)
4	Power & telephone facilities	15,000 (.14%) (35,407)	20,000 (.15%) (49,275)	28,000 (.14%) (48,972)
5	Railroads	20,000 (.18%) (45,524)	54,000 (.40%) (131,400)	110,000 (.58%) (202,884)
6	Highways, roads, streets & sewers	293,000 (2.76%) (695,031)	389,000 (2.93%) (962,505)	616,000 (3.25%) (1,136,850)
	1963 Costs	$10,609,000 (99.97%)	$13,273,000 (99.98%)	$18,930,000 (99.98%)
	1972 Costs	(25,283,411) 4	(32,823,720) 4	(34,973,004) 4

1/ 140,000 c.f.s. at Mount Vernon gauge and 157,000 c.f.s. at Sedro Woolley

2/ 182,000 c.f.s. at Mount Vernon gauge and 210,000 c.f.s. at Sedro Woolley

3/ 223,000 c.f.s. at Mount Vernon gauge and 239,000 c.f.s. at Sedro Woolley

4 1972 total damage costs (the 1932 flood figure was not an update by the Corps) see Appendix for determination of costs

Note: Damages are the 1963 prices and upstream storage regulation developments. Discharges indicated are recorded flows.

Table 9

MANUFACTURING

	1958		1963		1967	
	# of Firms	Value Added	# of Firms	Value Added	# of Firms	Value Added
Total	157	$41,036,000	163	$72,100,000	137	$101,900,000
Food & kindred products	30	10,579,000	---	14,300,000	---	13,600,000
Lumber & wood	87	6,200,000	---	10,300,000	---	12,100,000

Table 9

WHOLESALE

	1958		1963		1967	
	# of Firms	Sales	# of Firms	Sales	# of Firms	Sales
Total	78	$21,917,000	74	$28,532,000	69	$32,537,000
Anacortes	9	4,174,000	11	4,116,000	8	4,933,000
Mount Vernon	28	10,024,000	30	12,622,000	27	16,564,000
Rest of County	41	7,719,000	33	11,794,000	34	11,040,000

Table 9

RETAIL

	1958		1963		1967	
	# of Firms	Sales	# of Firms	Sales	# of Firms	Sales
Total	650	$65,751,000	596	$73,057,000	587	$91,917,000
Anacortes	122	8,967,000	100	10,732,000	105	12,301,000
Burlington	---	----	76	8,840,000	65	11,094,000
Mount Vernon	178	29,703,000	189	32,676,000	181	42,397,000
Sedro Woolley	78	8,053,000	92	11,638,000	73	12,612,000
Rest of County	272	19,028,000	139	9,171,000	163	13,513,000

APPENDIX 1

The procedure for determining the 1972 item costs was to: 1) select updated 1972 costs as obtained in Appendix 1; 2) determine the percentage each component is of the total for the various floods, and 3) multiply the percentages by 1972 total damage costs divided by 100 to get 1972 item costs.

Computation of Average Annual Damages Update

Using the same method and figures used by the Corps of Engineers in updating flood damages for selected flows, the following calculations were made to update the Puget Sound and Adjacent Waters Study average annual damages of $3,020,000 (1966 prices and conditions).

Table 10

AVERAGE ANNUAL DAMAGES UPDATE

Indicator	%	Indices 1972/1966	Factor	Factor x %
Farm Labor	25	1051/729	1.442	0.360
Building Costs	30	1033/650	1.589	0.477
Construction Costs	25	1740/1019	1.707	0.427
All Commodities	20	120.5/98.2	1.227	0.245
				1.509

Growth of damageable items:

6 years at 3/4% per year = 1.046

Composite price and growth factor:

1.046 x 1.509 = 1.578

1972 Average Annual Damages

1.578 x 3,020,000 = 4,765,560.000

EXISTING FLOOD CONTROL PROJECTS

1. DIKING DISTRICTS

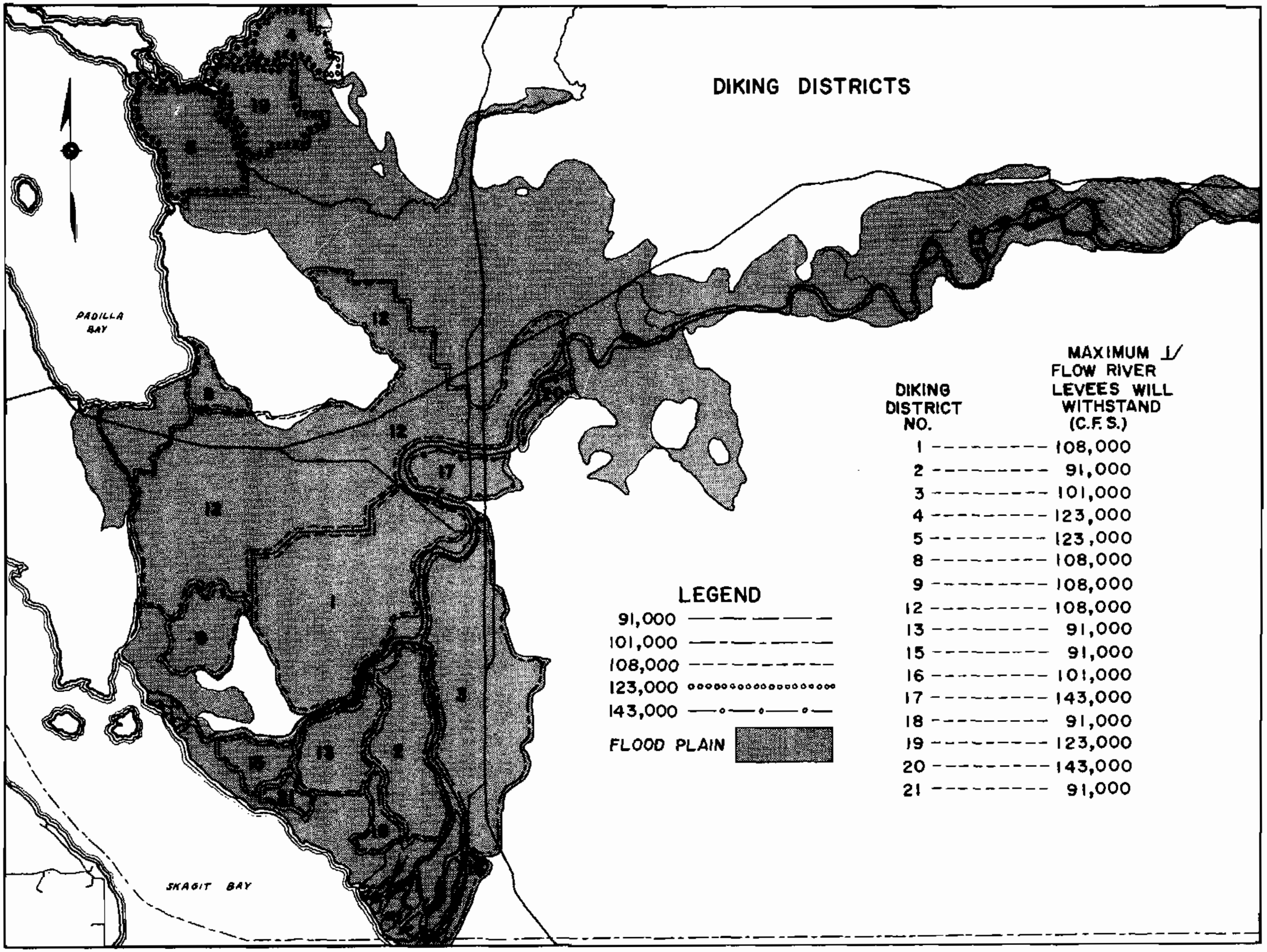
The Corps of Engineers Technical Report on the Skagit River states that 13 Diking Districts have been formed between Burlington and the mouth of the Skagit River and three districts have been formed on the Samish River, although according to the County Engineer, no flood dikes are built on the Samish. As Table 1 illustrates, the dikes range in capacity from 91,000 c.f.s (three year interval) to 143,000 c.f.s. (14 year interval) at the Mount Vernon gauge. The County Engineer feels that all levees are safe to 144,000 c.f.s. discharge. His opinion is based on the fact that the levees held during the 1951 flood (except for some Conway levees).

The Community Facilities Map, in the map section of this report, shows the location of these districts in relation to the floodplain. Fairly effective flood protection works for the existing agricultural development have been completed on the floodplain from Burlington towards the mouth of the Skagit. Unfortunately, as one moves east of Burlington, flood protection slackens. A need may arise for further flood protection east of Burlington, depending on future development proposals.

The county in 1971 spent $30,018.91 for maintenance in all of the Diking Districts. Table 2 itemizes the money spent in each district. Several Diking Districts are planning future improvements.

Despite the improvements that have been made, the condition of several of these is questionable. The Corps of Engineers stated:

> The 1951 floodflow exceeded the safe capacities of all diking districts. Discussion with diking district officials confirmed that the levees which did not fail in 1951 were in extreme danger of failure from saturation and loss of strength or from extensive, rapid seepage under levee foundations. The



DIKING DISTRICT NO.	MAXIMUM 1/ FLOW RIVER LEVEES WILL WITHSTAND (C.F.S.)
1	108,000
2	91,000
3	101,000
4	123,000
5	123,000
8	108,000
9	108,000
12	108,000
13	91,000
15	91,000
16	101,000
17	143,000
18	91,000
19	123,000
20	143,000
21	91,000

Table 1

SKAGIT RIVER DIKING DISTRICTS

Diking Dist. No.	Date Orga-nized	Area Protected (acres)	Miles of Levee: Bordering saltwater bays & channels	Miles of Levee: Bordering river channels 1/	Maximum flow river levees will withstand (c.f.s.) 2/	Probable interval of flooding in District (years) 3/
1	1897	8,264	0	7.9	108,000	5
2	1897	2,669	0	6.4	91,000	3
3	1897	6,365	0	11.5	101,000	4
4	1897	1,577	4.1	2.5	123,000	8
5	1897	2,847	6.6	2.0	123,000	8
8	1897	632	2.1	0.9	108,000	5
9	1897	1,419	3.5	1.7	108,000	5
12	1897	13,379	12.6	6.5	108,000	5
13	1897	1,869	2.6	2.6	91,000	3
15	1903	885	1.8	1.9	91,000	3
16	1904	407	0	2.9	101,000	4
17	1910	1,263	0	4.5	143,000	14
18	1918	576	1.4	0.6	91,000	3
19	1919	1,961	2.7	1.8	123,000	8
20	1919	537	0	.30	143,000	14
21	1922	391	2.1	0	91,000	3
Private Dikes	--	1,000	5.7	9.5	91,000	3
TOTALS		46,041	45.2	66.2		

1/ Skagit and Samish Rivers and primary and secondary sloughs.

2/ Assumes river at stage 1 foot below average low sections of levee. (Mount Vernon gauge) and sandbagging of extreme low areas.

3/ For failure of levee protecting District. This does not take into account flooding from failure of cross levees.

Table 2

DIKING DISTRICT FINANCES

Diking Districts	Total Spent	Commissioners Salaries and Bonds (1)	Administration (2)	Spraying (3)	Maintenance (4)	Materials and Supplies (5)	Engineering (6)	Utilities (7)	Capital Outlay (8)
1	$ 1,109.95	$ 965.00	$ 144.95	$	$	$	$	$	$
2	9,566.35	924.00	89.24	1,756.90	1,455.90	255.63			5,085.45
3	28,858.71	1,668.87	1,203.29		14,832.52	1,124.43			10,029.60
4	2,296.73	20.00	53.63						2,223.10
5	7,670.91	20.00	112.18		1,481.89	145.89	482.51	1,535.91	3,893.20
8	281.23	129.00	152.23						
9	144.85		144.85						
12	10,451.22	1,733.70	1,140.96	2,004.20	3,033.52	1,105.65	1,362.00	13.44	57.75
13	15,089.04	341.00	40.86		5,604.48		5,166.30		3,836.40
15	3,853.89	501.18				281.24	627.91	118.82	2,324.74
16	2,164.25		38.00		2,126.25				
17	1,858.05	616.00	135.82	906.23	200.00				
18	102.25	53.00	49.25						
19	236.68	10.00	48.18	178.50					
20	111.18	38.00	73.18						
21	1,585.82	53.00	48.18		1,285.20	199.94			
TOTALS	$85,354.11	$7,052.75	$3,474.80	$4,845.83	$30,018.91	$3,111.61	$7,638.72	$1,668.17	$27,450.24

Source: Skagit County Auditors

fact that any particular levee has withstood flows in excess of those listed (in Table 1) is no assurance that it can restrain such a flow in the future. A prolonged flood crest or the sequence of other levee failures may cause a levee to fail during an equal or lesser flow and flooding of a district which escaped damage in 1951.

The County Engineer feels that recent levee improvements have made all levees structurally safe.

Appendix 1, describes flood control projects by area, type of work, and year, dating from 1946 to August 1, 1970. Table 2 summarizes this information by location and general type of project.

Table 2

SUMMARY - FLOOD CONTROL PROJECTS
1946 to August 1, 1970

Location	Cost*	Length	Cost/year
Skagit	$2,171,474.91	311,232'	$ 89,456.12
Samish	133,632.30	28,874'	5,429.88
Cascade	11,789.32	1,400'	481.19
Sauk	16,370.17	600'	668.17
Others	234,001.22	43,533'	9,551.07
TOTAL	$2,555,117.42	385,639'	$104,290.51

Work Type	Cost	Cost/year
Rock work	$1,598,218.20	$ 65,233.39
Channel work	174,253.93	7,112.40
Dike maintenance work	453,072.02	18,492.73
Sub-total maintenance	$2,225,544.15	$ 90,838.53
Others	258,977.74	10,570.52
TOTAL	$2,464,522.29	$100,592.74

This information indicates that a significant amount of money ($104,290.51) is being spent annually for flood control projects. About $90,838.53 has been spent per year on maintenance alone. One must remember that these values are project cost figures for that particular year and that in terms of 1971 dollars about $138,000 is being spent annually.

There are several causes of levee failure during a flood including overtopping, improper bank design, inadequate treatment of poor foundation soils during construction, poor alignment, river bank erosion and lack of maintenance (i.e. cutting of trees and brush, rodent holes and damage caused by cattle and construction operations).

The probability of a levee break in a given area is dependent on several factors, one of which is the location of other levee failures. If a levee fails upstream, water would be released from the channel to flow elsewhere. The water released is water a downstream levee does not have to contain. Therefore, it could be said that for every levee break upstream, the chances of levee failures downstream are reduced.

A levee failure often has serious consequences. Besides the economic loss to fields, residential, business, and industrial areas, the destructive force of the river is increased because of a concentration of increased velocities and it happens unexpectedly. This also increases the risk of losing lives. Thus, locating residential areas near dikes may increase the risk involved with living on the floodplain.

Another problem regarding levees is the situation where levees are located on one side of the river but not the other; protection on one side will tend to push the water up instead of out. In this case, the water velocities are greater than under natural conditions and greater damage to the leveed side occurs.

If the floodplain is to be developed, development should be limited in areas without levees when opposite to areas that are protected. If development is located in these areas, flood damage may be more extensive than under natural situations. The possibility of damage for the area protected by levees is also increased because after the new residential area is built, dikes would probably be built to protect it. The flood flow would then be confined to a narrower channel increasing the water level which in turn would increase the possibility of the opposite bank levees being overtopped.

These and other problems are discussed as follows. The capacities of the levees are based on a Corps of Engineers Technical Report published in 1967 which is regarded as current by the County Engineer. As an example, the levee capacity in the Burlington area is only 108,000 c.f.s. (5 year flood frequency). There are no levees (even though a diking district exists there) immediately across the river from Burlington. Because the land profile across the river is lower than the levees, the area across the river from Burlington has a greater flood problem than it would under natural conditions. The area across the river, then, should be examined carefully prior to any future development.

The levee capacity in the Burlington area is only 108,000 c.f.s., which is considered to be below minimal protection for urban areas according to the Federal Government. There is a possibility that during a major flood it would break or overtop. Not only could it be expected to break for the reasons previously mentioned, but also because of the relation of the levee to the probable flood flow. For example, one can see that the Burlington area levee would be taking full force of a flood. The levees not only have the function of keeping the flood in the channel, but also have the function of changing the direction of the river flow from west to south. Due to this added stress, it would seem that dike failures in that area would be numerous. The information illustrated seemd to support this hypothesis, as no less than three breaks occurred during two floods (1917, 1921). The County Engineer feels, however, that the levees will hold in Burlington but the water will come around the levee.

It should be noted, though, that Nookachamps Creek enters the Skagit River just east of Burlington. The Nookachamps area serves as a natural storage facility during flood situations, and probably has an effect on the levees in the Burlington area. This possible effect would reduce current velocity in that area. Unfortunately, the Nookachamps generally is the first area to flood and thus has an excellent chance of being saturated during a flood of any duration and of any size.

This situation is important for two reasons. First, it places an extreme danger on the citizens, businesses and industries of Burlington. With the amount of capital invested and concentration and amount of people involved, this alone should be justification for increased protection.

There seems, though, another important aspect of this section of the levees. The Corps of Engineers mention that if these levees fail (depending, of course, on the amount of discharge) the flood water will flow into the Samish River. In fact, during the 1921 flood, 60,000 c.f.s. was dumped into the Samish River Delta and into the area between Bayview and Pleasant Ridge because of levee failure in the Burlington area. Thus, increased flood protection should be added, not only for future development, but to provide adequate protection for the existing development.

Another potential problem is the river bend area, which is just downriver from the Burlington area levees and northwest of Mount Vernon. According to Figure , levee capacity on the left side of the river (following the current) is 143,000 c.f.s. compared with only a 108,000 c.f.s. capacity on the opposite bank. As in the case with the Burlington area levee, the lower capacity levees have the responsibility of both maintaining the water in the channel and turning the flood flow 180°. In addition to the previously mentioned reasons, the levee may likely overtop because it is of lower capacity by a significant amount as compared to the opposite shore levee.

The opposite shore needs a high capacity levee to protect the high capital investments areas in and around North Mount Vernon. Some of these investments include the Mount Vernon and Riverside Malls and the Public Utility District No. 1 headquarters.

Like the Burlington area, increased flood protection may be needed to protect present development.

A third area presenting a possible problem is the West Mount Vernon-downtown Mount Vernon area. According to Corps of Engineers figures, the downtown Mount Vernon dike has a lower capacity than the dikes protecting West Mount Vernon. Although both dikes protect important development areas, it would seem the higher capacity dikes should be on the opposite east shore.

The County Engineer feels that there is a severe channel constriction in West Mount Vernon-downtown Mount Vernon area. This constriction could increase water heights in the area and place the area in danger. The County Engineer also believes that there are two other constricted areas on the North Fork which would prevent the efficient passage of high water.

After examining these three areas, several summary observations can be made. The Burlington area has a low capacity dike in an area of significant development and an area where the river course changes direction. One would normally expect the levee capacity to be high enough to make sure that water does not flood Burlington or beyond on the floodplain. Instead, the levee can only offer protection against a discharge of 108,000 c.f.s., or a five year frequency flood (assuming no levee failure) which is far below minimum Federal Guidelines. Even considering the Nookachamps storage area, this levee may not be adequate due to changes in river direction and the possible saturation of the Nookachamps area. The other two areas examined downriver are similarly affected, only without the benefit of a storage facility.

In these latter areas, the lower capacity levee exists on the more critical side. In both cases, it is the lower capacity levee which protects the highest value of development. It appears that little or no coordination exists between the Diking Districts. It seems that each District built dikes irrespective of what was on the opposite banks and without regard for the land use in that District.

One can also find problems in the placement of the dikes in regards to stream flow characteristics and future development. As previously mentioned, a river bend has two distinct shores. The outside bank erodes and the inside bank gains material. In many places the dikes are adjacent to the river. This location could possibly create several problems. First, the dikes (especially the outside bank in the river bend) have the erosional forces of the river working against them. Due to this situation, rip rap must be added in order to protect the dikes which may become weakened as the river displaces their base material. Thus, locating dikes next to the river in these areas increases maintenance costs as well as increasing the risk to people who depend on those dikes for protection. One other problem with the dike locations is relationship to present development. It has been pointed out previously that with a widening of the river channel, more discharge could be accommodated. Thus, one way of improving flood protection would be to move dikes further away from the river edge.

In summary, several problems seem to stand out: 1) many of the dikes are possibly not strong enough to withhold a major flood; 2) there seems to be a lack of coordination between Diking Districts; 3) the location of the dikes and existing land use complicates any movement of dikes for increased protection; 4) residential areas should not locate close to dikes in areas with a low level of flood protection or in areas of potential high water velocity (especially on river bends), and 5) the dikes only provide protection from flows below 91,000 c.f.s. to 143,000 c.f.s. (3 to 14 year flood frequency).

2. ROSS DAM

According to the Corps of Engineers, this dam controls 30% of the basin's runoff and is the only project that has storage for flood control along the lower river. Of the 1,022,800 acre-feet of useable storage, 120,000 acre-feet is allocated for flood control. This storage, under average conditions, can reduce flood crests by 15,000 to 25,000 c.f.s. or less than 10% at Sedro Woolley. The Corps of Engineers mentions that Seattle City Light hopes to raise Ross Dam another 125 feet, but construction is not definite. This would increase reservoir capacity to 3,450,000 acre-feet.

Ross Dam seems to contribute significantly to total flood control, although it may not be very effective if the storm center is west of the dam or if the storage facility is saturated, it is normally an effective flood control device.

3. UPPER BAKER DAMS

These dams provide 16,000 acre-feet of flood storage on the Upper Baker Reservoir to compensate for natural channel storage loss when the dams were constructed. Unfortunately, this amount of storage does not contribute significantly towards flood control according to the Corps of Engineers.

4. NOOKACHAMPS CREEK AREA

Although this is not a flood control project or an area that is protected from floods, it does have a significant influence on flood control. This area of about 5,000 acres provided approximately 34,000 acre-feet of storage for the 1951 flood and reduced the peak by 6,000 c.f.s.

One must remember the characteristic of the long duration 1951 flood, which identifies the main problem of the area for use of flood control--saturation of the area.

The current flood protection downriver ranges from 91,000 to 143,000 c.f.s. flows with the present levee system. Upriver storage from Ross and Baker Dams and downriver storage in the Nookachamps area helps reduce the probability that these flows will occur (the 3 to 14 year flood interval takes into account these storage facilities). Unfortunately, in certain cases these levees and storage areas may become ineffective and if development is to continue to take place in the floodplain area, further measures of flood control are needed.

APPENDIX 1

FLOOD CONTROL PROJECTS--SKAGIT COUNTY
1946 -- August 1, 1970

Table 3

FLOOD CONTROL PROJECTS BY LOCATION

Location	Cost	Length
Skagit River		
Mouth to Forks	$ 688,788.03	154,715'
Forks to Highway 99 Bridge	719,656.55	87,625'
Highway 99 to Dalles Bridge	733,887.31	63,392'
Dalles to Rockport Bridge	12,023.72	2,100'
Rockport to Marblemount Bridge	17,119.30	3,400'
Subtotal	$2,171,474.91	311,232'
Samish River		
Mouth to Burlington-Alger Bridge	$ 123,539.10	2,450'
Upstream of Burlington-Alger Bridge	9,493.20	26,424'
Subtotal	$ 133,032.30	28,874'
Others		
Cascade	$ 11,789.32	1,400'
Hansen	49,083.45	21,300'
Day	15,703.44	600'
Grandy	27,735.60	3,450'
Friday	1,025.69	400'
Colony	1,550.50	---
Sauk	16,370.17	600'
Jackman	9,119.75	750'
Manser	4,200.78	---
Sutter	987.79	1,000'
Thomas	3,500.00	5,600'
Swede	1,344.40	200'
Coal	11,022.19	2,000'
Illabot	66,205.00	2,000'
Nookachamps	32,522.63	6,233'
Subtotal	$ 252,160.71	45,533'
TOTAL	$2,555,117.42	385,639' or 73 miles

Note: Totals are different for various tables in this Appendix because some projects lacked date and some lack project type information.
Note: These are totals for just flood control projects on the rivers and creeks, not for saltwater areas.
Source: Skagit County Engineers

APPENDIX 1

FLOOD CONTROL PROJECTS--SKAGIT COUNTY

Table 4

FLOOD CONTROL PROJECTS BY YEAR

Year	Actual Cost	1971 Dollars
1946	$ 12,262.22	$ 19,987.42
1947	44,352.72	72,294.93
1948	28,177.78	45,929.78
1949	13,419.48	21,873.75
1950	29,174.38	43,469.83
1951	60,146.69	89,618.57
1952	36,333.39	54,136.75
1953	129,424.20	192,842.06
1954	80,891.01	120,527.60
1955	220,701.93	311,189.72
1956	59,181.44	83,445.83
1957	169,502.58	238,998.64
1958	166,392.70	234,613.71
1959	454,526.22	640,881.97
1960	33,473.30	45,523.69
1961	98,440.61	132,894.82
1962	9,787.48	13,017.35
1963	134,391.82	176,053.28
1964	232,302.62	297,347.35
1965	127,909.11	162,444.57
1966	44,121.87	53,828.68
1967	135,843.22	163,011.86
1968	91,308.48	104,091.67
1969	37,912.73	39,319.29
1970	76,093.67	80,659.29
TOTAL	$2,526,071.65	$3,438,002.41

Source: Skagit County Engineers

APPENDIX 1

FLOOD CONTROL PROJECTS
BY TYPE OF WORK

Table 5

Rock Revetment	$ 29,576.56
Riprap	1,568.642.04
Channel work	174,253.93
Log jams	4,381.34
Dam	15,081.21
Dike reinforcement	335,045.04
Dike construction - new dikes	167,508.23
Dike rehabilitation	50,322.90
Dike moving Realign dike	47,704.08
Miscellaneous	43,756.91
Emergency work	28,250.05
TOTAL	$2,464,522.29

Source: Skagit County Engineers

APPENDIX 2

ESTIMATED FLOOD DISCHARGE
FOR VARIOUS FREQUENCIES OF OCCURRENCE

NAME OF STREAM	LOCATION	DRAINAGE AREA ACRES	CFS (25 Year)	CFS/ ACRE (25 Year)	CFS (50 Year)	CFS/ ACRE (50 Year)
Baker River	1/2 Mi. Below Baker Power Plant	190,080	34,000	.178	39,000	.205
Cascade River	Confluence w/Skagit River	126,720	18,200	.143	21,100	.166
Jordan Creek	Confluence w/Cascade River	8,448	1,530	.181	1,810	.214
Boulder Creek	Confluence w/Cascade River	5,184	1,040	.200	1,230	.237
Irene Creek	Confluence w/Cascade River	4,096	690	.168	640	.156
Day Creek	South Skagit Highway	21,888	2,500	.114	2,780	.127
Day Creek	Below Confluence w/Rocky Creek	16,704	2,280	.136	2,550	.152
Rocky Creek	At Confluence w/Day Creek	5,312	400	.075	440	.082
Day Creek	Above Confluence w/Rocky Creek	11,392	1,820	.159	2,040	.179
Deer Creek	Confluence w/N. Fk. Stillaguamish River	40,704	9,100	.223	10,200	.250
East Fork Nookachamps Cr.	At Confluence w/Nookachamps Cr.	26,176	2,900	.110	3,100	.118
	Below Confluence w/Turner Cr.	19,200	2,320	.120	2,590	.135
Turner Creek	Confluence w/E. Fk. Nookachamps C.	3,264	660	.202	740	
East Fork Nookachamps Cr.	Above Confluence w/Turner Cr.	15,872	2,240	.141	2,500	.227
	Below Confluence w/Walker Cr.	11,008	1,580	.143	1,760	.160
Walker Creek	Confluence w/E. Fk. Nookachamps C.	6,400	1,000	.156	1,110	.173
East Fork Nookachamps Cr.	Above Confluence w/Walker Cr.	5,248	910	.173	1,020	.194
Finney Creek	South Skagit Highway	34,432	5,300	.153	6,300	.183
Halbot Creek	Confluence w/Skagit River	27,648	5,200	.188	6,200	.224
Nookachamps	Clear Lake Road	48,384	3,300	.068	3,700	.076
Nookachamps	Above Confluence w/East Fork	22,144	1,990	.089	2,220	.100
Nookachamps	750' Downstream from Big Lake Outlet	15,360	870	.056	970	.063
Nookachamps	St. Hwy. 9 1500" SE of Big Lake	10,880	580	.053	650	.060
S. Fk. Nooksack River	At County Line	55,680	17,300	.310	19,800	.356
Pilchuck Creek	At Snohomish County Line	30,464	3,330	.109	3,700	.121
Pilchuck Creek	At Gaging Station	32,000	3,600	.112	4,000	.125
Samish River	At Mouth	213,760	19,100	.089	21,900	.102
Samish River	Avon-Allen Road	211,200	19,100	.090	21,900	.104
Samish River	Below Confluence w/Thomas Cr.	209,920	19,100	.090	21,900	.104
Thomas Creek	Confluence w/Samish River	5,120	660	.128	760	.148
Samish River	Above Confluence w/Thomas Cr.	204,800	18,900	.092	21,600	.105
Samish River	Below Confluence w/Friday Cr.	74,880	8,000	.106	9,200	.123
Friday Creek	Confluence w/Samish River	45,184	5,200	.115	6,000	.133
Friday Creek	Below Confluence w/Silver Creek	17,088	2,170	.126	2,480	.145
Silver Creek	Burlington-Alger Road	3,456	510	.147	590	.171
Friday Creek	Above Confluence w/Silver Creek	13,632	1,650	.121	1,890	.139
Samish River	Above Confluence w/Friday Cr.	29,824	3,600	.120	4,100	.137
Samish River	Below Confluence w/Swede Cr.	27,968	3,300	.117	3,800	.136
Samish River	Parson Cr. Rd.-Warner Rd.(Sec.27)	23,872	2,920	.122	3,400	.142
Samish River	State Hwy. 9, Prairie	14,144	2,260	.159	2,590	.183

NAME OF STREAM	LOCATION	DRAINAGE AREA ACRES	DISCHARGE PER ACRE 25 Year		50 Year	
Swede Creek	Confluence w/Samish River	2,176	300	.137	340	.156
Sauk River	Confluence w/Skagit River	462,080	59,000	.127	81,000	.175
North Fork Stillaguamish River	Snohomish County Line	39,104	7,600	.194	8,400	.220
Suiattle River	Confluence w/Sauk River	222,080	59,000	.265	70,000	.315
	Blanchard-Edison Area					
Whitehall Creek	Tidewater	3,456	300	.086	340	.098
Edison Slough	Tidewater (at Edison)	768	77	.100	87	.113
Edison Slough	1/4 mile S.E. of Bow	3,840	350	.091	400	.104
Oyster Creek	Tidewater	3,584	320	.089	360	.100
Joe Leary Slough	At Mouth;Section 18,T35N,R3E	8,960	710	.079	800	.089
Joe Leary Slough	Below Confluence w/Tributary(Sec.27)	6,400	660	.103	760	.119
Brickyard Creek	Great Northern Railroad X-ing Section 19	3,072	260	.084	290	.094
Unnamed Slough	At Tidegate	2,240	230	.102	260	.116
Indian Slough	At Mouth; Section 6,T34N,R3E	3,968	340	.085	390	.098
Indian Slough	Hwy. "Y", Section 9,T34N,R3E	4,224	370	.087	420	.099
Higgins Slough	At Tidegate; Section 13,T34N,R2E	5,184				
Unnamed	At Tidegate; Section 24,T34N,R2E		300	.058	350	.068
Sullivan Slough	500' N of Chiberg Rd., Section 31 T34N,R3E	16,384	760	.046	860	.051
Hansen Creek	Minkler Road	7,552	780	.103	890	.118
Hansen Creek	Below Confluence w/Unnamed Cr.	4,992	610	.122	700	.140
Unnamed Creek	Confluence w/Hansen Creek	832	150	.180	170	.204
Hansen Creek	Above Confluence w/Unnamed Cr.	3,904	460	.117	530	.136
Cool Creek	State Highway 20, Section 10	1,792	360	.200	420	.234
Powell Creek	State Highway 20, Section 11	2,688	690	.256	790	.294
Child's Creek	State Highway 20, Section 7	1,152	400	.347	460	.399
Jones Creek	State Highway 20, Section 17	5,056	900	.178	1,130	.223
Mannsor Creek	State Highway 20, Section 16	1,024	250	.244	290	.283
Red Cabin Creek	Cemetery Road, Section 10	3,776	720	.190	820	.217
Meford Creek	Crossing north line of Section 14 T35N,R6E	2,752	350	.127	400	.145
Alder Creek	Great Northern Railroad	6,592	900	.136	1,130	.171
Alder Creek	Below Confluence w/North Fork	4,928	580	.117	670	.140
North Fork Alder Cr.	Confluence w/Alder Creek	2,048	300	.146	350	.171
Alder Creek	Above Confluence w/North Fork	2,944	480	.163	560	.190
Grandy Creek	Great Northern Railroad	10,048	2,810	.279	3,200	.318
Unnamed Tributary	Confluence w/Grandy Creek	7,680	1,450	.188	1,660	.216
Grandy Creek	Below Confluence w/Unnamed Trib.	2,176	300	.137	350	.161
Unnamed Tributary	Confluence w/Grandy Creek	833	180	.216	210	.252
Grandy Creek	Above Confluence w/Unnamed Trib.	4,672	1,030	.220	1,170	.250
Unnamed Tributary	Above Confluence w/Grandy Cr.	2,176	1,000	.459	1,150	.528
Jackman Creek	State Hwy. 20,S 13,T35N,R8E	15,424	3,600	.233	4,300	.279
Rocky Creek	State Highway 20, Section 22	6,464	1,840	.284	2,180	.337
Corkindale Creek	State Highway 20, Section 22	3,008	860	.285	1,020	.339
Olson Creek	Confluence w/Skagit River Sec. 7	3,456	870	.251	1,030	.298
Diobsud Creek	State Highway 20, Section 32	16,640	2,450	.147	2,900	.174
Bacon Creek	State Highway 20, Section 20	32,896	5,500	.167	6,500	.197
Damnation Creek	State Highway 20, Section 11	3,328	980	.294	1,160	.348
Alma Creek	Confluence w/Skagit River, Sec.15	5,696	1,230	.215	1,450	.254
Copper Creek	Confluence w/Skagit River, Sec.21	2,496	560	.224	670	.268

NAME OF STREAM	LOCATION	DRAINAGE AREA ACRES	DISCHARGE PER ACRE 25 Year		50 Year	
Presentin Creek	South Skagit Hwy., Sec.13,R7E	8,576	1,260	.146	1,400	.163
Mill Creek	South Skagit Hwy., Sec.22,R7E	2,752	570	.207	640	.232
Boyd Creek	South Skagit Hwy., Sec.22,R7E	960	210	.218	230	.239
O'Toole Creek	South Skagit Hwy., Sec.21,R7E	3,776	720	.190	800	.237
Cumberland Creek	South Skagit Hwy., Sec.23,R6E	4,288	960	.223	1,070	.249
Loretta Creek	South Skagit Hwy., Sec.22,R6E	2,176	800	.367	900	.414
Morgan Creek	Walbert Road, Section R6E	2,176	770	.353	850	.391
Unnamed Creek	South Skagit Hwy., Sec.25,R5E	1,280	240	.187	270	.211
Sorenson Creek	South Skagit Hwy., Sec.25,R5E	1,088	180	.165	200	.184
Unnamed Creek	South Skagit Hwy., Sec.35,R5E	2,176	250	.114	280	.129
Gilligan Creek	South Skagit Hwy, Sec.35, R5E	4,544	1,150	.253	1,280	.282
Carpenter Creek (Hill Ditch)	S29,T33N,R4E;Below Confluence w/Franklin Creek	19,200	1,010	.052	1,130	.059
Franklin Creek	Confluence w/Carpenter Creek	8,832	380	.043	430	.049
Carpenter Creek	Above Confluence w/Franklin Cr.	10,368	410	.039	450	.043
Carpenter Creek	Section 17, Below Confluence w/Unnamed Creek	8,384	400	.047	440	.052
Carpenter Creek	Section 9, Below Confluence w/Unnamed Creek	5,101	310	.060	340	.066
Carpenter Creek	Section 4, Below Confluence w/Unnamed Creek	2,874	200	.069	220	.076
Skagit River	Skagit River near Concrete	1,751,680	184,000	.105	222,000	.127
Skagit River	Skagit River near Sedro Woolley	1,929,600	177,000	.091	206,000	.107
Skagit River	Skagit River near Mt. Vernon	1,979,520	164,000	.083	192,000	.097
arpenter Creek	Section 17, Above Confluence w/Unnamed Creek	5,421	340	.062	380	.070

PROPOSED FLOOD CONTROL PROJECTS

Several flood control projects proposed by the Corps of Engineers and the Puget Sound and Adjacent Waters Study are summarized below. Appendix 1 describes the procedure used for updating the costs of the proposed projects to 1972 dollars. The benfit-cost ratio is derived from 1972 Corps of Engineers information using a 5 3/8% and 7% discount rate, which is the United States Water Council's suggested rate for water related projects.

1. AVON BYPASS

The Avon Bypass is an eight mile diversion channel of 360 feet bottom width. It was authorized in 1933 and reactivated in 1960. Currently it is a deactivated project which can be reactivated if the County desires so. The location proposed by the Corps of Engineers would cut through Gages Slough, follow the toe of Bayview Ridge and discharge into Padilla Bay at the mouth of Indian Slough. With this alignment, the Corps also proposed a four mile levee extension and improvement extending from the bypass past Burlington to the high ground between Sedro Woolley and Burlington.

A shorter alternative route would begin near Avon. This alignment would require that the river channel be enlarged for three miles and levee improvements be completed on both sides of the river. However, this would cost more than the Gages Slough alignment.

The two proposed capacities of the bypass are 60,000 cubic feet per second (c.f.s.) and 100,000 c.f.s. These would provide a minimum of 35 year protection (144,000 c.f.s.) when combined with the proposed levee. The bypass would begin operation at 84,000 c.f.s. at Mount Vernon, or at 100,000 c.f.s. if the levee and channel works were accomplished.

Updating the costs developed by the Puget Sound and Adjacent Waters Study, the 60,000 c.f.s. project would cost approximately $42,000,000. Based on calculations from the Avon Bypass Reactivation Report, the non-federal share could be as high as $7,500,000. Making the same assumption, the 100,000 c.f.s. project would cost $53,000,000 with a non-federal share of around $9,000,000. Using the United States Water Resources Council advised 7% discount rate, the 60,000 c.f.s. project has a benefit-cost ratio of .82 according to the 1972 updated Corps of Engineers figures. At this ratio, the project would not receive Federal participation. Using the 5 3/8% discount rate, as used by the Puget Sound and Adjacent Waters Study, the benefit-cost ratio would be 1.05.

No ratio has been computed for the 100,000 c.f.s. project.

2. BAKER DAM PROJECT

This project is currently being investigated by the Corps of Engineers. The project proposes to lower the level of the reservoir to increase flood storage from 16,000 acre-feet to 84,000 acre-feet. This would increase the protection level from a minimum of three years to six years. The cost of the project would be in terms of lost power, which (in 1968 dolars as given by the Puget Sound and Adjacent Waters Study) would be $133,000.

3. LEVEE IMPROVEMENTS

The Flood Control Act of 1966 authorized the strengthening of existing levees and channel improvements along the lower 17 miles of the Skagit River. The proposed levee and channel improvements are described in the table on the following page.

This work would remove serious obstructions to flood flows, lower channel velocities, and reduce upstream river stages. The improvements would provide protection to the level of 120,000 c.f.s. discharge or an eight year frequency flood.

The cost of such a project would be approximately $10,080,000 of which about $400,000 would be the non-Federal share. A computed 1972 benefit-

Table 1

LEVEE IMPROVEMENTS

Left Bank (Mount Vernon Side)			Rigth Bank (Burlington Side)		
Portion of River	Location (River Mile)	Work Done	Portion of River	Location (River Mile)	Work Done
Main stem & South Fork	16.5 to 13.4	Increase top widths & flatten riverward slope	Main stem & North Fork	13 to 15	Increase top widths & flatten riverward slope
	2.5 miles between 11 & 6	Raising low levees		13.1	Minor raising
	4.5	Raise levees of tributary		11.4 for 600'	Levee raising
	3.5 to 2	Widen levee		11.2 to 10.2	Increase top widths & flatten riverward slope
North Fork		Widening throughout most of North Fork		9.0 for 3/4 mi.	Increase top widths & flatten riverward slope
	5 to 9	Minor raising		6.0 to 7.0	Minor levee raising
			South Fork	9.5 to fresh-water slough for 6 miles	Widening slough
				2.5 miles	Intermittent raising

Table 2

CHANNEL IMPROVEMENTS

Portion of River	Location (River Mile)	Work Done
North Fork	3.8 to 4.7	Widen along left bank and/or raise levees
	7.0 to 8.1	Evacuation to straighten and enlarge channel
South Fork at Freshwater Slough	4.0 to 4.7	Channel widen left bank; realign levee

cost ratio derived by the Corps of Engineers is 1.45 (using 5 3/8% discount) or 1.12 (using 7% discount). This project would have Federal participation, although it, too, is in the disactive category.

4. NEW LEVEES

The Puget Sound and Adjacent Waters Study proposes the construction of new levees at the Nookachamps, Hamilton, and Sedro Woolley. These new levees would have a design capacity of 135,000 c.f.s. for a three mile levee at Hamilton and a four mile levee at Sedro Woolley under Alternative Plan "A" in the study. Under Alternative "B" the levees at Hamilton and Sedro Woolley would be larger in order to maintain the 100 year protection provided in Alternative "A". The Nookachamps levee would provide 20 year protection and would be designed to overtop before other levees downstream would.

The cost of the levees would be as follows:

Table 3

LEVEE IMPROVEMENT COST

	Alternative "A"	Alternative "B"
Nookachamps	$3,600,000	$3,600,000
Sedro Woolley	4,320,000	5,800,000
Hamilton	4,032,000	5,500,000

There was no benefit-cost ratio nor non-Federal share computed for these projects.

5. SAUK DAM

The Lower Sauk Dam has not been authorized by Congress but preliminary figures have been computed for it. The purpose of the dam is to reduce peak runoff from the Sauk River system, which contributes about 1/3 of the runoff in the Skagit River Basin above Mount Vernon. The dam would provide 134,000 acre-feet for flood control storage and 250,000 acre-feet total. This project would give over 100 year protection on the Skagit River.

The total investment cost of the project would be $184,000,000, with $86,000,000 allocated to flood control and $98,000,000 for power production. No benefit-cost ratio or non-federal financial figures were determined for the project.

Table 4

Project	Benefit-Cost Ratio 5 3/8%	7%	Cost in 1972 Dollars	Non-Federal Share
Avon Bypass				
60,000 c.f.s.	1.05	.82	$42,000,000	$7,500,000
100,000 c.f.s.			52,500,000	9,500,000
Baker Dam Project	---	---	---	---
Levee Improvements	1.45	1.12	10,080,000	400,000
New Levees				
Nookachamps	.79	.62	3,600,000	---
Sedro Woolley	---	---	4,400,000	---
	---	---	5,800,000	---
Hamilton	---	---	4,032,000	---
	---	---	5,500,000	---
Sauk Dam	---	---	86,000,000	---

6. PROPOSED PROJECTS IMPACT ON FISH AND WILDLIFE

This section discusses the specific impact flood control projects have in general. This section also examines impacts the proposed projects would have. This information was supplied by the Puget Sound and Adjacent Waters Study, Appendix XI, Fish and Wildlife; input from the Department of Interior for the Skagit River Report, March 1965; and input from Reade Brown, Regional Supervisor of the State Department of Game.

Generally, flood control projects affect anadromous and game fish significantly. Man-made barriers which impound water interfere with the migration and spawning of fish. This is especially critical for some fishes whose spawning and migration occur during histrocial flood (November-February) and high water (early spring) periods.

Any stream alterations usually entail straightening the river course, which reduces the length and increases the gradient. This eliminates pool and riffle areas which are essential for fish spawning and rearing. Also, combined with increased gradient is an increase in velocity, which may eliminate the re-establishment of pool-riffle areas. Removal of gravel from a stream bed for construction or dredging purposes also eliminates spawning and food producing areas.

Flood control projects also effect game significantly. Some diking projects may eliminate marshy areas where upland birds, waterfowl, and aquatic fur-animals would tend to locate. With the elimination of the marshy areas other uses which eliminate the production of cereal, would probably occur.

The factors on fish and wildlife for the proposed flood control projects are provided below.

6A. Avon Bypass

This project could assist in propagation of fish and wildlife. The Department of Interior has raised some questions about the usage and construction of the Bypass. Motor boat operation would be hazardous, increase water turbidity and wave erosion, and would conflict with swimming and fishing. They also suggest that under the proposal, the lower pool would be too shallow to ensure fish survival. Their suggestion is to add another fish weir.

The Bypass could have a detrimental effect on fish and wildlife outside of the project area. During a flood, several species of migrating fish may become entrapped in the Bypass and die. The Bypass may also change the migration habits of many fish from Skagit Bay into Padilla Bay. This would alter the fish life cycle and re-direct the fish into a dead end by from which they cannot migrate. When the Bypass is operating, fresh water and silt would enter Padilla Bay. This would have harmful effects on shellfish, eel grass, waterfowl, and fish habitat in the Bay by limiting food production and reducing propagation. This would be dependent on whether the Bypass was open annually or on an irregular basis. The Bypass would also drain existing sloughs and drainage ditches, which would destroy aquatic fur animal habitats in the area.

6B. Baker Lake

The reduced storage would adversely effect existing fish spawning areas. Depending on what time of year the lake was lowered, many spawning areas would be exposed and lost. The possible fluxuation during the spawning season may cause many eggs to be placed in potentially dry areas, while other areas would be inundated. As a result, a large fish kill might occur.

6C. Levee Improvements

Levee improvements would have no new impact unless construction occurred during critical migrating months, because these levees are downstream from spawning and rearing areas. The elimination of various channel constrictions would reduce stream velocity and thus enhance migration.

6D. New Levees

The removal of material from the stream channel around the Hamilton Dike, may destroy fish spawning and aquatic food production areas. The Nookachamps Levee would eliminate the marshy areas used by fur animals and waterfowl. This is especially critical since this area is the winter grounds for a flock of rare Trumpeter Swans.

6E. Sauk Dam

This dam would severely reduce fish runs up the Sauk River system and eliminate spawning areas by inundation and fluxuation of the water level. This dam would destroy the winter grounds of much wildlife such as deer, ring-necked pheasant, and grouse. Annual losses in deer, steelhead, and grouse just within the dam area itself was calculated to be $62,000 by Mr. Brown.

7. EFFECT OF SKAGIT WILD AND SCENIC RIVER STUDY

The Wild and Scenic River Study would restrict many flood control projects east of Sedro Woolley. According to the information from the U.S. Forest Service, classification of the Sauk River System would prevent the Sauk Dam from being built. With the recreational classification, as proposed in alternatives C, D, E, and F, levees could still be placed if designed correctly. Thus, the only impact the Wild and Scenic River Classification would have on flood proofing is to preclude the Sauk Dam project. One hundred year flood protection could be provided without the Sauk Dam, as provided in Alternative "D" of the Wild and Scenic River Study.

8. SUMMARY

It may be advisable to encourage new and existing development of areas away from the floodway and floodplain for several reasons. One, there is a strong possibility of flood losses on the floodplain. Although these losses may occur only once in 20 years, this frequency may be such that the losses incurred for that one year may be greater than the benefits accrued over the previous 20 years. The United States Water Council felt that it would be difficult for many businesses to make up losses from a flood occurring once every 50 years. These losses would be more critical for residential areas, whose many benefits are not economically measured. Losses here could not be made up by economic returns. Residential areas should not be developed within the 100 year floodplain. Additionally, residential areas should be out of the 100 year floodplain due to the risk of life. This is especially acute in the high velocity riverine, and the possible dike break areas.

Secondly, assume that development is allowed to continue on the floodplain at the present level of protection, which is far below the capacity needed to handle a 50 or 100 year flood. With an increase in development, there is an increase in the cost of potential damages. This in turn would increase the burden on State and Federal disaster assistance, which would less likely be able to pay the losses as development increases. To protect the State and Federal governments' "investment" and try to reduce this financial burden, they would demand new flood control projects which would give the needed level of protection to reduce the frequency of flood losses. With better protection more development would be justified within the floodplain. Because of the similarity of the floodplain and agricultural areas, this would cause an increasing encroachment on the agricultural areas. The county and the dike districts would incur the cost of maintaining these new projects, which would increase the current $138,000 average annual maintenance cost.

Not only would there be monetary costs to the county and local taxing districts, but there would also be costs incurred on the natural systems. Some projects could possibly disorient fish migration, while others would greatly reduce it. This would not only raise havoc with the other parts of the natural system which depend on fish, but would also disturb fishermen and ecologists who enjoy and are concerned with fish migration.

Despite these flood control projects, it must be remembered that projects never guarantee total protection. A flow may occur which would be greater than the capacity of the projects. Meteorological patterns may be such that certain projects would be ineffective. Other projects may fail due to some physical or mechanical problem. These problems will only increase in magnitude and costs if development is not redirected towards upland areas.

Thirdly, directing development to upland areas would conform with Federal and State guidelines. There would be a better coordination of development policies within the Region, plus a better way of providing services. It may be more difficult and more costly in the future to get Federal and State assistance monies for projects in the floodplain and floodway areas. Present county arterials, future sewage projects, and federally and state aided water systems, may require flood insurance or placement out of the floodplain.

Forth, it may be a better development investment to locate out of the floodplain. Future flood insurance proposals could increase the cost of developing the floodplain by eliminating the insuring of loans, or by requiring that structures be flood proofed.

For the county and the incorporated areas which compose the Skagit Regional Planning area, the concern is the protection of existing urban development on the floodplain. These areas cannot be neglected due to the amount of existing investment involved. If flood control projects are chosen that provide the whole lower valley with 100 year protection, the agricultural area would be subject to urban expansion and would depend on zoning restrictions as the only means of preserving the agricultural land. This problem would not be as severe if the 100 year protection extended only to the urban and fringe areas of the cities, with a lesser (but perhaps greater than current) degree of protection for the agricultural areas. These fringe areas would not have to completely eliminate any intensification or expansion of selected uses. Through the early warning system and flood proofing, many uses which have movable stock and low flood damageable and/or damage producing materials, could be used in the floodplain. This may include automobile dealerships, warehouses, and grocery stores which could modularize the racks in order to move shelved stock out. Also, to give better financial security for businesses and residents in the floodplain, it is suggested that municipalities investigate the Flood Insurance Program.

Upriver recreational developments on the Skagit River are also of major concern.

These developments, although small now, could proliferate to a significant size in the future. If they became large enough, they could create a financial burden for Skagit County, the State, and Federal governments. There may also be an increase in the potential loss of life and property due to these developments. Damage and injury could occur downriver by floating debris.

Although development cannot be completely eliminated from the floodplain, the county and the cities should determine the direction their areas are planning to grow, with respect to floodplain management.

APPENDIX 1

The updating of cost figures for the flood control projects was done on the following basis. During March of 1972, the Corps of Engineers developed a cost update on the Sauk Dam into 1972 prices. Comparing those prices with the 1968 costs given in the Puget Sound and Adjacent Waters Study, Appendix XV, Plan Formulation on page 4-30, a percentage increase was determined on the 1968 costs.

(1)	\$184,000,000	(1972 prices - Corps of Engineers)
	-128,000,000	(1968 prices - PSAWS)
	\$ 56,000,000	

(2) $\frac{56,000,000}{128,000,000}$ = 43.7% increase in 1968 prices to achieve 1972 prices

This percentage increase was applied to every project listed in Table 4-13 on page 4-22 of the Puget Sound and Adjacent Waters Study, Appendix XII, Flood Control except for the cost of the 100,000 c.f.s. capacity Avon Bypass and levees at Hamilton and Sedro Woolley which was taken out of the Alternative "B" cost summary located in Appendix XV, of the Puget Sound and Adjacent Waters Study. The costs are as follows on the next page.

The non-Federal share computed for the Avon Bypass and Levee Improvements was derived from the Federal and non-Federal share computed by the Corps of Engineers as given in the <u>Avon Bypass Reactivation Report</u> and <u>Skagit River Report</u>. Finding the percentage amount of the non-Federal share given in the Corps reports, this percentage was then applied to the 1972 prices to determine the non-Federal share.

<u>Avon Bypass</u>

Federal	\$19,100,000
Non-Federal	4,150,000
TOTAL	\$23,250,000

$\frac{4,150,000}{23,250,000}$ = .18 or 18%

60,000 c.f.s. -- .18 x 41,616,000 = 7,490,880 1972 Non-Federal

100,000 c.f.s. -- .18 x 52,272,000 = 9,408,960 1972 Non-Federal

<u>Levee Improvements</u>

Federal	$5,770,000
Non-Federal	237,000
TOTAL	$6,007,000

$\frac{\$\ 237,000}{6,007,000} = .039$ or 3.9%

.039 x 10,080,000 = $397,695

Table 5

PROJECT COST ESCULATION -- 1968 - 1972

Project	1968 Prices	x 1.43 x 7 =	1972 Prices
Avon Bypass			
60,000 c.f.s.	$ 28,900,000		$ 41,616,000
100,000 c.f.s.	36,300,000		53,272,000
Baker Dam*	---		---
Levee Improvements	7,000,000		10,080,000
New Levees			
Sedro Woolley			
Plan "A"	3,000,000		4,320,000
Plan "B"	4,000,000		5,800,000
Hamilton			
Plan "A"	2,800,000		4,032,000
Plan "B"	3,800,000		5,500,000
Sauk Dam	128,000,000		184,000,000
Flood Control	60,000,000		86,000,000

*Baker Dam does not represent any construction cost, but reflects a loss of revenue from lower power production. Thus, this form of cost updating procedure would not follow for the Baker Dam case.

FEDERAL FLOOD INSURANCE PROGRAM

This Chapter is concented with: 1) a brief introduction to the program; 2) the status of the program in Skagit County; 3) important aspects of the program; 4) information for the purchaser, and 5) future proposals. The Act as amended and regulations governing the Act are available for inspection at the Skagit County Planning Department.

1. INTRODUCTION

The program was created by the National Flood Insurance Act of 1968 as part of the Housing and Development Act of 1968. The purpose of the program is to offer flood insurance protection to property owners in flood/mud slide prone areas that was not available before. One other important purpose is to create the incentive for communities to adopt minimum land use controls, as specified, which would start to minimize the total flood/mud slide damage in the community. This would benefit both the Federal Government and the community involved. The program provides monetary protection for existing development and locational protection for proposed or improved development.

2. STATUS

Skagit County was acknowledged as being eligible for the program on June 16, 1971, by the Federal Flood Insurance Administration. An amendment to the Interim Zoning Ordinance was amended to meet the minimum land use requirements in December, 1971, by the Skagit County Board of Commissioners. This applied for only unincorporated areas of Skagit County and not the incorporated areas of Burlington, Hamilton, Lyman, LaConner, Mount Vernon, and Sedro Woolley. A rate study is currently being done by the Federal Insurance Administration, and the county is currently on the emergency rate program. This rate study will determine which actuarial rates should be used in the county, and define the floodway east of Sedro Woolley (this concept will be explained later).

3. IMPORTANT ASPECTS

There are several portions of the regulation and the Act which are important to people qualified for the program and to communities which may be interested in applying for Federal Flood Insurance eligibility.

The first significant portion of the Act is the emergency rating program for which Skagit County is currently eligible. Section 1909.3 of the Act states that only after completion of a ratemaking study (to determine the actuarial rates) could a community become eligible for the sale of flood insurance. Due to possible delays, the regulation provides in Section 1909.3 that communities that meet the requirements may be eligible for insurance at the subsidized rates before the ratemaking study is completed. Under the emergency rating program a person can only purchase insurance up to set limits. When the actuarial rates are determined, the purchaser may acquire additional coverage under the new rates. New construction can obtain insurance only at the actuarial rate.

As amended, the emergency program will exist until December 31, 1973. After that date, a rate study will be needed to qualify.

In order to qualify for the program, a community must meet certain requirements that are described in Subsection 1909.22 of the Act. (copies of the Act are available at the Skagit County Planning Department)

> (a) In order to qualify for Federal flood insurance a community must apply for eligibility for the entire area within its jurisdiction, and must submit---
> (1) Copies of official legislative and executive actions indicating a local need for flood insurance and an explicit desire to participate in the Federal Flood Insurance Program;
> (2) Citations to State and local statutes and ordinances authorizing actions regulating land use and copies of the local laws and regulations cited;
> (3) A summary of State and local public and private floodplain or mud-slide area management measures, if any, that have been adopted for the floodplain areas and/or mud-slide areas in the community. This submission may be in any suitable form, but should list or enclose copies of easements, zoning, building, and subdivision regulations, health codes, and other corrective and preventive measures instituted to reduce or prevent flood or mud-slide damage;

(4) A large-scale map of the entire area under the community's jurisdiction, identifying local floodplain areas and mudslide areas, if any, and showing the names of rivers, bays, gulfs, lakes, and similar bodies of water that cause floods;

(5) A brief summary of the community's history of flooding and/or mudslides and the characteristics of its floodplain and/or mudslide areas, if available, including the locations of any known high water marks and/or mudslide occurrences. A current floodplain information report prepared by the U.S. Army Corps of Engineers or a similar report will satisfy the requirements of this sub-paragraph and the preceding sub-paragraph with respect to floodplain areas;

(6) A clean map of the community, preferably in black and white, clearly delineating its corporate limits, which can be reproduced for publication. If the best available map is copyrighted, a letter of release must be obtained;

(7) A list of the incorporated communities within the applicant's boundaries (if the application is made on behalf of a county or a political subdivision containing more than one incorporated community);

(8) Estimates relating to the flood-prone area concerning:

(i) Population,

(ii) Number of one to four family residences,

(iii) Number of small businesses;

(9) Address of a local repository, such as a municipal building, where the flood insurance and flood hazard maps will be made available for public inspection;

(10) If applying before December 31, 1971, a commitment to adopt by that date and maintain in force for areas having special flood and/or mudslide hazards adequate land use and control measures with effective enforcement provisions consistent with the criteria set forth in Part 1910 of this subchapter;

(11) If applying after December 31, 1971, a copy of the land use and control measures the community has adopted in order to meet the requirements of 1910.3 and/or 1910.4 of this subchapter.

(12) A commitment to recognize and duly evaluate flood and/or mudslide hazards in all official actions relative to land use in the areas having special flood and/or mudslide hazards and to take such other official action as may be reasonably necessary to carry out the objectives of the program; and

(13) A commitment to:

(i) Delineate or assist the Administrator, at his request, in delineating the limits of the areas having special flood and/or mudslide hazards on available local maps of sufficient scale to identify the location of building sites;

(ii) Provide such information as the Administrator may request concerning present uses and occupancy of the floodplain and/or mudslide area;

(iii) Maintain for public inspection and furnish upon request, with respect to each area having special flood hazards, information on elevations (in relation to mean sea level) of the lowest floors of all new or substantially improved structures and where there is a basement, the distance between the first floor and the bottom of the lowest opening where water flowing on the ground will enter; and

(iv) Cooperate with Federal, State, and local agencies and private firms which undertake to study, survey, map, and identify floodplain or mudslide areas, and cooperate with neighboring communities with respect to management of adjoining floodplain and/or mudslide areas in order to prevent aggravation of existing hazards;

(b) An applicant must also legislatively---

(1) Appoint or designate an agency of official with the responsibility, authority, and means to implement the commitments made in paragraph (a) of this section; and

(2) Designate an official responsible to submit, on each anniversary date of the community's initial eligibility, an annual report to the Administrator on the progress made during the past year within the community in the development and implementation of floodplain and/or mudslide area management measures.

(c) The documents required by paragraph (a) of this section and evidence of the actions required by paragraph (b) of this section must be submitted to the Federal Insurance Administrator, Department of Housing and Urban Development, 451 Seventh Street, S.W., Washington, DC 20410.

If a community wants the program, it must adopt a land use control measure consistent with the objectives and criteria of the program.

Land use control measures must meet one of five sets of criteria, depending on the amount of information available. The minimum land management criteria evaluation sheet in this act, is used to determine which set of guidelines (thus, the level of information) the community has to meet. The four sets of guidelines which would concern Skagit County are contained in Subsection 1910.3 of the Federal Flood Insurance Program enabling act.

Skagit County is currently using tht Interim Flood Ordinance and state laws to meet the land use control standards. A new flood control ordinance should be adopted. Although presently the county does not have to concern itself with waste treatment, cities in the floodplain will have to contend with if it they are to be qualified.

The regulations of the Act establish the flood level at the 100 year level but Section 1910.5 provides exemptions according to local conditions. This exemption clause is the reason why the current Interim Zoning Ordinance is directed at 50 years flood flows.

Another consideration of the flood insurance program is the mudslide hazard in the county. Although certain slide areas are prevalent in the county, no delineation has been made, nor does the present zoning ordinance consider such areas. In the future, it may be necessary to determine potential mudslide zones and incorporate them into the zoning ordinances. Subsection 1910.4 of the regulations gives recommended guidelines for a land use control measure for this problem.

These land use controls should try to attain the following goals:

1. Encouraging only that development into flood prone area which
   a. is appropriate in light of the probability of flood damage and the need to reduce flood losses,
   b. is an acceptable social and economic use of the land in regards to the hazards involved,
   c. does not increase the danger to human life.
2. Discourage all other development.

(Section 1910.23 (a))

These controls should not conflict with a suggested social and economic goals of Section 1910.22 (a):

(a) Diverting unwarranted and unwise development away from flood prone and mudslide prone areas;
(b) Encouraging flood and mudslide control and damage abatement efforts through public and private means;
(c) Deterring the unnecessary or improper installation of public utilities and public facilities in flood prone and mudslide prone areas; and
(d) Requiring construction and land use practices that will reduce flooding resulting from surface runoff, improper drainage, or inadequate storm sewers, and reduce the potential for mudslides.

These goals should be considered by the decision makers of the community when adopting community goals. In this way, a policy could be created which would: 1) explain to the community the intent of zoning ordinances and development; 2) develop a consistent, definite development scheme which will be of benefit to the community over a long period of time, and 3) assist in furthering inter-governmental relations and workings, with consistent development goals for various levels of government.

One important aspect of the Act is its relationship to emergency disaster relief. The Act states:

> . . . that no federal disaster assistance shall be made available to any persons for the physical loss, destruction, or damage of real or personal property to the extent that such loss, destruction, or damage could have been covered by flood insurance made available under the authority of the Act, and provided that such loss, destruction, or damage occurred subsequent to one year following the date flood insurance was made available in the area in which the property was located.

This stipulation applies to all people except for those with low incomes and includes any financial assistance as a result of: 1) a declared disaster area by the President; 2) a natural disaster as declared by the Secretary of Agriculture, and 3) a disaster, the result of which money would be loaned through the Small Business Act. With the amount of development (homes and businesses) in the floodplain, this clause could be very important to the economic recovery of the county after a severe flood.

Another important aspect of the Flood Insurance Program is their definition and delineation of the floodway and floodway fringe. The Flood Insurance Program defines the floodway as the area needed for a defined 100 year flood flow. This would only be applicable in a riverine situation such as east of Sedro Woolley in the Skagit River Basin.

The area between the 100 year floodplain and floodway is called the floodway fringe. The floodway fringe area is important in Federal agency guidelines which will be discussed in following sections.

The Flood Insurance Program requires that existing non-conforming uses not be expanded, but may be altered to incorporate floodproofing so long as it does not raise the level of the 100 year flood. Any fill or encroachments that would impair the floodway area from carrying a 100 year flood is prohibited, unless the effect on flood heights are offset by channel improvements. The only problem here is if the Wild and Scenic Rivers classification is extended to the Skagit River. With the River classified, no channel improvements could be made to offset development within the floodway area.

4. STATE REQUIREMENTS

The state regulations are similar but one important addition is that no permanent home or high potential flood damage use will be allowed in the floodway (WAC 508-60-040 part 4). Although no definition of a high potential flood damage use is provided, it would most likely include large floatable objects and/or materials which could be highly damaged. An example could be a furniture store or lumber mill.

5. INFORMATION FOR THE PURCHASER

The subsidized rates for a participating community are:

Table 1

SUBSIDIZED RATE STRUCTURE

Type of structure	Value of structure	Rate per year per $100 structural coverage	Rate per year per $100 contents coverage
(1) Single family residential	$17,500 & under	$0.25	$0.35
	17,501 - 35,000	.30	.40
	35,001 & over	.35	.45
(2) All other residential	30,000 & under	.25	.35
	30,001 - 60,000	.30	.40
	60,001 & over	.35	.45
(3) All non-residential (including hotels & motels with normal occupancy of less than 6 months in duration)	30,000 & under	.40	.75
	30,000 - 60,000	.50	.75
	60,001 & over	.60	.75

6. FLOOD INSURANCE PROVISION

In addition to covering residential units, the flood insurance rates also can be used for structures used for business, structures for religious or agricultural purposes, structures occupied by non-profit organizations, and structures owned by State and local government.

This insurance may be purchased from any licensed property and casualty insurance agent and is processed in the same way as any loss claim for other types of property insurance. Only existing structures may be covered at the subsidized rates. New structures may purchase insurance at the actuarial rates.

The policy covers losses from a flood, which is defined as "a general and temporary condition of partial or complete inundation of normally dry land areas from: 1) the overflow of inland or tidal waters; 2) the unusual and rapid accumulation or runoff of surface waters from any source, or 3) mudslides which are caused or precipitated by accumulations of water on or under the ground." The policy does not cover losses which result from causes at the location of the insured or within control of the insured. It does not cover erosion losses or losses from flood or mudslides which are in progress at the time of application for coverage. It does cover losses due to sewer backup that is clearly a result of flooding.

The Flood Insurance Program provides financial security for business and residential structures in a flood hazard area. With only dependence on disaster assistance, the community must be declared a disaster area in order to receive assistance.

Even if the community was declared a disaster area, sufficient monies may not be available for the communities. The situation in Western Washington is such that if Skagit County is seriously flooded, several other drainage basins with larger financial investments will also be in a similar situation. What this means is that disaster assistance monies could, in all likelihood, be spread out over several drainage basins. If this happens, the possibility of receiving sufficient disaster funds to cover the actual cost of damages is questionable. This problem could be further aggravated by current Federal spending policies and state budgetary problems.

The more important aspect is that some disaster funds are low interest loans which have to be paid back. The Flood Insurance Program would be a damage claim which would not have to be paid back.

The current Flood Insurance Program attempts to control future construction in flood hazard areas. It does not stipulate that development cannot be placed in a flood hazard area, but that necessary precautions must be made so that damages are kept to a minimum. The impact of this concept on development of the county is minimal because the provisions of the flood management regulations of the Skagit County Interim Zoning Ordinance fulfills the floodplain requirements.

The basic difference is that with program adoption the minimum flood frequency heights are changed from a 25 year frequency flood to a 50 year frequency flood. This would have a minimum impact in the area west of Sedro Woolley because of the water's tendency to spread out over the whole alluvial plain. For the area east of Sedro Woolley, the program would have a far greater impact because of the height differences between a 25 and 50 year flood.

With the greater height difference, the cost to raise a house above the flood elevations would be greater east of Sedro Woolley than west of Sedro Woolley. No data is readily available to measure this impact, however.

New proposals, which have been advocated by the Flood Insurance Administrator, would have a greater impact on the County and the incorporated communities than the existing law. First, if the incorporated areas of the county want Federal monies for construction and acquisition purposes in flood hazard areas, they will have to have the Flood Insurance Program available. The feasibility of doing projects without Federal participation is limited. For example, it would be difficult to construct the proposed and new sewage lines in several communities without Federal assistance. Along with the lack of Federal funds, there would also be a lack of loans from banks for mobile homes or real estate purposes within a flood hazard area.

(less land cost) or the new limit of the coverage, whichever is less. Also, any lending agency which the Federal government is responsible for supervision over, must require flood insurance for any loan relating to real estate or mobile home or personal property.

The new Act would repeal the provision that would deny disaster assistance to flood insured areas after December 31, 1973.

There was no action on the proposed Act in the last session of Congress.

THE FEDERAL AND STATE GOVERNMENTS ROLE IN FLOODPLAIN MANAGEMENT

1. FEDERAL FLOOD GUIDELINES

The United States Resources Council prepared flood guidelines for Federal agencies in response to Executive Order #11296. These guidelines were published in May of 1972. This portion of this report will discuss several portions of the Executive Order and the guidelines, to provide the public and public officials with information on the Federal Government's role in floodplain management.

Paragraph 2 of Section 1 of Executive Order #11296 is important to local governments. It states that any agency responsible for Federal grant, loan or mortgage insurance programs used for construction must evaluate flood hazards and, where practical, prohibit the uneconomic, hazardous, or unnecessary use of floodplains in such connections.

Guideline 11 suggests that an agency . . . "make the valuation of flood hazard for the site or structure, using information compiled under the preceding guidelines and decide whether the proposed use is suitable at the proposed location, and if so, under what conditions." After compiling information, the United States Water Resources Council created a guide which suggests the degree of protection various uses of land and facilities should have, as reproduced on the following page.

Guideline 12 states that various public utilities (roads, sewers, etc.) should be excluded from a high flood hazard area except when crossing a stream. The United States Resources Council felt a high flood hazard is an area within the 25 year floodplain or 100 year floodway, whichever is greater.

Table 1

FLOOD PROTECTION LEVELS FOR VARIOUS USES

Uses or Facilities	Degree of Protection Required	Permissible Location & Lowest Water-Entry Elevation
Bldgs. containing valuable documents or data or instruments, or materials dangerous to the public if released by flooding; power installations needed in emergencies; hospitals and like institutions; etc.	Maximum	Outside the area of floodplain floods.
Residential bldgs. whose occupants may not have adequate warning or means of escape during floods; public service installations needing high protection; permanent memorial cemeteries; etc.	High	Not below the elevation of the 100 year flood, and not in a riverine floodway.
Bldgs. with salvageable or replaceable goods or for storage of readily moved goods; low cost service shops; etc.	Moderate	Not below the elevation of the 50 year flood, and not in a riverine floodway.
Open-air markets or theaters or facilities storing low-cost, non-dangerous materials; etc.	Low	Not below the elevation of the 25 year flood, and not in a riverine floodway.
Low-value crop or pasture land, picnic grounds, fishing piers, recreation and wildlife use, etc.	Minimum	

These guidelines are similar to the Flood Insurance Program, although potentially more severe. Because most of Skagit County has developed in the lowlands, it may be difficult to provide needed services for present or future development. Depending on the interpretation of the Executive Order, these areas within the 25 year floodplain, especially east of Sedro Woolley, may have to fund projects themselves. If this happens, the cost of developing the area would be increased providing motivation to develop upland areas. Over the long run, this may be beneficial. Persons who presently, however, live within this area may be required to have sewers eventually and they may have to bear the full cost of these services.

The question, though, is how agencies will define what conditions are practical to prevent ". . . uneconomic, hazardous, or unnecessary use . . ." If services are built with Federal monies for these areas, then greater cause for future expansion would be added for these floodplain areas. With more development, more flood control devices are needed and greater potential flood damage may occur.

These guidelines may also have an effect on Federally insured mortgages and home and small business loans. Without these financial devices available for areas within at least the 50 year floodplain, most future development would be directed towards the upland areas due to lower costs and better financing availability. If the developed portions of the floodplain still qualified through flood protection for financial assistance, growth of the floodplain area may continue. With continued development, potential flood damages would be increased.

One other important aspect of the guidelines is the classification of various types of uses by the level of protection demanded and location on the floodplain. It must be noted that the idea behind the guidelines is not to eliminate all development off the floodplain, but protect those developments which: 1) could cause substantial damage (i.e. gas stations, log dumps); 2) cause substantial loss to the owner, and/or community (i.e. small businesses, county courthouses), and 3) could create a danger to human life (residential areas).

Open space uses could most compatibly exist in high flood frequency locations. These uses may range from automobile dealerships to outdoor theaters to farm lands. These types of open space uses, with limited permanent investment, are capable of being floodproofed, and do not contribute greatly to downriver damages.

It is suggested that this open space classification be examined when determining future development policies.

2. CORPS OF ENGINEERS

In accordance with the Federal Guidelines, the Corps of Engineers have established a policy for flood control projects. It is their basic policy that projects, if involving urban areas, should provide 100 year protection. This policy could be in conflict with various proposed projects suggested for the Skagit River.

Overall, the Federal Government is trying to control development through financial means. By raising the cost of development in floodplain areas, either through limiting federal funds (thus needing more cash available in the private or local government sector) or through insurance (thus raising the total cost of a project), and reducing or eliminating new utility construction in the floodplain area, new development may move to upland areas. By raising the cost of development in the floodplain, a price is then assessed for subjecting land uses to possible flood damage. If development is diverted from the floodplain, there would be a reduced demand for disaster assistance from governmental sectors.

3. WASHINGTON STATE FLOOD DAMAGE RELIEF COUNCIL

Various recommendations of this Council are included to provide information on State action in relation to solutions and ideas concerning flood problems. The Council was founded in 1934 as the Puget Sound Flood Control Council with the intent of providing a place where common problems could be discussed, information exchanged, and recommendations formulated for presentation to the Legislature for State flood control programs.

After renaming the Council the Washington State Flood Control Council in 1957, there was a shift in emphasis from structural solutions to other alternative methods in reducing flood damages. This shift was partly due to changes in federal and state program emphasis from individual to a combined, cooperated effort of all levels of government with the local government taking the initiative in creating long range flood damage reduction programs.

Below is a list of fifteen recommendations made by the Council to the Governor and Director of the Department of Ecology:

1. A state-wide, basin-by-basin, master plan for flood damage reduction should be developed as soon as possible.
2. An active public information program on floodplain management should be initiated by the Department and supported by appropriate funding and additional personnel.
3. Small, local projects with only minimal, localized benefits (and perhaps with downstream and/or upstream detrimental effects) should be carefully reviewed. Where possible, projects should be supported which incorporate alternatives to strictly structural solutions.
4. Projects which are strictly structural in nature should not be approved until all alternatives (i.e. land-use regulation, etc.) have been considered and incorporated into the project as efficiently as possible.
5. All counties and cities which have significant flooding problems should be encouraged, and required if necessary, to enact zoning and land-use regulations governing the floodplain. Also, structural design criteria for those structures allowed to occupy the floodplain should be supplied as part of sound zoning and floodplain management. This activity could be enhanced by the establishment of additional flood zones in the State.
6. Departmental State planning should be undertaken to provide more efficient use of the presently allotted biennial flood control funds. More efficient uses of portions of these funds could be for:

(a) expansion of the staff into such disciplines as planning, hydraulics, economics and law,
(b) a public information program by the Division, and
(c) larger contributions to well-designed and more comprehensive flood damage alleviation projects.

Efficiency in this sense is with respect to a larger reduction in flood damages for each dollar expenditure by the State. Recommendation 6 will possible require revision of present legislation governing flood control funds for public benefit (Chapter 86.26).

7. Small, obsolete flood, diking and drainage districts should be consolidated into more effective, basin-wide commissions. This topic will be expended by the Project 2(b) team on legal and political criteria.
8. Continuity should be provided for a state-wide flood damage alleviation program by having a Division engineer supervise the activities in only a few basins. In this manner the engineers will be able to provide effective guidance, continuity and control over haphazard and wasteful practices which have been "the order of the day" in the past.
9. A review board of economists and engineers should be formed to review all proposed projects to determine their relative merits as part of a state-wide flood damage alleviation plan.
10. The Corps of Engineers should be requested to complete floodplain information studies on as many flood-prone areas as soon as possible in the near future. Completion of these studies should be included as an initial phase of the state-wide flood damage reduction plan mentioned earlier.
11. Agencies submitting plans for flood projects should be required to submit more information on project benefits and costs than has been the practice in the past.
12. Money for the loan fund for qualified flood damage alleviation projects should be requested for appropriation by the Legislature during its next session, but loans should not be limited to construction features of projects.

13. The leadership for all flood activities within the State should be provided by the Department of Water Resources with active assistance and guidance to county and local engineers, planners, and government officials.
14. The practice of providing funds for repair and maintenance of private and semi-private flood associated projects, as part of Federal-State cooperative programs, should be critically reviewed. This practice falls under recommendations 3 and 6 (C).
15. A detailed study of past distribution of funds and a critical evaluation of the efficiency of these expenditures should be performed as an initial phase of the state-wide flood damage alleviation plan.

Basically, these recommendations suggest state wide planning of flood damage reduction projects, better coordination of small projects and the use of techniques other than structural as a solution to flood damage reduction.

APPENDIX 1

FEDERAL GUIDELINES - SUMMARY

In carrying out their responsibilities under Executive Order 11296, the Federal Executive Agencies should:

1. Determine first, when a proposed use is examined, whether there is any need to evaluate the flood hazard at the site or structure location being considered.
2. Consider both the "plan" and the "case" approaches for a floodplain about to receive a flood hazard evaluation, and specify the conditions under which one or the other of the approaches is more appropriate.*
3. Use the following to identify and evaluate the flood hazard:
   a. The 100 year flood as the basic flood;
   b. The flood hazard zone, defined as the area inundated by the basic flood;
   c. 1. In the plan approach, a floodway, defined as the portion of a riverine floodplain needed to convey a basic flood with not more than one foot rise in flood water elevation or
      2. In the case approach, a procedure to assure that any encroachment on the floodplain will permit conveyance of the basic flood without increasing flood heights or velocities to an extent which would cause significant upstream or downstream damage to existing or reasonably anticipated future development.

*It should be mentioned what the "case" and "plan" approaches are. The "case" approach means that, after an agency adopts general standards based on these guidelines, the suitability of a proposed use is determined on case-by-case basis. The "plan" approach develops specifications on flood hazards, based on these guidelines, which are incorporated in an agency's administrative rules and regulations. Then for each floodplain to be considered, a long-range plan of land-use regulations for the area is made. The rules and regulations, and the plan and related maps for a particular area indicate in detail what uses under what conditions are suitable in that area.

d. Floods greater or less than the basic flood as appropriate.* (This means all flood frequencies will be determined on the same basis.-see Water Resources Council's Bulletin 15, "A Uniform Technique for Determining Flood Flow Frequencies.")

4. Determine whether there are existing laws or statutes of the Federal Government, rules or regulations of other Federal Agencies, or laws, statutes, ordinances, etc., of state or local governments that provide standards for regulation of the floodplain under study. In cases where those standards are either more stringent than those based on these guidelines, or are applicable to situations or conditions not covered by these guidelines, they should be considered for the evaluation of flood hazard in that area.
5. Decide on the conditions under which an evaluation must be made to determine the impacts of including or excluding the use of site in a floodplain. Such evaluation must demonstrate clearly that the use of the site is to the advantage of society as well as to the advantage of the user of such site.
6. Select the floods to be used in a flood hazard evaluation to fit conditions of the area being investigated. (In other words, several floods flows should be examined when evaluating a site. Suggested flows are 100 year flood, floodplain flood, state and local regulatory floods, and lesser floods such as the 25 year and 50 year, where their boundaries would extend outside the floodway.)
7. Use, as the minimum amount of information for an evaluation of flood hazard, the elevation of the lowest point of water entry (taking seepage under the flood conditions into account, if necessary) at the site or structure being evaluated, the elevations of the applicable floods at the locations of the site or structure, and the intended use of the site or structure and it contents.
8. Use, as supplementary information for an evaluation of flood hazard, the present and proposed means of flood warning, available means of escape from floods, and types of structures for permanent or temporary occupancy, whichever is applicable.
9. Consider the effects of flood proofing on the reduction of flood hazard.

10. Determine the effects of proposed highway construction in the floodplain and its vicinity, and of proposed upstream or local flood prevention or control measures, if any, on the elevations of the evaluation floods.
11. Make the evaluation of the flood hazard for the site or structure, using information compiled under the proposed use is suitable at the proposed location, and if so, under what conditions.
12. Adopt the policy of discouraging the construction of those roads, utilities and other public facilities (except those crossing streams) within the most hazardous portions of the floodplain that aggravate flooding and encourage undesirable developments in that zone.
13. Develop, in conjunction with local "permit agencies" a list of facilities and uses that would be permitted in present floodplains before and after completion of upstream or local flood prevention or control measures so as to ensure that construction or occupancy does not occur before the measures are effective.
14. Delineate, or ensure the delineation of, on Federally owned properties, the elevation of the 100 year flood, and the elevations and dates of occurrence of floods of record whose magnitudes should be known by the public.
15. Encourage state and local agencies to keep a permanent record of information on each floodplain evaluated, the flood hazard evaluation procedures and decisions, the flood prevention or control measures proposed for upstream or local construction, the flood elevation delineations, the uses that are suitable and the order or schedule of establishment of suitable facilties, the satisfactory human and animal occupancy and the general standards applicable to recommended or approved uses of the flood hazard area. Where floodplain regulations by local "permit agencies" or direct Federal regulation is made a condition of use or occupany, or where guarantees from users whose permission to build or occupy is contingent on their performance of specified actions, formal guarantees or agreements and other decisions reached for the area should be a matter of permanent record.

FLOODPLAIN MANAGEMENT

An effective floodplain management program is an alternative to flood control projects. The floodplain management program can be accomplished in a variety of ways. The primary concern of the program is to minimize structures on the floodplain and/or to require that new structures be built to offer minimum resistance to floodwater in certain crucial areas.

Some objectives of the floodplain management program are as follows:

1. Prohibition of floodplain uses such as filling, dumping, storage of materials, structures, buildings and any other works which, acting alone or in combination with other existing or future uses, will increase potential flood heights and velocities by obsturction to flows and loss of valley storage. (This would be most critical east of Sedro Woolley.)
2. Protection of human life and health.
3. Minimization of public and private property damages.
4. Minimization of surface and ground water pollution which will affect human, animal or plant life.
5. Control of development which, acting alone or in combination with similar developments, will create an additional demand for public investment in flood control works.
6. Control of development which, acting alone or in combination with similar development, will create an additional burden to the public in the costs of rescue, relief, emergency preparedness measures, sand bagging, pumping, and temporary dikes or levees.
7. Control of development which, acting alone or in combination with similar development, will create an additional burden to the public for business interruptions, factory closing, disruption of transportation routes, interference with utility services and

other factors that result in loss of wages, sales, production and result in tax write-offs.

8. Provisions for public awareness of the flooding potential and to discourage the victimization of unwary land and home buyers.
9. Maintenance of stable tax base through the preservation or enhancement of property values for future floodplain development. In addition, development of future flood blight areas on floodplains will be minimized and property values and the tax base adjacent to the floodplain will be preserved.

(Source: "Factors in Floodway Selection," by Thomas Lee A.M. ASCE, Chief, Flood Plain and Shoreland Management Section, Wisconsin; presented at the August 18-20, 1971, ASCE, 19th Annual Specialty Conference of the Hydralics Division, Iowa City, Iowa)

There are several ways by which a floodplain management program could be implemented. These are: 1) land use controls; 2) tax adjustments; 3) public policy directing the construction and location of public facilities and services out of flood prone areas, and 4) flood proofing existing structures. The feasibility of using such techniques should be examined for use in Skagit County.

As mentioned, one important form of floodplain management is flood proofing. No costs have been determined for flood proofing existing or new facilities due to the differences of structures, but methods of effective flood proofing are known. Residential, commercial, and industrial areas could effecitvely be raised four or five feet, five or six feet, and in excess of ten feet, respectively.

Skagit County presently has a form of floodplain management through an amendment to the Interim Zoning Ordinance #4081, as mentioned before:

1. All construction or structures on land situated within the floodways that are or will be established by the Corps of Engineers shall be permitted by conditional use permit only. Such permits shall only be issued when:
   a. The structures, works, or obstructions are designed so as not to be appreciably damaged by flood waters.

b. The structures, works, or obstructions shall be placed or affixed upon the property so as to offer the minimum obstruction to and effect upon the flow of flood water.

c. The structures, works, or obstructions shall be firmly anchored or affixed to the property in order to prevent dislocation by flood water and damage to life, health, and property.

d. The strucutres, works, or improvements will not adversely influence the regimen of any body of water by restricting, altering or hindering, or increasing flow of the flood waters in the floodway or flood channel expected for a maximum flood of up to a fifty (50) year frequency.

e. The structures, works, or improvements meet all other zoning requirements and State Regulations W.A.C. 508.60 and R.C.W. 86.16.

2. All lands situated below the fifty (50) year frequency flood level[(1)] except for properties included in above noted paragraph, shall be classified as floodplain and as such the following conditions shall be required:

   a. The floor level of structures for residential, commercial, or industrial use shall be located above the fifty (50) year frequency flood level. (1 & 2)

   b. All furnace fire pots and electrical distribution panels shall be placed above the fifty (50) year frequency flood level. (1)

   c. A certified benchmark[(3)] shall be located within 200 feet of all proposed structures in the floodplain area prior to issuance of a building permit.

3. All structures located on tracts 20 acres or larger in an agricultural zoned area are exempt from the standards.[(4)]

(1) As established by Army Corps of Engineers
(2) Limitations shall apply only to those structures used for human occupancy, or the principal buildings housing commercial, or industrial operations. Limitations shall not apply to barns, garages, or other accessory structures and their contents which are not susceptible to major flood damage.
(3) Benchmark as established by a registered land surveyor or registered civil engineer.
(4) Structures constructed not in conformance with these standards are not eligible for flood insurance.

The ordinance is very similar to State Regulations W.A.C. 508.60 and R.C.W. 86.16 except with reference to flood frequency and floodway concepts. Also, the state regulations prohibit structures used for permanent human habitation, or uses associated with high flood damage potential within the floodway.

Unfortunately, neither the State nor county regulations are concerned with the control of high damage producing uses which could be located on the floodplain. For example, it would be almost impossible to eliminate gas stations from the floodplain in the lower valley. In some floods, though, fires which were caused and maintinaed by gas from gas stations create more damage and danger than the flood itself. Present ordinances require that structures must be designed so that the structure would not be appreciably damaged by flood waters. Present regulations do not require potentially high damage <u>producing</u> uses to be designed so that danger to human life or other structures is minimized. This requirement would help eliminate potential damage on the floodplain.

The impact of the present regulations has an effect of raising the cost of development in the floodplain area through their requirements for flood proofing. By requiring structures to be elevated/flood proofed, construction costs increase. When costs increase, fewer people are willing, or can afford, to live on the floodplain. Thus, less demand is created for residential use of the floodplain and the desirability of upland areas is increased. This increased cost of developing the floodplain is the true cost for residing in that area. By requiring flood proofing, the cost of developing the floodplain is transferred from the public sector to the private sector.

TECHNICAL FLOOD INFORMATION

1. GENERAL STREAM CHARACTERISTICS

This portion of the report will briefly describe some concepts which apply to rivers.

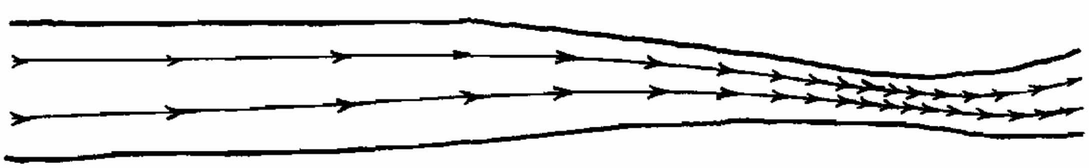
1A. Drop in Elevation

The energy which a stream initially gets in order to start moving comes from the earth's gravity pulling the water down. So, just like a ball rolling down a hill, the steeper the stream channel (the greater drop in a given distance) the faster the water will move through a channel.

1B. Channel Width

When a river channel narrows, the velocity of the river increases (assuming the depth of the channel is the same). Illustration 1 below illustrates this idea.

Illustration 1



Closer the arrows, the faster the velocity

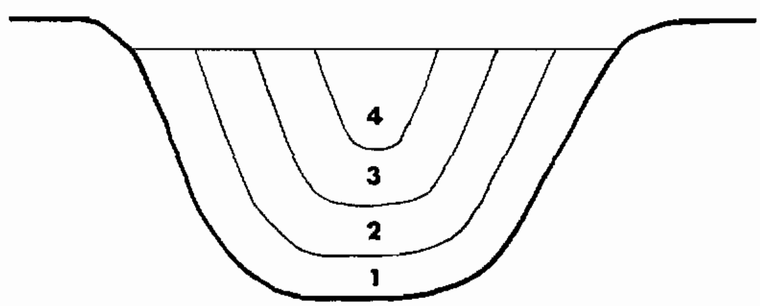
This idea explains the basis of upstream storage areas where the river widens out, water starts to accumulate, especially when a narrow passage is ahead. As one knows, when using a funnel, not all the water can pass through at once. Thus, some of the water is temporarily stored in this wide area before passing downstream.

This idea also helps explain the danger of a dike failure. A failure creates a small opening (like a narrow channel), which the water tries to get through assuming that a positive head exists. Going through the small opening means the water goes at a much faster speed than in the river channel. At a faster speed, the water is more destructive.

1C. Up to now, velocity in general has been discussed in relation to a river. At one part of a river though, velocities are different, depending on the location to the channel. The closer to the bottom or sides. the slower the current because of the effect the shore has on the water.

Looking at the illustration below, zone 1 is the slowest because of the friction with the side and bottom of the river. Zone 4 is the fastest portion with zones 2 and 3 in between zones 1 and 4.

Illustration 2

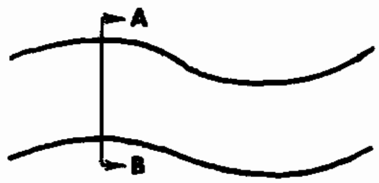


speed in a continum

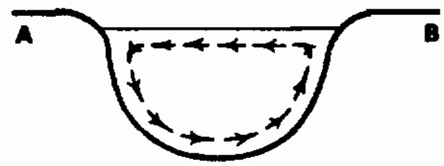
slowest -------- fastest
zone 1 -------- zone 4

When a river starts to meander, another type of current exists at the bend of a river. If one looked at a river cross section at a bend, it would be seen that the current also flows from the outer bank (A) across the bottom to the inner bank (B) as illustrated below:

Illustration 3



Section A - B

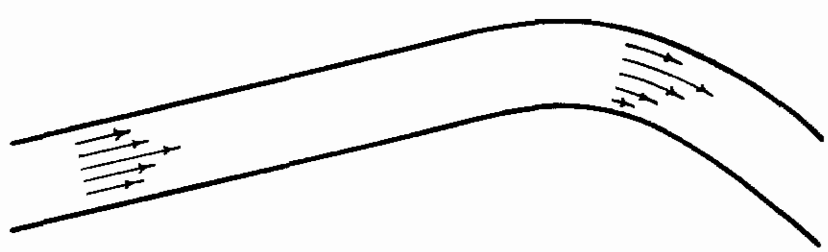


From this illustration, one can see that bedload materials (rocks, etc., that are dragged across the bottom) is eroded from the outer bank (A) to the inner bank (B).

1D. River Course

Generally speaking, the straighter the river runs, the faster the water travels. Conversely, the more meandering (curving back and forth) the slower the current. The faster portion of the river changes. In a straight path, the faster current is in the middle where there is no friction or drag from the river shore. In a river bend, the faster current goes towards the outside bank, but not next to it. The illustration below demonstrates these two ideas.

Illustration 4



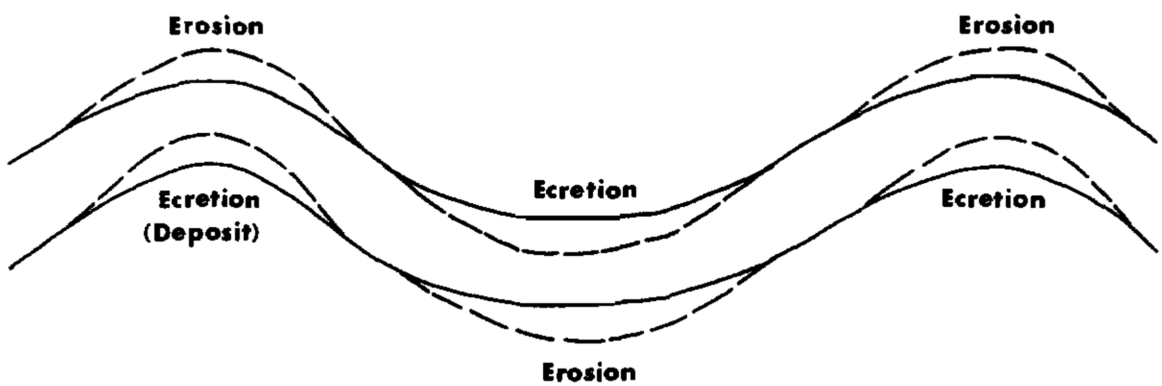
Thus, a transfer of force is exerted from the center of the river to the outside bank, which could create bank erosion and dike failures.

1E. Centrifugal Force

When the river bends, the water tends to push up against the outside bank. This is due to the centrifugal force (pushing outward) that is influencing the water. Not only does the water push against the banks, but also the water level on the outer curve of the bank is actually slightly higher than on the inside bank.

Combining some of this information, one can gain an understanding how a river works. When the river begins to bend, a certain process begins. The outside bank begins to erode and the inside bank accumulates deposits. (The size or the amount of material that erodes or accumulates depends on the river velocity. The faster the velocity, the larger the size of material.) As this process continues, the meanders (curves) get larger and the river velocity decreases. The drawing below attempts to show this process:

Illustration 5



Hopefully, these ideas and concepts will give one a better perspective and understanding when reading the rest of this report.

2. GENERAL FLOOD INFORMATION: SKAGIT RIVER BASIN

The Skagit River flows for 163 miles from Canada to Skagit Bay and drains 3,105 square miles of land, which includes 400 square miles in Canada and approximately 874 square miles in Whatcom County. According to Corps of Engineers data, the mean annual flow ranges from 10,000 to 20,000 c.f.s. with maximum and minimum flows of 144,000 c.f.s. in 1951 and 2,740 c.f.s. in 1942, respectively at Mount Vernon. The Skagit River flow has equaled or exceeded 62,000 c.f.s. at Sedro Woolley (close to the zero damage flood flow) about 1% of the time during a 13 year recoding period. This flow has been calculated in the Puget Sound and Adjacent Waters Study as having a 40% probability of being a three day average flow at Mount Vernon. A flood flow of around 100,000 c.f.s. could be a peak flow and also could be a three day average flow, which could create saturated dikes that could break. Thus, in considering flood control, the duration of lesser but significant flows are as important as concern about peak flows.

Through the drainage basin, the Skagit River flows from an elevation of about 1,600 feet at the Canadian border to sea level. From the Skagit headwaters to Rockport (a distance of 70 miles) the river has an average drop of 15 feet per mile. Between Rockport and Sedro Woolley, the river drops four feet per mile and in the delta area west of Sedro Woolley, one foot per mile. The tributaries are relatively steep, though, ranging from 30 to 80 feet per mile drop.

Water profiles vary greatly as to the amount of discharge. As might be expected, when confined to the river channel, water elevation and decent varies, so that velocity is not necessarily the same for different flows. Future flood control works in the form of dikes would have great difficulty in maintaining the flow in the river channel, unless the dikes were extremely high. An alternative may be to move the dikes apart in order to increase the water area - a popular method called "tangent diking."

The runoff in the Skagit River Basin varies. The Baker River, which receives precipitation from the initial lifting of Pacific air over the

Cascade Range, receives an annual runoff of 120 inches of precipitation at Concrete. The Skagit River above Newhalem is in the rain shadow of these same mountains and annually receives 50 inches of precipitation. The Sauk River system contributes about one third of the total runoff of the Skagit River Basin above Mount Vernon. The Corps of Engineers, in determining potential upstream storage facilities, estimated the amount of discharge of a 100 year flood and a maximum three day runoff volume:

Table 1

AMOUNT OF DISCHARGE

River Basin	100 Year Peak Flow at Site c.f.s.	Maximum 3-Day Volume Acre-Feet
Sauk River	110,000	342,000
Cascade River	22,000	70,000
Thunder Creek near Hamilton	12,700	40,000
Skagit River (Copper Creek site*)	45,000*	140,000*

*On the Skagit River and controls about two thirds of the inflow between Ross Dam and Marblemount; i.e. about 40% of the unregulated "Skagit at Marblemount" hydrograph.

Total runoff of the basin is equivalent to about 71 inches of precipitation per year, with high and low extremes of 94.1 inches (15,520,000 acre-feet) and 46.2 inches (7,628,000 acre-feet) respectively at Mount Vernon.

The bedload sediment handled by the Skagit River amounts to about 500,000 cubic yards annually. The channel depths are quite stable, but due to the great amount of bedload sediment, any new channel that would be placed would require maintenance dredging, which would cost from about $.65 to $1 per cubic yard.

DEVELOPMENTAL CHARACTERISTICS

An inventory and analysis of the developmental characteristics, when combined with data on physical characteristics, flood characteristics, and community facilities provide a set of perimeters within which the decision making functions of the planning process can occur. The interrelationship of the natural and man made developmental systems must be clearly reviewed to successfully develop meaningful land use decisions.

The Developmental Characteristics portion of this report is composed of the following chapters:

1) Existing Land Use Analysis
2) Population Analysis and Projections
3) Housing Analysis and Projections
4) Land Ownership Patterns
5) History of Development
6) Developmental Costs
7) Economic Base Analysis

EXISTING LAND USE

1. INTRODUCTION

The existing land use data discussed in this element of the report was developed in the summer of 1972 on a parcel by parcel basis for the entire study area. The raw data is displayed on section maps. On these section maps, each land use is identified and located both in relation to property lines and in relation to change in land use characteristics within individual parcels of property. Thus, the portion of a parcel adjoining a road and containing a residence would be described, and the back portion, used for active cropland, would be delineated as well.

This raw and bulk land use data is available at the Skagit County Planning Department.

In addition to the section maps containing parcel and land use characteristic information, the land use data is cross-referenced with numerical land use data logs. These land use data logs describe each 40 acre parcel of land, in terms of the 1) various land uses within that 40 acre parcel; 2) the number of each of the land uses, and 3) the acreage of each of the land use classifications which occur in that 40 acre parcel of property.

The land use data logs are also available for reference purposes in the Skagit County Planning Department. The information contained in the data logs is prepared by computerization and has been key punched onto cards for use in a computer. These keypunched cards are also available at the Skagit County Planning Department.

2. EXISTING LAND USE IN THE STUDY AREA (See Map I in the Map Section)

The existing pattern of land use in the floodplain and related upland areas

Table 1

LAND USE ACREAGE
(for activities and areas)

	Residential	Community	Commercial	Industry	Transport	Forest	Agriculture	Parks	Total by Area
Mount Vernon Proper	2,808.00	284.50	330.00	172.25	1,562.50	29,721.50	17,717.25	51.00	52,647.50
Burlington/ Bayview	1,278.00	253.75	174.25	36.25	574.00	3,363.00	13,259.25	38.50	18,977.00
Sedro Woolley Proper	1,735.25	200.00	90.50	195.00	682.50	20,534.00	13,261.75	17.50	36,716.50
Bow/Alger/ Samish	879.25	59.50	43.75	150.25	1,446.50	24,032.00	20,599.00	442.00	47,353.25
Middle Skagit River	1,393.75	97.25	48.00	230.50	1,152.00	82,534.00	13,985.00	8.50	99,449.00
South Skagit Floodplain	683.00	97.50	111.50	72.50	166.50	1,585.50	23,652.50	---	26,473.00
Upper Skagit River	475.00	54.50	16.00	69.00	597.00	63,975.00	2,652.50	392.50	68,232.00
Sauk River	103.75	4.00	---	---	464.00	33,296.50	1,136.25	5.00	35,009.50
Lower Wilderness	124.25	1.00	.50	20.50	92.50	90,651.50	145.00	---	91,035.25
Upper Wilderness	7.50	---	---	7.00	46.00	76,394.50	247.00	---	76,702.00
TOTAL BY USE	9,488.25	1,052.00	814.50	954.25	6,483.50	426,088.00	106,760.00	955.00	552,595.00

Table 2

LAND USE BY STRUCTURES
(for activities & areas)

	Residential[1]	Community	Commercial[2]	Industry	Total by Area
Mount Vernon Proper	5,353	110	608	59	6,130
Burlington/ Bayview	2,377	42	211	12	2,642
Sedro Woolley Proper	3,320	51	169	44	3,585
Bow/Alger/Samish	1,211	18	45	37	1,311
Middle Skagit River	1,471	51	65	39	1,626
S. Skagit Flood-plain	991	27	128	14	1,160
Upper Skagit River	432	20	21	12	485
Sauk River	54	1	---	---	55
Lower Wilderness	353	2	2	2	359
Upper Wilderness	3	---	---	1	4
TOTAL BY USE	15,565	322	1,249	220	17,356

[1]Less accessory buildings

[2]Less parking lots

of the Skagit River varies from moderately intense urbanization (i.e. apartments, commercial structures, and city residential) to scattered structures in the agricultural areas of the area, to completely uninhabited and very large forested areas.

3. LAND USE BY ACREAGE (See Table 1)

In terms of gross acreage, the various land use classifications in the Skagit River Floodplain and related uplands areas are described in the tables below. These tables display the total gross acreage and the distribution (by percentage) of each land use classification for each of the geographic areas of the Skagit River Floodplain. These tables can be used to compare land use patterns in the total study area with patterns in each of the geographic areas. See Tables 1 and 2 for these comparisons.

4. LAND USE BY STRUCTURES (See Table 2)

The land use data developed in this study was designed to provide information on both the acres (i.e. area) of land in each of the land use classifications and the number of structures which occupy each of the primary land use classifications. The number of structures for the residential, community, commercial and industrial land use classifications is displayed on the following pages. These tables are arranged in the same fashion as the tables which display the acreage relationship for each of the land use classifications. The land use unit tables can be used to determine the gross number and percentage of structures in each primary land use classification for the project area. Comparisons can also be developed between the geographic areas and the pattern of land use activities can be derived within each geographic area. See Tables 1 and 2, for these comparisons.

5. GENERALIZED LAND USE

The following table, "Generalized Land Use," is a summary table displaying land use data by classification for geographic areas. Table 3 capsulizes the information contained in Tables 1 and 2, and applies to the entire Skagit River Floodplain and related uplands areas. The Generalized Land Use table contains nine land use classifications and compares these classifications by: 1) the number of structure in each classification; 2) the percentage in each classification; 3) the acreage in each classification, and 4) the percentage of acres in each classification.

Table 3

GENERALIZED LAND USE*
(by activity)

Use	# of Units	% of All Units	Acres	% of Acres
Residential[1]	15,565[1]	89.68	9,488.25	1.71
Community	322	1.85	1,052.00	.18
Commercial[2]	1,249[2]	7.19	814.50	.44
Industrial	220	1.26	954.25	.17
Transportation	---	---	6,483.50	1.17
Forest	---	---	426,088.00	77.10
Agriculture	---	---	106,760.25	19.31
Parks	---	---	955.00	.17
TOTAL	17,356	100.00	552,595.75	100.00

* Skagit River Floodplain and Related Uplands (East of Swinomish Slough)

[1]Less accessory buildings

[2]Less parking lots

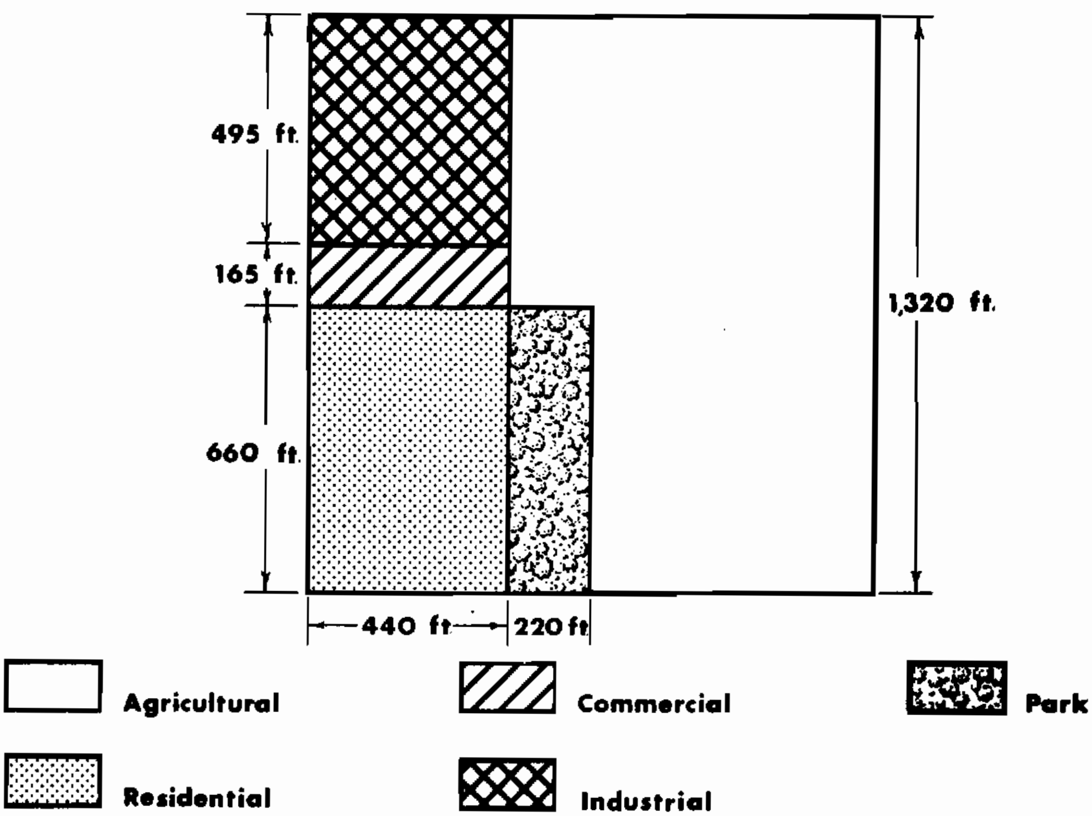
6. VALIDITY OF LAND USE DATA

The validity of the land use data was checked by comparing the number of single family residential units (not including accessory buildings) with the 1970 census data on single family dwelling units. The 1972 land use survey indicates that there were 15,565 single family dwelling units in the project area. The 1970 census figures indicate that there were 15,215 single family dwelling units.

The aggregation of each of the land use classifications in each quarter of a quarter was used to determine the primary land use classification in that particular forty (40) acres parcel. An example of a typical quarter of a quarter of a section is as follows:

Example of a Quarter of a Quarter

Land Use Sample



In the above example there are 217,800 square feet of industrial land use, 72,000 square feet of commercial land use, 290,400 square feet of residential land use, 145,200 square feet of park area, and 1,016,400 square feet of agricultural land. Therefore, this quarter of a quarter of a section would be represented on the generalized land use map as being agricultural land.

In addition to the generalized land use map contained in the map section, the Skagit County Planning Department has a reference copy of the generalized land use map at a scale of one inch to the mile which identifies the number of land uses in each of the primary land use classifications

Comparison of Residential Dwelling Units	
1972 Land Use Survey	15,565
1970 Census Data	- 15,215
	350

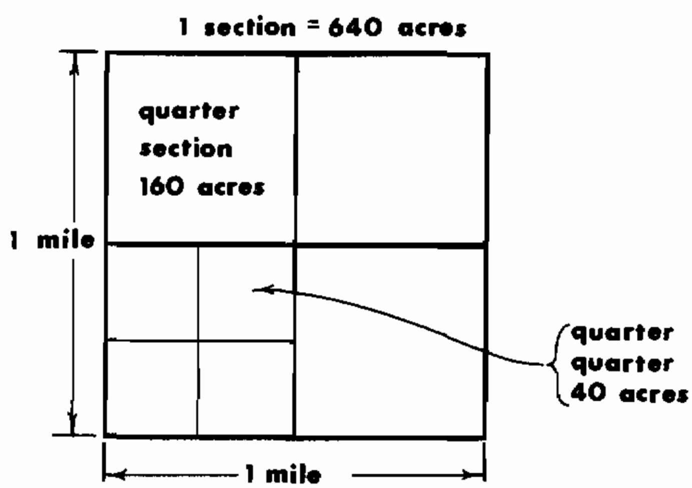
7. ESTIMATED NEW CONSTRUCTION

Taking in account new construction between the 1970 census and the 1972 Land Use Survey, there appears to be a high level of correlation between the two data sets.

The other figures given by the land use survey could not be checked for comparability because information was not available to make comparisons. Thus, the dwelling unit comparison is the only way the validity of the 1972 Land Use Survey could be checked. On the basis of the comparison with census data, it is felt that the 1972 Land Use Survey is reasonably and satisfactorily accurate.

8. MAP OF EXISTING LAND USE

The map following this section is the land use map of the project area. The information contained in the map is generalized by 40 acre increments. The forty (40) acre generalization was developed by aggregating the land uses in each quarter of a quarter of a survey section (i.e. 640 acre (1 square mile) = 1 section) within each of the Townships and Ranges in the project area. The illustration below demonstrates the quarter of a quarter of a section concept.



in each quarter-quarter section of land. This dot chart provides an excellent reference as to the regional array of the various land uses in comparison with the generalized distribution of land uses.

9. LAND USE DENSITIES

The table which follows presents the relationship between land use and their respective densities for the project area. Table 4 compares the number of structures per acre for the various land use calssifications and conversely, the number of acres allocated per structure. This table was developed as a part of the analysis of the existing land use data to facilitate the development of the alternative land use models and alternative land use plans described in other elements of this report.

Table 4

LAND USE CLASSIFICATIONS BY DENSITY

Land Use Density	Structures/Acre	Acres Allocated Per Structure
Single Family	2.04	.49
Multi-Family	1.94	.52
Mobile Home	2.68	.37
Accessory Building	4.54	.22
Group Housing	1.32	.76
Vacant	.52	1.94
	Services/Acre	Acres/Services
Community Service	.28	3.35
Quasi-Public	.32	3.15
Vacant	.33	3.00
	Commercial/Acre	Acres/Commercial
Goods	2.11	.47
Services	1.48	.68
Parking	.76	1.25
Warehouse	1.88	.53
Vacant	1.62	.62
	Industry/Acre	Acres/Industry
Heavy	.20	4.90
Light	.29	3.49
Vacant	.18	5.62
	Barns/Acre	Acres/Barns
Barns & Out Buildings	1.98	.50
Vacant	.36	2.76

LAND USE SUMMARIES
(by activity and area)

The following tables, 5-15, are summary sheets of tabulated land use data for the following:

Project Area	Table 5
Mount Vernon Proper	" 6
Burlington/Bayview	" 7
Sedro Woolley Proper	" 8
Bow/Alger/Samish	" 9
Middle Skagit River	" 10
South Skagit Floodplain	" 11
Upper Skagit River	" 12
Sauk River	" 13
Lower Wilderness	" 14
Upper Wilderness	" 15

These tabulated summaries can be used quite effectively, as can the previous section, by the various planning commissions and city councils, to help them develop adequately sized areas for proposed new developments.

Table 5

LAND USE INVENTORY

Existing Land Use	Number	Acres	Acres-% of Total	Acres-% of Section
1. Single Family	13,646	6,687.00	1.21	70.47
2. Multi-Family	307	158.50	.02	1.67
3. Mobile Home	1,196	447.00	.08	4.71
4. Accessory Bldg.	6,562	1,445.00	.26	15.22
5. Group Housing	47	35.50	---	.37
6. Vacant	369	715.25	.12	7.53
1. Community Service	199	666.25	.12	63.33
2. Quasi-Public	114	358.75	.06	34.10
3. Vacant	9	27.00	---	2.56
1. Goods	471	222.75	.04	27.34
2. Services	555	375.00	.06	46.04
3. Parking	72	95.00	.01	11.66
4. Warehouse	181	95.75	.01	11.75
5. Vacant	42	26.00	---	3.19
1. Heavy	108	537.75	.09	56.35
2. Light	100	349.00	.06	36.57
3. Tran./Util./Corridor	1,163	6,483.50	1.17	100.00
4. Vacant	12	67.50	.01	7.07
1. Standing		405,584.00	73.39	95.18
2. Harvested		20,427.50	3.69	4.79
3. Vacant		76.50	.01	.01
1. Crop Active		58,846.50	10.64	55.12
2. Crop Inactive		700.00	.12	.65
3. Pasture Active		38,552.00	6.82	36.11
4. Pasture Inactive		2,500.75	.45	2.34
5. Woodlot		3,347.75	.60	3.13
6. Barns & Outbuildings	4,334	2,182.75	.39	2.04
7. Vacant	228	630.50	.11	.59
1. Aquatic - Marine				
2. Aquatic - Fresh				
3. Park	33	955.00	.17	100.00
4. Forestry Park				
5. Shoreline, Dikes, Levees				
6. View Spot - Turnoff				

MOUNT VERNON PROPER SUMMARY

Table 6

LAND USE INVENTORY

	Existing Land Use	Number	Acres	Acres-% of Total	Acres-% of Section
1.	Single Family	4,626	1,972.00	3.74	70.21
2.	Multi-Family	130	49.75	.09	1.77
3.	Mobile Home	403	98.75	.19	3.51
4.	Accessory Bldg.	1,810	366.75	.69	13.05
5.	Group Housing	27	22.25	.04	.79
6.	Vacant	167	299.00	.57	10.64
1.	Community Service	70	234.75	.44	82.51
2.	Quasi-Public	40	49.75	.09	17.49
3.	Vacant				
1.	Goods	265	115.00	.22	34.84
2.	Services	263	119.50	.23	36.21
3.	Parking	42	55.75	.11	16.89
4.	Warehouse	56	24.75	.05	7.50
5.	Vacant	24	15.00	.03	4.54
1.	Heavy	22	97.50	.18	56.60
2.	Light	33	56.75	.11	32.94
3.	Tran./Util./Corridor	304	1,562.50	2.96	100.00
4.	Vacant	4	18.00		10.44
1.	Standing		27,876.50	52.94	93.79
2.	Harvested		1,842.00	3.50	6.20
3.	Vacant		3.00	.006	.01
1.	Crop Active		8,430.50	16.01	47.58
2.	Crop Inactive		161.00	.30	.90
3.	Pasture Active		7,524.75	14.92	42.47
4.	Pasture Inactive		437.50	.83	2.46
5.	Woodlot		584.25	1.10	3.29
6.	Barns & Outbuildings	889	484.25	.92	2.73
7.	Vacant	13	95.00	.18	.53
1.	Aquatic - Marine				
2.	Aquatic - Fresh				
3.	Park	9	51.00	.10	100.00
4.	Forestry Park				
5.	Shoreline, Dikes, Levees				
6.	View Spot - Turnoff				

BURLINGTON/BAYVIEW PROPER SUMMARY

Table 7

LAND USE INVENTORY

Existing Land Use	Number	Acres	Acres-% of Total	Acres-% of Section
1. Single Family	2,162	1,074.00	5.65	84.03
2. Multi-Family	59	32.75	.17	2.56
3. Mobile Home	134	39.50	.20	3.09
4. Accessory Bldg.	784	107.75	.56	8.43
5. Group Housing	2	.75	---	---
6. Vacant - Other	20	23.25	.12	1.81
1. Community Service	22	67.50	.35	26.60
2. Quasi-Public	20	186.25	.98	73.39
3. Vacant				
1. Goods	71	43.25	.22	24.82
2. Services	106	103.75	.54	59.54
3. Parking	4	2.75	---	1.57
4. Warehouse	34	24.50	.12	14.06
5. Vacant Ind.	1	4.50	---	12.41
1. Heavy	3	7.75	---	21.37
2. Light	8	24.00	.12	66.20
3. Tran./Util./Corridor	105	392.00	2.06	68.29
4. Vacant - Other	14	182.00	.89	46.42
1. Standing		3,096.00	16.31	92.06
2. Harvested		267.00	1.40	7.87
3. Vacant				
1. Crop Active		8,400.00	44.26	63.35
2. Crop Inactive		83.00	.43	.62
3. Pasture Active		3,737.75	19.67	28.18
4. Pasture Inactive		188.25	.88	1.41
5. Woodlot		625.00	3.29	4.71
6. Barns & Outbuildings	490	220.25	1.16	1.66
7. Vacant	6	5.00	---	.03
1. Aquatic - Marine				
2. Aquatic - Fresh				
3. Park	6	38.50	.20	100.00
4. Forestry Park				
5. Shoreline, Dikes, Levees				
6. View Spot - Turnoff				

Table 8

LAND USE INVENTORY

Existing Land Use	Number	Acres	Acres-% of Total	Acres-% of Section
1. Single Family	2,918	1,128.50	3.07	65.03
2. Multi-Family	83	32.00	.08	1.84
3. Mobile Home	238	81.75	.22	4.71
4. Accessory Bldg.	1,404	417.00	1.13	24.03
5. Group Housing	1	4.00	---	.23
6. Vacant - Other	80	72.00	.19	4.14
1. Community Service	31	147.50	.40	73.75
2. Quasi-Public	16	35.00	.09	17.50
3. Vacant	4	17.50	.04	8.75
1. Goods	75	30.50	.08	33.70
2. Services	69	35.50	.09	39.22
3. Parking	16	15.00	.04	16.57
4. Warehouse	22	7.50	---	8.28
5. Vacant - Other	3	2.00	---	2.20
1. Heavy	27	127.00	.34	65.12
2. Light	16	64.00	.17	32.82
3. Tran./Util./Corridor	124	682.50	1.85	100.00
4. Vacant - Other	1	4.00	---	2.05
1. Standing		20,003.50	54.48	97.41
2. Harvested		505.50	1.37	2.46
3. Vacant		25.00	.06	.12
1. Crop Active		5,360.00	14.59	40.41
2. Crop Inactive		173.50	.47	1.30
3. Pasture Active		6,233.75	16.97	47.00
4. Pasture Inactive		618.00	1.68	4.66
5. Woodlot		373.00	1.01	2.81
6. Barns & Outbuildings	680	325.00	.88	2.45
7. Vacant	102	178.50	.48	1.34
1. Aquatic - Marine				
2. Aquatic - Fresh				
3. Park	7	17.50	.04	100.00
4. Forestry Park				
5. Shoreline, Dikes, Levees				
6. View Spot - Turnoff				

Table 9

LAND USE INVENTORY

Existing Land Use	Number	Acres	Acres-% of Total	Acres-% of Section
1. Single Family	1,037	561.00	1.18	63.80
2. Multi-Family	11	27.00	.06	3.07
3. Mobile Home	137	67.00	.14	7.62
4. Accessory Bldg.	799	211.75	.45	24.08
5. Group Housing	11	7.00	.01	.79
6. Vacant	15	5.50	.01	.62
1. Community Service	11	38.50	.08	64.70
2. Quasi-Public	7	21.00	.04	35.29
3. Vacant				
1. Goods	12	8.50	.02	19.42
2. Services	21	14.50	.03	33.14
3. Parking	5	15.50	.03	35.42
4. Warehouse	9	3.75	---	8.75
5. Vacant	3	1.50	.003	3.42
1. Heavy	3	17.50	.04	11.64
2. Light	33	133.25	.28	88.68
3. Tran./Util./Corridor	243	1,146.50	2.42	100.00
4. Vacant	1	.50	---	.33
1. Standing		23,905.50	50.48	99.47
2. Harvested		126.50	.27	.53
3. Vacant				
1. Crop Active		13,213.50	27.90	64.14
2. Crop Inactive		60.00	.12	.29
3. Pasture Active		6,024.25	12.72	29.24
4. Pasture Inactive		477.50	1.00	2.31
5. Woodlot		290.00	.61	1.40
6. Barns & Outbuildings	759	360.75	.76	1.75
7. Vacant	64	173.00	.36	.83
1. Aquatic - Marine				
2. Aquatic - Fresh				
3. Park	5	442.00	.93	100.00
4. Forestry Park				
5. Shoreline, Dikes, Levees				
6. View Spot - Turnoff				

Table 10

LAND USE INVENTORY

Existing Land Use	Number	Acres	Acres-% of Total	Acres-% of Section
1. Single Family	1,252	925.50	.93	66.40
2. Multi-Family	6	2.50	---	.18
3. Mobile Home	158	108.00	.10	7.74
4. Accessory Bldg.	833	153.25	.15	10.99
5. Group Housing	1	0	---	---
6. Vacant	54	204.50	.20	14.67
1. Community Service	35	64.00	.06	65.80
2. Quasi-Public	15	31.25	.03	32.13
3. Vacant	1	2.00	---	2.05
1. Goods	17	6.00	---	12.50
2. Services	38	37.75	.03	78.64
3. Parking	2	1.00	---	2.08
4. Warehouse	6	2.75	---	5.72
5. Vacant	4	.50	---	1.04
1. Heavy	32	192.50	.19	83.51
2. Light	3	4.50	---	1.95
3. Tran./Util./Corridor	233	1,152.00	1.15	100.00
4. Vacant	4	33.50	.03	14.53
1. Standing		78,847.50	79.28	95.53
2. Harvested		3,667.00	3.68	4.44
3. Vacant		19.50	.02	.02
1. Crop Active		2,782.50	2.79	19.89
2. Crop Inactive		68.00	.06	.48
3. Pasture Active		8,842.00	8.89	63.22
4. Pasture Inactive		627.50	.63	4.48
5. Woodlot		1,199.50	1.20	8.57
6. Barns & Outbuildings	660	313.50	.31	2.24
7. Vacant	28	152.00	.15	1.08
1. Aquatic - Marine				
2. Aquatic - Fresh				
3. Park	5	8.50	---	100.00
4. Forestry Park				
5. Shoreline, Dikes, Levees				
6. View Spot - Turnoff				

SOUTH SKAGIT FLOODPLAIN SUMMARY

Table 11

LAND USE INVENTORY

Existing Land Use	Number	Acres	Acres-% of Total	Acres-% of Section
1. Single Family	876	506.50	1.91	74.15
2. Multi-Family	13	13.00	.04	1.90
3. Mobile Home	83	30.50	.11	4.46
4. Accessory Bldg.	653	123.50	.46	18.08
5. Group Housing	5	1.50	---	.21
6. Vacant	14	8.00	---	1.17
1. Community Service	17	69.00	.26	70.76
2. Quasi-Public	10	28.50	.10	29.24
3. Vacant				
1. Goods	23	16.00	.06	14.34
2. Services	44	51.50	.19	46.18
3. Parking	3	5.00	---	4.48
4. Warehouse	53	32.00	.12	28.69
5. Vacant	8	7.00	---	6.27
1. Heavy	8	25.50	.09	35.17
2. Light	6	47.00	.17	64.83
3. Tran./Util./Corridor	38	166.50	.62	100.00
4. Vacant				
1. Standing		1,475.50	5.57	93.06
2. Harvested		81.00	.30	5.10
3. Vacant		29.00	.10	1.82
1. Crop Active		20,211.50	76.34	85.07
2. Crop Inactive		154.50	.58	.65
3. Pasture Active		2,771.50	10.46	11.66
4. Pasture Inactive		65.00	.24	.27
5. Woodlot		154.00	.58	.65
6. Barns & Outbuildings	713	397.25	1.50	1.67
7. Vacant	11	3.50	---	.01
1. Aquatic - Marine				
2. Aquatic - Fresh				
3. Park				
4. Forestry Park				
5. Shoreline, Dikes, Levees				
6. View Spot - Turnoff				

Table 12

LAND USE INVENTORY

Existing Land Use	Number	Acres	Acres-% of Total	Acres-% of Section
1. Single Family	375	350.00	.51	73.68
2. Multi-Family	5	1.50	---	.31
3. Mobile Home	38	17.00	.02	3.57
4. Accessory Bldg.	213	57.50	.08	12.10
5. Group Housing				
6. Vacant - Other	14	49.00	.07	10.31
1. Community Service	12	44.50	.06	81.65
2. Quasi-Public	4	2.50	---	4.58
3. Vacant	4	7.50	---	13.76
1. Goods	8	3.50	---	21.87
2. Services	12	12.00	.01	75.00
3. Parking				
4. Warehouse	1	.50	---	3.12
5. Vacant				
1. Heavy	12	69.00	.10	100.00
2. Light				
3. Tran./Util./Corridor	66	597.00	.87	100.00
4. Vacant				
1. Standing		60,397.00	88.51	94.40
2. Harvested		3,578.50	5.24	5.59
3. Vacant				
1. Crop Active		431.00	.63	16.24
2. Crop Inactive				
3. Pasture Active		1,987.50	2.81	74.92
4. Pasture Inactive		57.50	.08	2.16
5. Woodlot		109.50	.16	4.12
6. Barns & Outbuildings	96	43.50	.06	1.63
7. Vacant	4	23.50	.03	.88
1. Aquatic - Marine				
2. Aquatic - Fresh				
3. Park	1	392.50	.57	100.00
4. Forestry Park				
5. Shoreline, Dikes, Levees				
6. View Spot - Turnoff				

Table 13

LAND USE INVENTORY

	Existing Land Use	Number	Acres	Acres-% of Total	Acres-% of Section
1.	Single Family	51	46.25	.13	44.97
2.	Multi-Family				
3.	Mobile Home	3	3.50	---	3.38
4.	Accessory Bldg.	41	2.50	---	2.42
5.	Group Housing				
6.	Vacant		51.50	.14	49.87
1.	Community Service				
2.	Quasi-Public	1	4.00	---	100.00
3.	Vacant				
1.	Goods				
2.	Services				
3.	Parking				
4.	Warehouse				
5.	Vacant				
1.	Heavy				
2.	Light				
3.	Tran./Util./Corridor	27	464.00	1.32	100.00
4.	Vacant				
1.	Standing		31,272.00	89.32	93.91
2.	Harvested		2,024.50	5.78	6.08
3.	Vacant				
1.	Crop Active				
2.	Crop Inactive				
3.	Pasture Active		1,107.00	3.16	97.42
4.	Pasture Inactive				
5.	Woodlot		3.00	---	.26
6.	Barns & Outbuildings	34	26.25	.07	2.31
7.	Vacant				
1.	Aquatic - Marine				
2.	Aquatic - Fresh				
3.	Park		5.00		100.00
4.	Forestry Park				
5.	Shoreline, Dikes, Levees				
6.	View Spot - Turnoff				

Table 14

LAND USE INVENTORY

	Existing Land Use	Number	Acres	Acres-% of Total	Acres-% of Section
1.	Single Family	347	118.25	.12	95.17
2.	Multi-Family				
3.	Mobile Home	2	60.00	---	.80
4.	Accessory Bldg.	14	3.50	---	2.81
5.	Group Housing				
6.	Vacant - Other	4	1.50	---	1.20
1.	Community Service	1	.50	---	50.00
2.	Quasi-Public	1	.50	---	50.00
3.	Vacant				
1.	Goods				
2.	Services	2	.50	---	100.00
3.	Parking				
4.	Warehouse				
5.	Vacant				
1.	Heavy	1	1.00	---	4.87
2.	Light	1	19.50	.02	95.12
3.	Tran./Util./Corridor	9	92.50	.10	100.00
4.	Vacant				
1.	Standing		87,363.50	95.96	96.37
2.	Harvested		3,288.00	3.61	3.62
3.	Vacant				
1.	Crop Active		.50	---	.34
2.	Crop Inactive				
3.	Pasture Active		132.00	.14	91.03
4.	Pasture Inactive				
5.	Woodlot		3.00	---	2.06
6.	Barns & Outbuildings	11	9.50	.01	6.55
7.	Vacant				
1.	Aquatic - Marine				
2.	Aquatic - Fresh				
3.	Park				
4.	Forestry Park				
5.	Shoreline, Dikes, Levees				
6.	View Spot - Turnoff				

Table 15

LAND USE INVENTORY

Existing Land Use	Number	Acres	Acres-% of Total	Acres-% of Section
1. Single Family	2	5.00	---	66.67
2. Multi-Family				
3. Mobile Home				
4. Accessory Bldg.	11	1.50	---	20.00
5. Group Housing				
6. Vacant-Other	1	1.00	---	13.33
1. Community Service				
2. Quasi-Public				
3. Vacant				
1. Goods				
2. Services				
3. Parking				
4. Warehouse				
5. Vacant				
1. Heavy				
2. Light				
3. Tran./Util./Corridor		46.00	.05	100.00
4. Vacant - Other	1	7.00	---	100.00
1. Standing		71,347.00	93.01	93.38
2. Harvested		5,047.50	6.58	6.60
3. Vacant				
1. Crop Active		17.00	.02	6.88
2. Crop Inactive				
3. Pasture Active		191.50	.24	77.53
4. Pasture Inactive		29.50	.03	11.94
5. Woodlot		6.50	---	2.63
6. Barns & Outbuildings	2	2.50	---	1.01
7. Vacant				
1. Aquatic - Marine				
2. Aquatic - Fresh				
3. Park				
4. Forestry Park				
5. Shoreline, Dikes, Levees				
6. View Spot - Turnoff				

POPULATION

1. ELEMENTS OF POPULATION ANALYSIS

The analysis of the population of an area and the subsequent projections derived from it are basic to the planning process. The gauging of growth potential must be expressed in terms of the population it can be expected to sustain; i.e. the size of the population, its composition and characteristics, and its spacial distribution.

1A. Size

Population size gives an indication of the overall dimensions of the physical environment, which can be used as a measure of the growth potential for various categories of land use. With the addition of the time element, future trends in population size are estimated, and these become a part of the basis for estimating the dimensions and space needs for various land uses in the future. The qualitative aspect of population analysis is the study of its composition and characteristics. This includes such considerations as household sizes, sex, races and nationalities, and income composition. This information is important when estimating residential space requirements for various dwelling types consistent with existing and anticipated family sizes, income levels, and needs. It also assists in determining the amount of emphasis, both physically and socially, needed for recreation areas, schools, and other community facilities for all segments of the population - young, old, in between, singles, families, rich, poor, black, or white.

1B. Population Distribution

The final element is population distribution. With accurate information of this nature, combined with other data, it can be determined how various land uses and facilities can and should be located in an area. Thus, population analysis not only aids in determining the proper land uses within a given period of time, but also helps to determine how these total space needs should be allocated to different parts of the planning area at a particular time.

2. BIRTHS, DEATHS, AND MIGRATION

Population change can be a rather complex phenomenon. It can involve such things as annexation and consolidation. But for the most part, population change occurs by death, births, and migration. All types of forecasts take these things into consideration, either explicitly or implicitly.

Deaths tend to be the most stable of the three elements. It is interesting to note, however, the impact of modern medicine on the mortality rate of a population. Since the greatest advances in medicine the first half of the century were in the control of infectious diseases, especially those to which babies are particularly susceptible, the sharpest drop was in mortality of infants and young children. This combined with a rather stable life expectancy has a tendency to lower the overall death rate. The lower death rate and a fluctuating birth rate have caused the exponential type of growth in world population.

The birth rate has a major role in population analysis, and can cause many changes in a specific population. Due to the more complex factors involved in birth rates, they are more difficult to speculate upon than death rates. It seems far easier to judge what can be done in lowering death rates in the future, than to judge what people may want to do regarding the size of their families. Values and attitudes can be of a very elusive nature. Ideas about such things as marriage, birth control, adoption, family size, divorce, and abortion tend to change and this in turn has an effect on the birth rate.

Migration has become an important factor in population analysis because of the increase of mobility within the present American society. Migration is also difficult to estimate with any degree of certainty. Some causes of migration are:

1. The desire for better economic opportunities.
2. The attraction of milder, more suitable, climates.
3. Desire for better living or housing conditions.
4. Movements for reasons of health, education, or retirement.

Of these reasons, the first is usually considered to be responsible for the major percentage of migration in most communities. Also, such basic considerations as prosperity or depression, peace or war, and so on, can have a very marked influence on the volume of net migration. The elements of births, deaths, and migration are shown as important components of population change in Table 5.

3. CHARACTERISTICS AND TRENDS EFFECTING POPULATION IN SKAGIT COUNTY

The total population of Skagit County at the time of the 1970 census was 52,381. This was a 2% increase over the 1960 population of 51,350. Comparisons with state trends can be found in Table 3. Of this 1970 population, 24,241, or 46.3% people lived in an urban environment, while 28,140, or 53.7%, maintained a rural type of existence. This trend is less significant than in previous years, for there has been a marked deceleration in both migration to the city and migration from the country, in Skagit County. Map J and Table 9 showing distribution of population throughout the county can be found at the end of this section.

Ninety-eight and one-tenth percent of the total 1970 population in Skagit County are white, only 1.9% were non-white. The non-white total increased only slightly from the previous decade and has deviated only .4% since 1940. Out of the 1970 total of 1,011, 650 people were American Indian, 182 were Mexican-American, 134 were Oriental, and 45 were Black. Minorities are examined by enumeration district and contrasted with the total population composition in Table 2.

The average age of the population of Skagit County has increased in the last decade, while the number of young children has decreased. The county exceeds the state in the percentage of people over 45. This has an effect on the rate of natural increase and may have had a part in the decrease in the rate of population growth in the county. The decrease in the younger age groups can probably be attributed to the decreasing number of births since 1960, shown graphically in Tables 1 and 5. These trends can have an effect on the extent and type of community facilities to be provided in an area.

There has been a slight increase in the number of deaths over the last 10 years. This is probably due to the fact that the increased number of older people also causes an increase in the number of deaths. The people that were part of the big population surge of 1900-1910 are now reaching the average maximum age and thus dying at an increasing rate. This trend could increase if the county becomes more widely accepted as a possible location for retirement. The number of deaths can be seen as an element of population changes in Table 5.

3A. Migration

When net migration is included with these other elements, it is further evidence of the overall decrease of population growth in Skagit County over the last 10 years. Between 1940 and 1950 the county experienced a "plus" net migration of 3,348 people. In the time period between 1950 and 1960 there was also a plus or "in" net migration of 2,269. However, between 1960 and 1970, net migration was minus or "out" of the county by 2,271 persons. The people born in the big post-war population surge were now becoming old enough to enter the labor market, as mentioned earlier a prime factor in relation to migration is the desire for better economic conditions. When these people could not find enough work in the county, they had to look elsewhere. Also, the desire for higher education lured people out of the county. The county's agricultural and extractive resources economic base cannot support great increases in employment or persons with masters and doctorate degrees. These people then generally find work in more urbanized areas where the demand for their talent and background is higher. This phenomenon of migration can be seen more clearly in the age/sex pyramid and the components of population change in Tables 1 and 5 at the end of this section.

3B. Distribution

Population distribution, past, present, and future, is shown on Map J and Tables 9 and 2 at the end of this section. In 1970, the population of the county was 46.3% urban and 53.7% rural. The change over previous years is as follows:

	Urban		Rural	
1970	24,241	46.3%	28,140	53.7%
1960	23,008	44.8%	28,342	55.2%
1950	15,448	35.7%	27,825	64.3%

As can been seen, the county is becoming increasingly urban, but at a slower pace. It is felt that this is due to the overall decrease in the rate of population growth. Whether there is slow or fast population growth, the areas to be most affected would probably be the Mount Vernon area, particularly eastward, the Sedro Woolley area, and the Fidalgo Island area. Provided that such things as: 1) agricultural zoning; 2) 1.0 acre minimum lots; 3) flood zone restrictions, and other similar measures are in existence, major portions of areas such as the south Skagit Floodplain, the Samish Floodplain, and the Middle Skagit River may become less important as extensive residential locations. However, portions of these areas out of the danger of flood and not conflicting with agricultural areas, could assume a higher proportion of people. These could include such areas as Bow Hill, Pleasant Ridge, Bayview, and east of Conway. If the restrictions mentioned earlier are not enforced, areas such as west Mount Vernon and west Burlington could grow, causing a split in the agricultural land and increasing the danger of flood damage to both life and property.

The Concrete, Rockport, and generally upriver areas are in a precarious position. They could grow in proportion to interest in the North Cascades Park. Much of this could be only seasonal growth, but still should be a planning consideration. This will be discussed more fully in the Parks and Recreation element of this plan.

The middle river area around Hamilton and Lyman, however, seems to be a little too far removed from the heart of the park, and will probably continue to decrease in population. The "back to the country" movement of the young could have an effect here, as well as other places upriver.

4. POPULATION TRENDS AND FORECAST - SKAGIT COUNTY

Historically it has been hard for demographers and planners to acquire the degree of accuracy in their predictions of population growth in less populated areas that they have attained in more densely populated areas. The larger numbers provide a higher degree of accuracy. For example, if a person owned four cars and one broke down, he would not feel the loss as much as a person who owned one car and lost the use of it.

There are a number of population forecasting methods, each being of different complexity and accuracy. For the more general purposes of this study, the migration and natural increase method was used. Age and sex groups were also considered. A range in the 2000 population estimate was derived using this method. The corresponding range is shown in Table 6.

As can be seen in Tables 3, 4, 5, and 6, the percent increase of population for Skagit County has decreased over the last 10 years to approximately .2% per year. This fact, combined with the decrease in births and young children, shows that the county's population is leveling off, at least for a while. The fact that migration has been "out" instead of "into" the county recently is another important sign of stablizing period. Assuming that there are no major economic changes in the county or in adjacent areas, this trend should continue during this planning period. However, if major economic changes do occur, for instance, south of the county, Skagit County could be in the path of possible expansion. This would be, in all probability, beyond the 27 year confines of this study.

The North Cascades Park could have an effect on population in the county, but it can be reasonably assumed that this will take place in the form of temporary or second homes, rather than permanent full-time residences. The initiation of an extensive rapid transit system would pose serious changes to this forecast, but, again, this is highly unlikely during this planning period. Industrial and commercial activity within the county also has an effect on population and will be discussed in another section of this report.

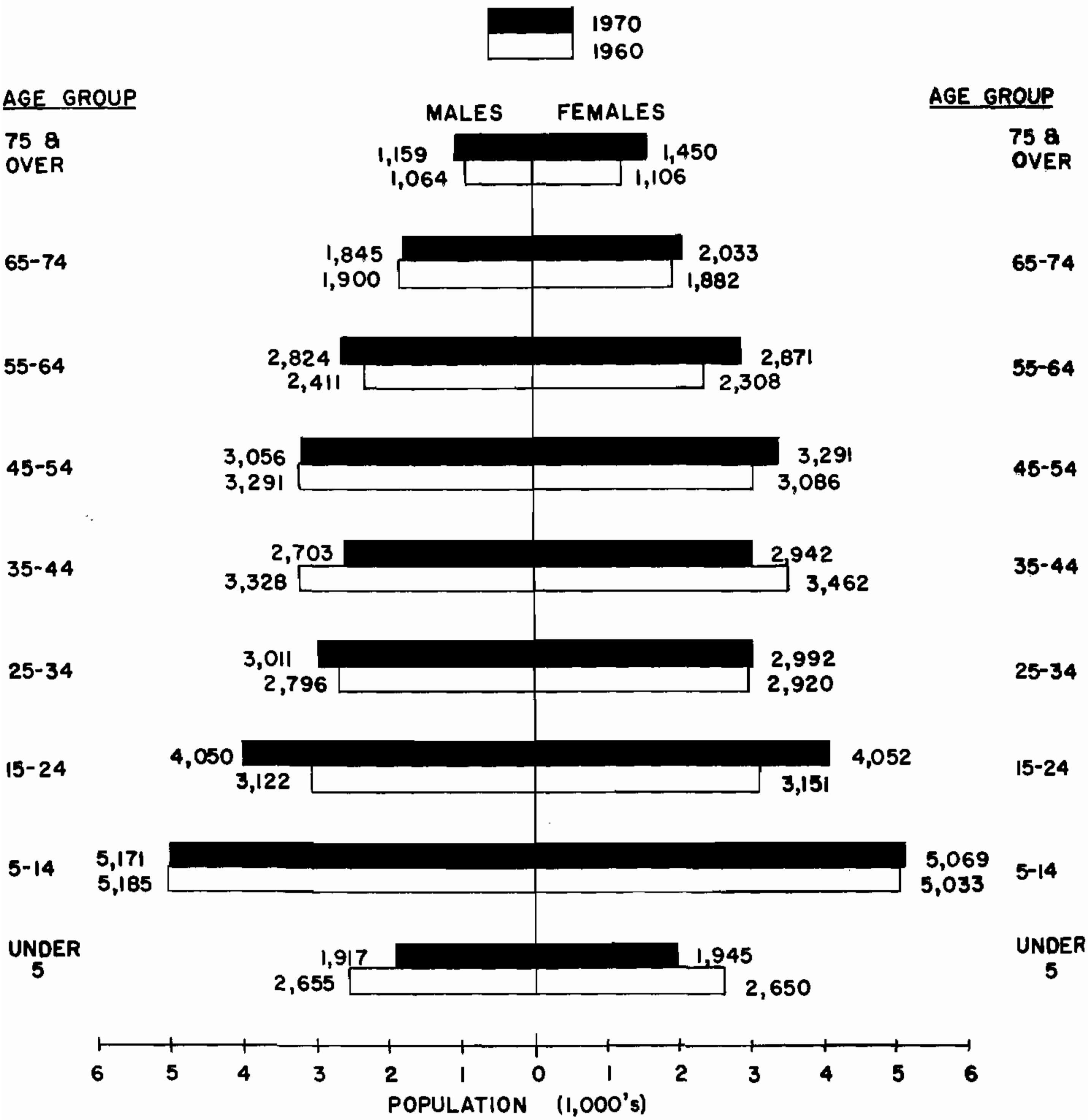
The actual population range projected here consists of a high and a low estimate. The low end of the range is, in actuality, an extension of the present population trend of .2% increase per annum. Given the decrease in births, the increase in migration out of the county, and the firmly established economic base of the county, this was considered to be reasonable as a low figure. The effects of a major upturn in the economy of the Puget Sound Region as a whole could cause a number of situations in Skagit County. However, there would be a time lag, with the effects of such an occurance not being felt soon, as it would over a period of time afterwards. Also, the Seattle-Everett metropolitan area would have ample room for such expansion if such an occurrance happened. However, at least the beginnings of such a phase were taken into account in the high figure of the projection range. It is based on the figures derived in the Comprehensive Plan for Skagit County, 1968.

Thus, although seeming very small, there is quite a degree of flexibility reflected in this range. The assumptions on which it is based were derived from U.S. Census Bureau data. As stated before, a great change could occur causing an upsurge of development within this county.

TABLE I

SKAGIT COUNTY

AGE & SEX DISTRIBUTION (PYRAMID), 1960-1970



* DERIVED FROM U.S. CENSUS BUREAU DATA

Table 2

LOCATIONAL CHARACTERISTICS OF MINORITY RESIDENTS OF SKAGIT COUNTY
BY GEOGRAPHIC AREA AND CENSUS ENUMERATION DISTRICT

Geographic Area	Enumeration District	Total Population	Indian	Oriental	Other	Black	Mexican-American (Chicano*)
Upriver	1	705	11				
	2	313	3				
	3	573	8	2			
	4	601	3	1			
	5	196					
	6	324	3				
	7	955			1		
	45	189	1				
		3,856	29	3	1	-0-	
Anacortes	16	284	8			1	
	17	762	23				
	18	241		1			
	19	1,158	5	5			
	20	1,384	23	1			
	21	393	5	4			
	22	756	9				
	23	873	9	3			
	24	542	6	1			
	25	1,579	10	4	3		
	26	636	26	3	1		
	67	874	8	3	2		
	68	600	6		1		
		10,082	138	25	7	1	
Sedro Woolley	8	432					
	9	1,122	2	2		1	
	10	1,017	2		1		
	11	983	4	9	4	22	
	35	1,254	5		1	1	
	38	1,067	10	1			
	39	1,249	17	3			
	40	1,354	10		8		
	41	727	9			1	
	42	201		1	2		
	43	792	8	7	9		
	44	545	1		7		
		10,743	68	23	32	25	
Burlington	12	989	3	4			
	13	359	7			1	
	14	855			11		

Geographic Area	Enumeration District	Total Population	Indian	Oriental	Other	Black	Mexican-American (Chicano*)
Burlington	15	719	5	8			
	27	1,040			7		
	28	1,248	7	13	19		
	30	113					
	31	1,489	24	4	2	1	
	32	376	6	5	4		
	33	1,160	13	1	6		
	34	379	5				
	35	1,254			1		
	36	402		3			
		10,393	70	38	50	2	
Mount Vernon	29	469	2			6	
	46	1,550	14	2	1		
	47	530	2	2			
	48	171					
	49	2,006	2	1	21	2	
	50	458	9		3		
	51	1,015	4		1		
	52	1,242	2	7	1		
	53	757	7	3			
	54	954		4	1		
	55	735	14		8		
	56	1,052	17	1	2	3	
	57	414	6				
	58	1,359	6	1	12	3	
	59	670	1	15			
	60	842					
	61	261			3		
	63	1,395	1	4	12		
	65[1]	621	1		2		
		16,501	88	40	67	14	
LaConner	62	639	12	3	13		
	64	272			1		
	65[2]	311					
	66	613	210			2	
		1,835	222	3	14	2	
TOTALS		53,410	615	132	171	44	1,250[3]

*U.S. Census Bureau

[1] 2/3 of Enumeration District

[2] 1/3 of Enumeration District

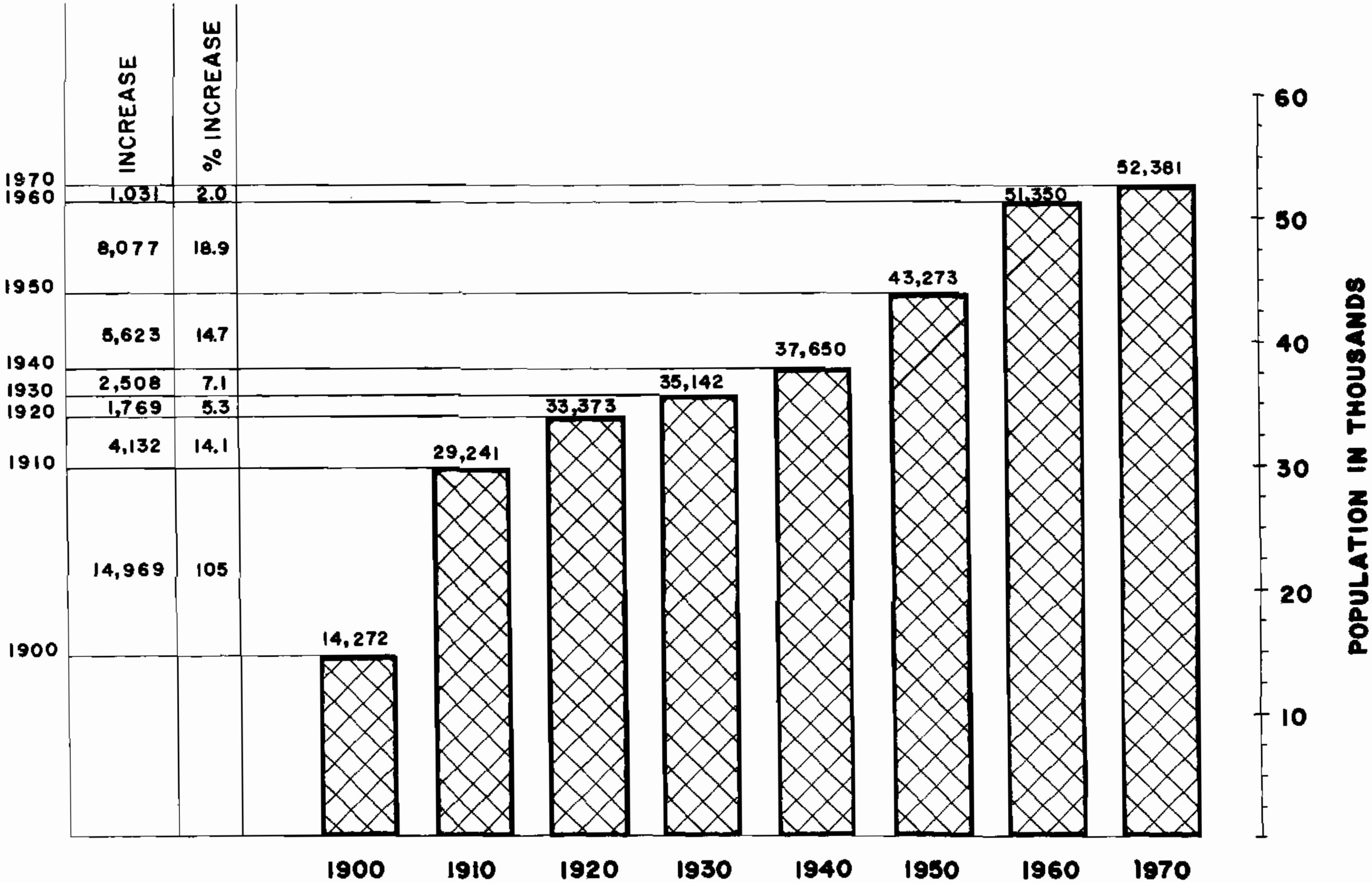
[3] It is estimated by the Skagit Multi-Service Center of Skagit County that approximately 230 Chicano families reside in Skagit County. These families have an average family size of approximately 5.5 persons per family unit. There is at present no reliable information on the locational characteristics of the distribution of Chicano families in Skagit County. However, it may be assumed that the majority of the Chicano families reside in the central portion of the County, and find employment in agricultural pursuits, in that other employment areas do not contain noticable number of Chicano employees.

Table 3

GENERAL POPULATION TRENDS AND COMPARISONS

	1900	1910	1920	1930	1940	1950	1960	1970
Population								
State of Washington	518,103	1,141,990	1,356,621	1,563,396	1,736,191	2,378,963	2,853,214	3,409,410
Puget Sound Region	196,000	481,000	634,000	737,000	818,000	1,196,000	1,468,000	---
Skagit County	14,272	29,241	33,373	35,142	37,650	43,273	51,350	52,381
Increase								
State of Washington	---	623,887	214,631	206,775	172,795	64,772	474,251	556,196
Puget Sound Region	---	285,000	153,000	103,000	81,000	378,000	272,000	---
Skagit County	---	14,969	4,132	1,769	2,508	4,623	8,077	1,031
% of Increase								
State of Washington	---	120.4	18.0	15.2	11.1	37.0	19.9	9.3
Puget Sound Region	---	68.7	31.8	16.2	11.0	46.2	22.7	---
Skagit County	---	104.9	19.1	5.3	7.1	14.7	18.9	2.0

POPULATION GROWTH, SKAGIT COUNTY TABLE 4



* U.S. CENSUS BUREAU

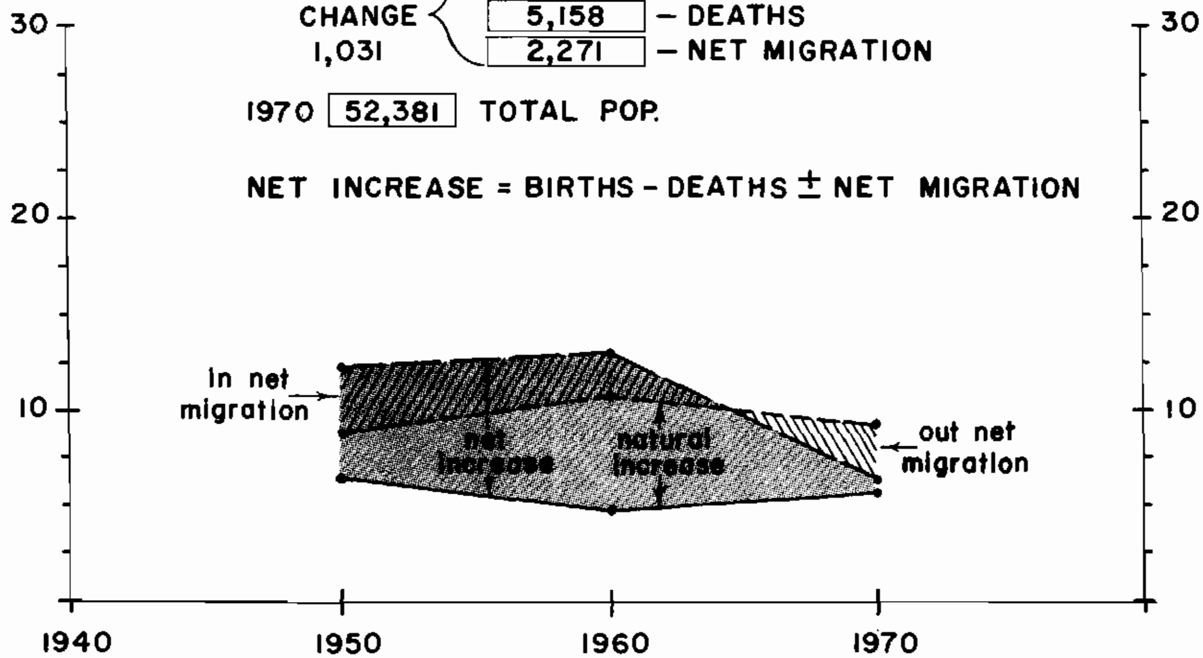
COMPONENTS OF POPULATION CHANGE — TABLE 5

Year	Total Pop.	Net Change	Births	Deaths	Net Migration
1940	37,650	5,623	+ 8,248	− 6,113	+ 3,438
1950	43,273	8,077	+ 10,368	− 4,560	+ 2,269
1960	51,350	1,031	+ 8,460	− 5,158	− 2,271
1970	52,381				

NET INCREASE = BIRTHS − DEATHS ± NET MIGRATION

LEGEND

- ------ BIRTHS
- —— DEATHS
- IN MIGRATION
- OUT MIGRATION
- NET POPULATION INCREASE



* DERIVED FROM U.S. CENSUS BUREAU FIGURES

TABLE 6

SKAGIT COUNTY PROJECTED POPULATION GROWTH TO 2000

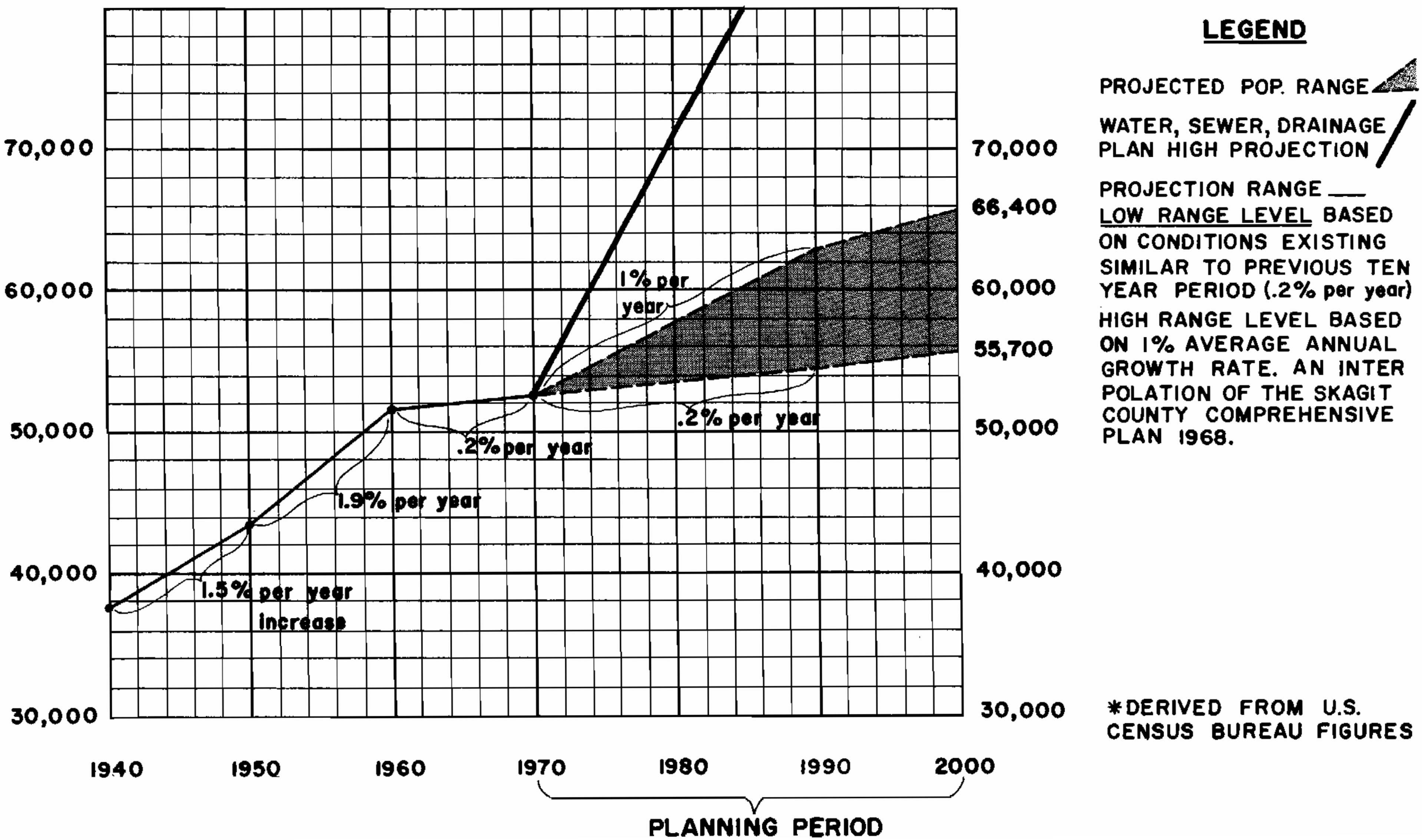


Table 7

INTERIM PROJECTED POPULATIONS
STATE OF WASHINGTON
1970 - 2000

County	1970	1980	1990	2000
Skagit	52,381	52,950	53,500	54,000
Snohomish	265,236	290,130	324,250	363,700
Whatcom	81,950	90,110	104,400	118,500

Information from the Office of Program Planning & Fiscal Management, October, 1972.

Table 8

POPULATION PROJECTIONS

Area	1960[1]	1970[2]	2000 Low	2000 High	1990 High[3]
Municipalities					
Anacortes	8,414	7,693	8,154	9,770	15,677
Burlington	2,968	3,183	3,374	4,024	5,122
Concrete	840	573	607	727	1,143
Hamilton	271	196	208	248	359
LaConner	638	639	677	811	899
Lyman	400	324	343	411	539
Mount Vernon	7,921	8,804	9,332	11,181	16,126
Sedro Woolley	3,299	4,598	4,874	5,839	6,634
Census Districts					
1	1,490	1,018	1,079	1,293	1,790
2	1,441	601	637	763	1,900
3	1,643	955	1,012	1,213	2,064
4	2,632	2,571	2,725	3,265	3,578
5		983	1,042	1,248	
6	789	989	1,048	1,256	1,111
7	1,845	1,933	2,049	2,455	2,634
8	265	284	301	360	660
9	777	636	674	807	172
10	738	1,040	1,102	1,321	1,780
11	1,732	1,870	1,982	2,375	2,150
12	5,329	2,249	2,384	2,856	7,512
13	1,204	1,337	1,417	1,698	1,512
14	1,878	2,269	2,405	2,881	3,186
15	1,639	2,029	2,193	2,577	2,736
16	1,164	1,103	1,169	1,401	1,146
17	3,081	2,593	2,749	3,293	4,693

Table 9

POPULATION DISTRIBUTION

Area	1960	1970	2000 Range	High
Anacortes	15.5%	14.8%	14.9%	17.4%
Burlington	5.4	6.0	5.8	5.7
Concrete	1.5	1.0	.8	1.3
Hamilton	.5	.4	.2	.4
LaConner	1.1	1.2	.8	1.0
Lyman	.7	.6	.4	.6
Mount Vernon	14.6	16.7	18.7	17.9
Sedro Woolley	6.0	8.8	10.8	7.9
Census District				
1	2.8	1.9	1.9	2.0
2	2.7	1.1	.9	2.1
3	3.3	1.8	1.2	2.3
4	4.8	5.0	5.5	4.0
5		1.8	1.7	
6	1.4	1.9	1.7	1.2
7	3.4	3.5	3.7	2.9
8	.4	.5	.7	.7
9	1.4	1.2	.8	.2
10	1.3	2.0	2.0	2.0
11	3.2	3.4	2.5	2.4
12	9.8	4.3	6.1	8.3
13	2.3	2.6	1.9	1.6
14	3.4	4.3	4.4	3.5
15	3.2	3.9	3.9	3.0
16	2.2	2.0	1.3	1.2
17	5.6	5.0	3.5	5.2
18	.9	1.1	1.2	1.5
19	2.3	2.8	3.6	3.0

Area	1960[1]	1970[2]	2000 Low	2000 High	1990 High[3]
Census Districts					
18	532	613	650	740	1,388
19	1,188	1,474	1,562	1,601	3,373

[1]Official U.S. Census figures

[2]Official U.S. Census figures

[3]Sewer, Water, Drainage Plan, Skagit County -- Stevens, Thompson, Runyan

HOUSING

1. GENERAL

Housing in the Skagit Regional Planning area is composed primarily of detached single family residential structures occupying separate and legally defined parcels of property with a sparse scattering of varying densities of multi-family residential structures. Housing in the planning area occupies larger lots than does housing in the State of Washington or the United States, as would be expected a semi-rural area.

Housing at the national and state level is undergoing a substantially more rapid change than is housing in the study area.

The greatest areas of change appear to be in the rate of economic growth and the rate of change of the number of persons per household. This study area is not experiencing the same rate of economic growth as the State of Washington or the United States; our economy is expanding at a slower rate of increase than the state or the nation. The number of persons per household for state and nation are decreasing more rapidly than average household size for this study area. These two factors have a stabilizing effect on the housing market of the planning area and on the life style of the residents of the study area. This stability will allow for a steady and measured improvement in the housing inventory of the study area.

One of the more significant features of dissimilarity between this planning area and the State of Washington is the rate of change of the urban-rural, incorporated-unincorporated population trend. As can be seen in the following chart series, there has been a general expansion of population and housing in both incorporated and unincorporated urban areas in Washington State. However, in this planning area the rate of urban growth is limited. Statewide rural population has remained relatively stable for both

HOUSING CHARACTERISTICS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	MU	A	SW	B	TOTAL
1. Total Population	1018	1174	1475	2571	983	989	1938	284	636	1040	1725	2249	1337	2269	2029	1103	3238	613	1474	8804	7701	4598	3138	52,381
2. Total Housing Units	479	465	537	852	20	318	774	266	246	358	564	722	445	1288	714	372	1109	301	684	3267	2860	1775	1159	19,575
3. Total Occupied Units	322	377	485	793	14	291	632	111	219	324	550	691	416	673	653	328	1032	195	528	3083	2653	1670	1106	17,185
4. Occupancy Rate	.672	.810	.909	.931	.700	.915	.817	.417	.891	.905	.975	.957	.934	.523	.914	.881	.931	.647	.772	.944	.979	.940	.955	.878
(Owner)	218	283	403	681	-0-	232	488	72	142	273	433	579	313	528	510	241	814	166	412	2000	2022	1215	759	12,798
5. Occupancy Status %	67.7	75.2	82.5	85.9	00.0	79.8	77.3	64.9	64.9	84.2	78.7	83.8	75.2	78.4	78.1	73.4	79.6	85.1	78.0	64.8	76.2	72.8	68.6	74.4% O.U.
(Renter)	104	94	85	112	14	59	144	39	77	51	117	112	103	145	143	87	218	29	116	1083	631	455	347	4351
6. Occupancy Status %	32.2	24.9	17.5	14.1	100.0	20.2	22.7	35.1	35.1	15.7	21.2	16.6	24.7	21.5	21.9	26.6	21.1	14.8	21.9	33.6	23.7	27.3	31.4	25.5% O.U.
(Vacant) % Total H. U. 7. Seasonal & Migrant	-0-	-0-	-0-	1	-0-	1	10	144 54.1%	-0-	-0-	-0-	2	2	457 35.4%	2	20	23	-0-	2	16	1	-0-	-0-	681 3.47%
8. Average Family Size	3.16	3.25	3.46	3.22	702	2.93	3.51	3.26	3.27	3.12	3.32	3.25	3.15	2.22	3.44	2.10	3.61	3.11	3.58	3.44	3.44	3.61	2.83	3.28
Owner Occupied 9. Average Value Unit	10,710	9,590	10,630	16,760	-0-	15,800	17,660	26,440	16,620	24,820	18,300	20,190	16,430	19,120	21,520	18,420	19,630	21,060	26,920	19,490	17,160	14,460	15,190	17,775
10. Mobile Home - Trailer	7	12	35	62	-0-	43	36	-0-	5	21	20	60	36	19	67	5	48	5	49	103	28	35	20	716
Renter Occupied 11. Average Monthly Rent	53	50	45	68	65	61	72	60	81	85	91	79	71	74	84	75	76	78	90	90	76	69	89	76
Occupied Unit by No. Persons / Unit: 1	59	47	75	102	2	42	77	30	37	36	80	77	68	87	109	41	165	35	69	740	502	393	256	3129
2	98	139	179	247	5	87	95	51	72	112	185	224	127	202	207	104	344	80	238	974	950	551	380	5651
3	42	61	75	127	2	44	226	12	40	46	75	113	63	78	100	51	168	19	84	504	421	250	160	2761
4	45	52	59	143	3	41	197	10	39	59	97	115	62	126	102	47	126	23	64	422	421	222	131	2606
5 & up	78	78	100	171	2	77	114	8	31	71	113	187	96	180	135	85	229	48	73	443	433	254	179	4085
Sound: Number	379	707		1,042			1,483				1,545			1,820		1245			599	3000	2576	1479	1092	17,124
Sound: % Total	79	71		88			90				90			91		88			88	91	90	83	94	89
Deteriorating: Number	90	245		101			110				110			126		95			59	206	204	218	66	1,634
Deteriorating: % Total	19	24		8			7				6.4			6		7			9	6	7	12	6	84
Occupied Dilapidated: Number	7	20		30			25				36			42		42			18	24	36	52	1	342
Occupied Dilapidated: % Total	*	2		2.5			1.5				2.1			2		3			2	.7	1.2	3	*	1.7
Unoccupied Dilapidated: Number	3	30		16			46				17			14		28			8	37	44	26	-0-	276
Unoccupied Dilapidated: % Total	*	3		1.3			2.8				1.0			1		2			1	1.1	1.5	1.4	*	1.4 (100.5
(Estimated) Remodels & Repairs Needed	100	295		147			188				165			182		165			85	267	284	296	67	2257
New Construction Needed	48	108		112			182				179			209		74			73	430	334	185	115	2084

incorporated and unincorporated areas, while the rural population in the Skagit area reflects a considerable decrease. The slight growth of urban incorporated areas of this planning area is due primarily to annexations by existing communities of the fringe area adjacent to communities and the building activity in these areas.

While the population in Skagit County has not expanded significantly in the last decade, the number of occupied housing units has expanded from 15,759 to 17,185, a change of 1,426 more occupied housing units. However, the total number of housing units has only changed by 215 units, from 19,360 in 1960 to 19,575 in 1970. This indicates: 1) a higher rate of occupancy and thus greater utilization of the housing resources; 2) a smaller average household size. It can also be assumed that a substantial number of deteriorated and/or delapidated structures have been demolished in the last decade, because approximately 1,100 building permits for new residences have been issued in that period and the total housing supply has increased only by 215 residential units.

2. SKAGIT REGIONAL HOUSING SUPPLY DATA

To establish a consistant data base for the analysis of housing characteristics in the Skagit planning area, information from the U.S. Department of Commerce, Bureaus of Census 1970 census data was used. Additional information on housing characteristics was provided from two sources: 1) the Skagit County Housing Study produced by the Skagit County Agriculture Extension Office, and 2) a questionnaire mailed to firms involved with building and selling residences in the Skagit area.

A table of housing characteristics by census division and municipality is presented on the preceding page.

The significant conclusions which can be drawn from this summary of housing characteristics are as follows:

1. There were 52,381 residents in Skagit County in 1970.
2. There were 19,575 dwelling units in Skagit County in 1970.

3. 17,185 of the 19,575 dwelling units were occupied.
4. The average household size was 3.28 persons per dwelling unit.
5. The occupancy rate was approximately 88%.
6. Of the occupied units, 12,798 (or approximately 74%) were owner occupied.
7. There were 4,351 rental occupied units, or approximately 26%.
8. The average value of the owner occupied units was $17,775.
9. The average monthly rental was $76.
10. 3,129 dwelling units were occupied by one person.
11. 5,651 dwelling units were occupied by two persons.
12. 2,761 dwelling units were occupied by three persons.
13. 2,606 dwelling units were occupied by four persons.
14. 4,085 dwelling units were occupied by five or more persons.
15. Of the 19,575 dwelling units, 17,124 (or approximately 89%) were classified as sound.
16. 1,634 dwelling units (or approximately 8%) were classified as deteriorating.
17. 618 dwelling units (or approximately 3%) were classified as dilapidated.
18. There are 716 mobile homes used as dwelling units.
19. It was estimated that 2,257 homes were in need of repairs or remodeling.
20. Within the next 20 years, approximately 2,084 new dwelling units will have to be constructed if:
    a. the average household size remains stable.
    b. the projected population rate of 1% annually is achieved.
    c. a significant economic event doesn't occur in the planning area, or in the adjacent counties.
21. During the last four years the following number and types of subsidized housing has been developed for low income families in Skagit County:

<u>Low Rent Public Housing</u>

May 1971	20 units	family
Jan. 1971	50 units	family
Dec. 1971	60 units	elderly
Jan. 1971	50 units	elderly

Owner Occupied Insured Cases

Dec. 1970	46* units	family	236
1968 - 71	228 units	family	235*

* All classifications of "235"
* Nine of which received rent supplement

Percent of the low income population served low rent public housing:

Families	15% or 79 units
Elderly	16% or 110 units

Owner occupied:

All "235"-"236" programs = 95% of projected need

As can be seen in a survey of residential units, the single family dwelling unit is the primary residential structure for the planning area. It may be assumed that this trend will continue. However, several factors are likely to alter this trend during the planning period. These factors are: 1) increased use of mobile homes as permanent residential structures; 2) expanded development of multi-family residential structures, and 3) the increased use of planned unit development versus conventional subdivisions. As land prices escalate, it can be assumed that there will be increase use of high density developments. However, the offsetting factor in this planning area is the seeming abundance of vacant and hence potentially developable land.

The most likely occurance with regard to housing for this planning area will be a slow continuation of the diversification of housing types. There will probably be continuing demand for rural and ranchette developments, as well as townhouses and garden apartments, especially near urbanized portions of the planning area and near natural resource areas, such as lakes and shorelines.

3. HOUSING GOALS AND OBJECTIVES

The following housing goals and objectives were developed and adopted by the Skagit Regional Planning Council:

1. All residents in the planning area should be housed in safe, sanitary and sound dwelling units.

2. Housing diversity of the broadest possible type should be available to residents of this planning area.
3. Residential land uses should not be mixed with incompatible land uses.
4. All urban services should be provided to the residents of the planning area living in middle and high density residential areas.
5. Services of a rural nature should be provided to the residents of the planning area residing in low density areas.
6. The building code should be revised to stimulate either the repairs or eventual demolition of deteriorating housing.
7. Land use policies should continue to be promulgated by local government.
8. Financing of residential development should continue to be controlled by the state and federal government, especially with regard to the amount of available capital and the interest rate at which capital can be expended.
9. Private enterprise should be encouraged to fulfill the demands of the housing market.
10. Land use regulations should be revised and amended as technology modifies development techniques, so the planning area will benefit from state and federal experiments in residential development.
11. Publically financed housing should continue to be provided for the elderly and for low income families in such a manner that efficiently allows for diversity in housing.

It is estimated that the various real estate firms in the Skagit planning area sold approximately 600 residential dwelling units in 1971. They were predominantly single family residential structures that sold for an average price of $20,700. The single family units averaged approximately 1,200 square feet in area. The median home sold in 1971 was approximately three to five years old and was financed with monthly payments of approximately $160 per month.

The average sales of area real estate sales firms were approximately 18-22 houses per year for the last five years. Whereas each builder constructs an average of 14-16 residences annually, which is approximately 255 residential structures in 1971. Approximately 60% of the new homes built in 1971 were financed through "235" or "502" Programs. The conventionally financed construction accounted by approximately 102 new residences; this figure corresponds very well with the Building Department estimate of approximately 1,100 new residences constructed in the last decade.

The two primary problems encountered in producing and selling houses mentioned by builders and relators were land use controls and septic problems; the secondary problems are financial and the availability of suitable structures and/or lots. Firms involved with housing project that the area around the central and more urban portion of the planning area, and the Fidalgo-Anacortes area will develop more rapidly than the rest of the planning area.

LAND OWNERSHIP PATTERNS

1. INTRODUCTION

The study of land ownership patterns resulted in a more precise picture of past, present, and future trends in land development for the study area. Trends in parcelization and ownership were the primary elements under consideration.

2. PARCELIZATION AND SUBDIVISION

The dividing of a piece of land into separate salable parcels is a common practice in the field of land development. Although it was beyond the means of this study to amass the amount of data for a complete study of all county land parcels, a sample of 51 randomly selected sections (51 areas of 1 square mile each) throughout the county were taken and studied through the years 1941 - 1972. This statistical sample was more than adequate to establish trends in parcelization in the study area. It was found that between the years 1941 and 1959 there was an average increase of approximately 3.7 parcels per square mile section. Between 1959 and 1972 this increase was 4.3 parcels per square mile. This demonstrates a reasonably steady increase in the amount of parcelization over the past 20 years. These figures (the number of parcels per square mile section) were then placed on a graph (#1) and compared with population trends and number of housing units for the same time span, Graphs 3, 4, and 5. The corresponding results were then placed together on Graph #6 to show similarities and differences among the trends.

This series of graphs included in this section attempt to demonstrate furthur the correlations between population, parcelization, and housing unit trends. As can be seen, Graph 1 plots the number of parcels per square mile section against the population figures for 1940, 1960, and 1970. When the results of this graph are compared with Graph 4, which plots number of housing units against the same population figures, the trend of parcelization exceeding the number of housing units is more easily seen. Graph 5 compares the number of housing units directly with the amount of parcelization and shows a smaller increase in the last 10 years relative to the amount of parcelization. This further depicts an increase in the amount of speculative subdividing of land.

These graphs show that in Skagit County there has been a steady increase in parcelization of land. Population and the total number of housing units, on the other hand, show signs of leveling off in later years. All of this seems to demonstrate that there is a trend toward more subdivision than is really needed. As slow as parcelization has been, it still has remained on a steadily increasing course.

This presents the people of the county with some problems. There is an increased burden on land-use management. A single piece of land is easier to manage in terms of water, sewer, drainage, roads, and other utilities, not to mention the added expense to assess the taxes on the extra parcels. In the case of platted subdivision, the developer often initiates the utilities to stimulate the sale of the properties, but sells out before all the utilities are completed. Combined with this is the fact that people often buy land purely for speculative reasons, not intending to live on the land. However, the people that do buy and build a home on the land want to be serviced with the remaining utilities and services. The number of people having actually bought and lived on the land does not make extension of the full package of utilities and services economically feasible. The taxpayer thus absorbs this loss.

More parcelization or subdivision also makes land values rise becoming an economic burden to potential buyers, as well as a tax burden to adjacent land owners. Adjacent land is almost automatically forced into subdivision. Leap-frogging of subdivision farther out to take advantage of cheaper land, expands cities beyond their economic limit.

Another aspect of over parcelization is the fact that it is substantially harder to acquire a number of parcels for the purpose of aggregating for a special use. This problem is characterized in the public sector by acquisition of land for parks, schools, community centers, and other similar facilities.

3. OTHER ELEMENTS OF LAND OWNERSHIP

Other elements studied included parcelization and land ownership trends in each geographical/planning area. The state and federal lands of the county are also an important element of this section. An inventory of all public lands in the study area was conducted by the Planning Department and is on file. The corresponding map that was prepared is presented as part of this report (Map K). See the map section of this report.

The question of land values and uses for various areas is important with respect to locational analysis. However, due to budgetary and time restraints, it was not feasible to attempt a specific and precise consideration of this area of emphasis.

4. SOUTH SKAGIT FLOODPLAIN

1941 - 1959

Between the years 1941 and 1959 the South Skagit Floodplain area remained similar in reference to land ownership patterns. Parcelization or subdivision of property was not widespread; at times land was aggregated under one owner in a few sections.

The land in and around the city of LaConner also remained quite stable. The area near Avon, however, was subject to some activity in terms of change of ownership and subdivision.

Inheritance of land through family ties seemed to be a frequent occurance in this area and the county as a whole. The general agricultural nature of the area is probably a great contributing factor to this phenomenon.

1959 - 1972

The South Skagit Floodplain continued to subdivide rather slowly through this period. Again the parcelization of land among heirs is noticed.

The land in and around the town of LaConner did not parcelize to any great degree. The LaConner Company still retained its extensive land holdings in this area.

5. BURLINGTON/BAYVIEW PROPER

1941 - 1959

This area, being similar to the South Skagit Floodplain in its extensive agricultural use, has much the same land ownership characteristics. There are, however, some apparent differences.

The Burlington area saw a substantial increase in subdivision activity. The influence of the cities grew considerably, primarily in the west and south.

Another interesting area during this period was the Bayview area. In 1941 the airport was rather small and was called the Skagit County Airport. By 1959 it had engulfed almost four square miles of land and became known as the Mount Vernon Airport. The actual community of Bayview remained constant through this period.

1959 - 1972

During this latter period, the agricultural land has remained the same. Parcelization seemed to be minimal, in fact, some consolidation of land holdings was seen. For example, the Sakuma Brothers expanded their extensive operations during this period.

Bayview grew through the subdivision of portions of the land in that area. The airport was acquired jointly by the Port of Skagit County and the Port of Anacortes.

The Burlington area again experienced some growth, with subdivision occurring on the south and west.

6. BOW/ALGER/SAMISH

1941 - 1959

Sections of this area remained the same during this period. These include the agricultural land in the southern part, containing Bow, Allen, and Edison, and of state land in the north.

The land along Chuckanut Drive had a tendancy to parcelize during this period. More extensive subdividing occurred around the Alger area and along Highway 99. In the Alger area, the county transferred its land to logging companies or to the state. The state was the primary purchaser of land in this area. During this period, the logging companies tended to subdivide their land extensively after it was logged and after development grew in the surrounding areas.

1959 - 1972

The agricultural land in the southern portion of this area remained the same, as did the majority of the area. Land owners retained large holdings while some areas such as Alger and parts of Highway 99 experienced parcelization.

Bow and Edison remained small, experiencing little or no subdivision of property in or around them during this time span.

The state remained an extensive land owner through the years to the present, especially on Chuckanut Mountain.

7. MOUNT VERNON PROPER

1941 - 1959

During this period, Mount Vernon's influence grew quite extensively especially to the east and north, with the subdividing of property being the prime reason for this growth.

The land in and around the Mount Vernon and Big Lake - Lake McMurray corridor changed ownerships, but did not subdivide to any substantial degree. Here again the county transferred much of its land to either lumber companies or the state. The land immediately around the two lakes did not show any substantial change in terms of parcelization. The area to the east of these lakes underwent the same type of county-state-lumber company changes previously mentioned, with the state and the timber companies controlling almost all of the land throughout this period.

1959 - 1972

During this period, Mount Vernon's influence did not spread to any great extent. The land around the city, especially on the north and east, showed some signs of parcelization, but for the most part land parcel sizes remained the same as in the previous years.

East of Mount Vernon, near Big Lake and Lake McMurray, subdivision of property was also minimal. However, there were some changes in ownership of various large parcels of land. The Walking Circle M Ranch bought all of Skagit Steel's land holdings near the north end of Big Lake. Scott Paper continued to be a large land owner. Also, Puget Sound Pulp and Timber Company sold its land in this area to Georgia Pacific.

The Conway area has seen little growth during this period. Scott Paper bought large parcels of property east of Conway, while Pacific Denkmann Company retained all of its holdings in this same area.

8. SEDRO WOOLLEY PROPER

1941 - 1959

Sedro Woolley's influence seems to have spread primarily northward during this period. Much of the land north of the city was subdivided during these years. Puget Mill Company owned a considerable amount of property in 1941, but by 1959 the majority of it had been parceled out and sold. The county also owned land in this area, which it transferred by 1959.

The area south of Sedro Woolley remained the same throughout this period, as did that area east of the city.

The area farther north around Thornwood and Prairie did not experience much subdivision. The state owned a sizeable amount of land in 1941 and expanded its interest to a certain extent during the next 18 years. A firm called Bloedel Timberlands Development, Incorporated, owned a major part of this area by 1959, acquiring the land from David Tozer. Their holdings, however, seemed to end rather abruptly on the east at the Samish River.

1959 - 1972

Land subdivision slowed down around Sedro Woolley during this period. However, there were more signs of this type of activity north and west of the city than occurred to the south or east.

The area around Thornwood experienced minimal parcelization. The large land owners such as the state, Bloedel Timber Company, and Simpson Log Company, remained as large, or even grew, during this period.

The county transferred more of its land during this period, while such big timber companies as Georgia Pacific and Scott Paper Continued to buy.

9. MIDDLE SKAGIT RIVER

1941 - 1959

A minimal amount of subdividing occurred around the towns of Lyman, Hamilton, and Concrete during this period. The action seems to have taken place between the timber companies. By 1959, such companies as Lyman Timber Company, Highland Timber Company, Bradsberry Logging Company, and Brown Brothers Lumber Company, sold most of their holdings to such names as Soundview Pulp Company, Puget Sound Pulp & Timber Company, and Scott Paper Company. Soundview had large holdings in 1941 and had expanded its way westward by 1959.

The state remained to be a large land owner in the forested sections of this area, throughout this period.

1959 - 1972

Some sections between Sedro Woolley and Concrete experienced growth during these latter years. The increase in the number of camping subdivisions along the river may have some relation to this phenomenon. For example, a piece of land between Lyman and Hamilton on the Skagit owned by R. H. Cochrehan in 1941, is now subdivided into an area called "Heart of the Skagit." Other areas have experienced similar action, such as the Birdsview-Cape Horn area, where there are groups of tracts call "Skagit Wilde" and "Pressentin Creek." Near the town of Concrete, on the river, the subdivision called "Cedar Grove" has also come into existence during this last period. Some of these developments have sparked activity in areas adjacent to them.

For the most part, the towns in the middle Skagit area did not grow during this period. There was some subdividing of land, however, along Highway 17 around these areas.

Scott Paper Company, as in other areas during this time, bought huge pieces of land, especially from Soundview Timber Company. Simpson Log Company remained a big land holder along the river, while Georgia Pacific continued to buy land from Puget Sound Pulp & Timber Company.

10. UPPER SKAGIT RIVER

1941 - 1959

Besides the vast amount of state ownership in this area, timber companies also had large holdings during this period. However, existing companies were often bought out by others. As a result, the holdings of such companies as Soundview Pulp Company, Puget Sound Pulp and Timber Company, Scott Paper Company, and Simpson Timber Company were greatly expanded. During this period, county holdings dwindled through transfer to the state as County Trust Land.

Certain areas around the town of Marblemount were subdividing land, but these were not extensive. Also, the state land near Rockport was designated a State Park during this period.

1959 - 1972

Here again, the majority of activity of importance in terms of land ownership pattern changes concerned the timber companies. Soundview Timber Company, a major land owner in this area through the previous period, sold most of its holdings to Scott during this latter time span. The vast holdings of Georgia Pacific were also accumulated mostly from Puget Sound Pulp and Timber Company. While all these transactions were taking place, Scott Paper Company was retaining or expanding its vast acreage.

The upper river area also had its share of camping tracts. Such areas as "Skagit River Tracts" and "Carefree Acres" near Corkindale are an example of this type of development. More recently, the sale of recreational tracts has become a trend, and the future seems to point to more of the same. These areas must be subjected to some controls, so that they are developed with care and fore-thought to best preserve the forests natural beauty for this and future generations.

Some other large land owners are the state, the Federal government, and Seattle City Light. Seattle City Light has large holdings of land along the Skagit above Marblemount.

11. STATE AND FEDERAL LANDS

Obviously the large amount of state and federally owned land in Skagit County affects the area in that the government has control of the development of these lands. When one remembers that more than 50% of Skagit County's total land area is under State or Federal jurisdiction, how the rest of the land is developed becomes a rather meaningful question. Furthermore, when one accepts the fact that agriculture is a permanent economic base in the planning period of this study and subtracts these agricultural lands and other previously developed or unsatisfactory areas, along with the state and federal lands from the total area, the amount of land presently suitable for development is substantially reduced. In addition to the fact that the county exercised no control over federal lands, the county also receives little or no tax revenues from them. Of course, it can be said that as long as the land is in Federal control, it will be protected and maintained. The benefits from the tourism stimulated by such wilderness areas can be a great boost to the county's economy, if reasonably and properly developed. Also, the county does receive monies from the state on County Trust Land. When this type of land produces income from logging, the county receives 50% of the income earned. The other 50% is retained by the state as a management fee. This County Trust Land is just one of several types of state ownerships. However, this type seems to be the most widespread and beneficial in Skagit County. The various types of Department of Natural Resources land are listed at the end of this section.

A map depicting the amount and location of these state and federally owned lands has been prepared as a part of this study and is shown in the map section of this report (Map K).

STATE DEPARTMENT OF NATURAL RESOURCES LAND TYPES

*1. County Trust

2. Forest Board

3. Scientific

4. School and Idem

5. Agriculture

6. University

7. CEP and RI

    A. Correctional
    B. Educational
    C. Penal
    D. Rehabilitation Institution

8. Capitol Grants

9. Normal School

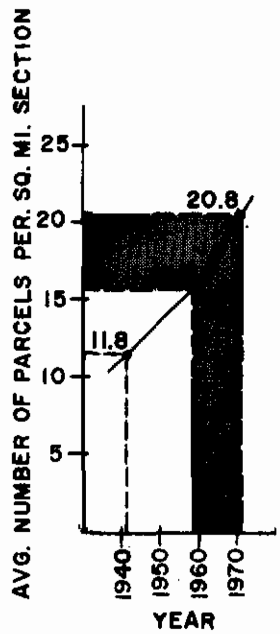
10. Escheat

11. Original University

*Through general observation, County Trust seems to be the most numerous of these types in Skagit County. Acreages broken down by types in specific counties were not readily available.

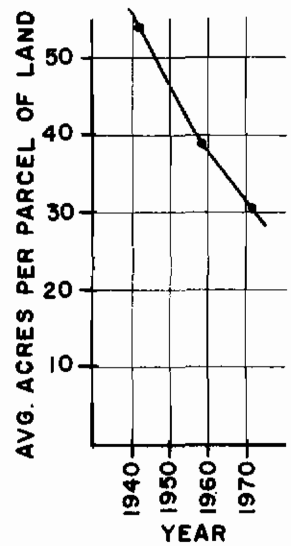
GRAPH 1

THIS GRAPH PLOTS PARCELIZATION OF LAND WITH YEARS. IT SHOWS PARCELIZATION TO BE GREATER IN THE LAST 13 YEAR PERIOD, THAN IT DID IN THE PREVIOUS 18 YEAR PERIOD. THIS WOULD ALSO MEAN THAT AVERAGE PARCEL OR LOT SIZE IS BECOMING SMALLER.



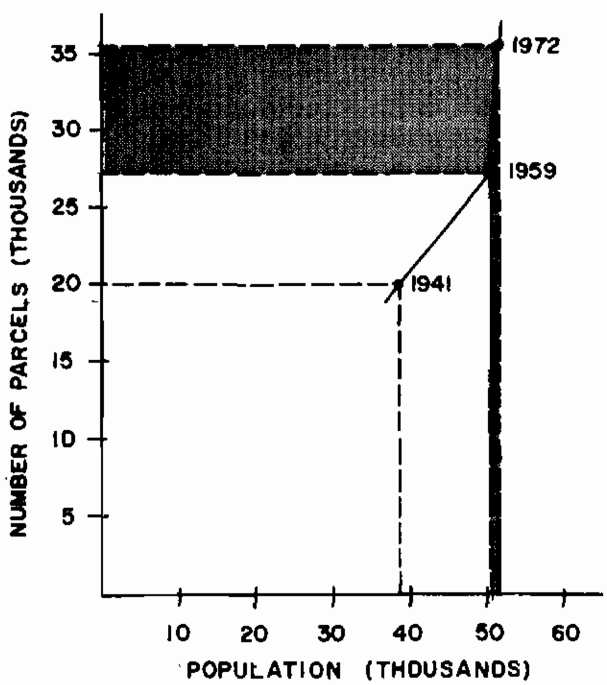
GRAPH 2

THIS GRAPH SHOWS THE DECREASING SIZE OF PARCELS OF LAND THROUGH THE YEARS.



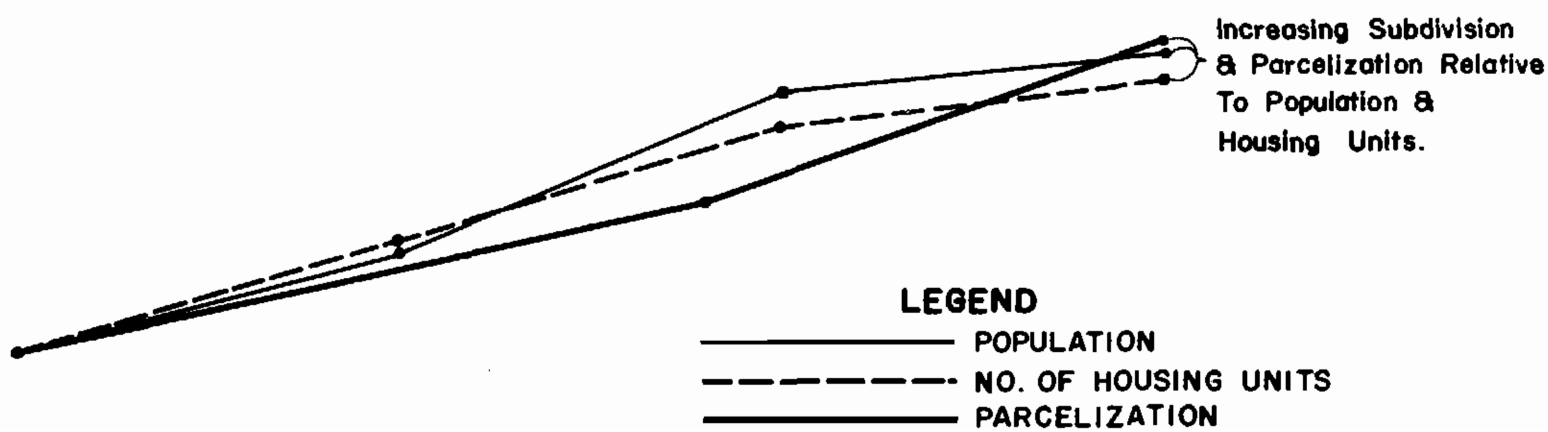
GRAPH 3

THIS GRAPH PLOTS THE PARCELIZATION, OR NUMBER OF PARCELS IN UNINCORPORATED PORTIONS OF THE COUNTY, AGAINST POPULATION. IT SHOWS A SUBSTANTIAL INCREASE IN SUBDIVISION AND PARCELIZATION RELATIVE TO A RATHER SMALL INCREASE IN POPULATION.



GRAPH NO. 7

POPULATION PARCELIZATION AND NUMBER OF HOUSING UNITS, SKAGIT COUNTY



HISTORY OF DEVELOPMENT

1. INTRODUCTION

Most of the information on early settlement was obtained from, An Illustrated History of Skagit and Snohomish Counties, published by the Interstate Publishing Company. The following summary is concerned mostly with early European settlement of the county. The history of the Indian Culture in Skagit County is contained in a book by Chief Martin J. Sampson.

2. EARLY SETTLEMENT OF THE DELTA AREA

The European settlement of Skagit County began on Fidalgo and Guemes Island. The first settlers on the mainland were Samuel Calhoun and Michael Sullivan. No one is quite sure who came first, although Calhoun is said to have come to the Skagit Delta area in the Spring of 1863. These men were supposed to have built the first diking systems in the area to reclaim the tidelands for crops.

As the fertility of the land and the feasibility of building dikes and levees became more apparent, settlers increased as did the crop yields. The first trading post on the Swinomish Flats was established by Alonzo Low in May, 1867, upon the site of the present city of LaConner. This business failed after a brief period, but was soon replaced by an establishment owned by Thomas Hayes. It was his successor, J. S. Conner, who named the town of LaConner.

In 1870, Jasper Gates and Joseph F. Dwelley became the first settlers in the area now known as Mount Vernon. However, the old site of Skagit City was the hub of the river transportation system until the work of removing the great log jams from the vicinity of Mount Vernon was completed in 1876. This caused the territory above the delta area to open for settlement, but destroyed the prestige of Skagit City. However, the problem of log jams on the Skagit occurred intermittently for years to come.

The city of Mount Vernon was actually founded in 1877 after the log jams were cleared. In 1883 Skagit County came into existence after being separated from Whatcom County.

3. LOGGING

The development of Skagit Valley grew steadily, with farming and logging becoming increasingly popular and successful.

Actually, logging had to be done first, for the whole valley was at one time covered by dense stands of timber. As a business, logging seems to have come into existence on the lower river as early as 1871. By the year 1875, there were hundreds of men engaged in logging at various places in the Skagit and Samish regions. The lure of these industries, combined with the later development of the coal mines and mineral resources, caused immigrants to move into the county in increasing numbers. There was a lag in this prosperity in 1874 due to the financial crisis in the East. This caused the Northern Pacific Railroad to suspend construction of its line to the valley and slowed immigration into the county. Money became very scarce.

After the clearing of the big log jams made the Skagit River navigable above Mount Vernon the logging industry began to prosper. It was not until Mr. Minkler built a sawmill at Birdsview in 1882, that Skagit County had an actual mill. Before that, all the logs were sent to large mills at Tacoma, Seattle, and Utsalady.

As this industry grew, so did the county. The various towns and cities upriver owe much of their existence to the logging industry, Sedro Woolley and Burlington being two good examples.

4. MINING

The mining industry in Skagit County got off to a slow start due to the giant log jams. It had a fairly short prosperous period and then evolved into a relatively unimportant industry. In 1874, Amasa Everett, Orlando Graham, and Lafayette Stevens discovered coal near Hamilton. The coal found here was of good quality, but the quantity was a hindrance in its long-range importance to the county. Skagit County was not without its dose of "gold fever" in the late 1800's. This precious mineral, however, was also found in too scarce a quantity to amount to any substantial sums, but it did cause quite a bit of excitement.

The discovery of large amounts of rock suitable for construction purposes near Concrete was of significant importance for many years. This importance has been reduced significantly in recent years.

5. FISHING

The fishing industry got a late start in this county due to the limited accessibility to a market. However, an abundant supply of fish was secured for local needs and it was a well known fact that the region's water swarmed with salmon. The pioneer in the fishing business on the upper Skagit seems to have been James H. Moores. He was located on the west bank of the Skagit, just above Mount Vernon, near the great log jam. His success opened the way for others. The Skagit area has seen great booms in the fishing and canning industries over the years since. It has been the home of some of the largest salmon canneries in the world. In recent years, however, the competition from other fishing areas and the increasing emphasis on agriculture and logging have tended to lessen the overall impact of the fishing industry on Skagit County.

6. AGRICULTURE

As the fame of the fertile Skagit Delta lands spread, so did the agricultural base of the county. The main crops of the early days consisted of oats, barley, and various vegetables. However, the prosperity that these farmers enjoyed was seriously hampered on many occasions by floods and high tides, which sometimes destroyed whole crops. As logging activities moved eastward, agriculture became the primary industry in the floodplain. As more land was cleared and reclaimed, the value and economy of the county grew. New and better crops have been introduced through the years, helping to affirm the strong agricultural base of the county.

As the county became more accessible and its great wealth of resources became known, it saw much growth. The greatest growth actually came in these earlier years, between 1900 and 1910. During these years the county grew from 14,272 people to 29,241. This was an increase of 105%. The population began leveling off between 1910 and the 30's, but between the 30's and the 60's it rose steadily once more. However, between the 60's and the 70's, the population has again shown signs of leveling off. It is interesting to mention that the county saw more than half its growth in the ten years between 1900 and 1910.

	1900	1910	1920	1930
Population	14,272	29,241	33,142	35,142
% of Increase		104.9	14.1	5.3

	1940	1950	1960	1970
Population	37,650	43,273	51,350	52,000
% of Increase	7.1	14.7	18.9	0.2

7. MOUNT VERNON

The city of Mount Vernon became the county seat in November, 1884. This was not without a long bitter fight between the older established cities of LaConner and Anacortes. Mount Vernon seemed to have more widespread appeal in all the industries, farming, logging, and mining, as well as shipping. The city soon became the hub of the county. It steadily grew as a center for food processing and distribution, trade, and county government.

The city's population growth was high through 1920 and increased steadily through 1960 except for a short time during the depression. Recently, the population growth has slowed.

New and better paying crops were introduced following the depression. These then supplemented dairy and feed crops and also brought additional fruit and vegetable processing plants to the city.

8. SEDRO WOOLLEY

The first settlers came to this area in 1878, carving homesites out of the dense wilderness. One of the first women pioneers of the area, Dr. Georgiana Batey, was also one of the first physicians in the county. The city itself derives its double name from the fact that at one time it was two towns. The Sedro section was founded in 1884 by a businessman, Mortimer Cook. Cook at first wanted to name the town "Bug" but was persuaded by his wife and other ladies of the town to name it "Sedro," which means cedar in Spanish. The town of Sedro was the home of the first shingle mill in the county. It is said that it was the first in Puget Sound area to ship shingles to the East. By 1889, the railroads reached Sedro. This event combined with Sedro's logging and lumber industry potential caused the town to grow at a very rapid pace. Because of this potential, one of the first things to be done was to plat land into streets, alleys, and lots. A prominent factor in the development of Sedro and Woolley during this era was the Sedro Land and Improvement Company, incorporated in the summer of 1890. The plat of old Sedro was filed for record October 17, 1889, by the Fairhaven Land Company. By 1892, Sedro had prospered enough to make a vigorous attempt at the contest for county seat but placed third behind Mount Vernon and Anacortes. Sedro was also the site of St. Elizabeth's, the first hospital in Skagit County.

The Woolley section of the city was platted by Philip A. Woolley in June of 1890. Mr. Woolley had anticipated the location for the junction of the railroads and built a large saw and shingle mill in the unplatted portion of town. With the development of the Bennett Coal Mines six miles northeast, now known as Cokedale, combined with the development of various mills in this vicinity, Woolley prospered and the rivalry between it and Sedro became intense. The general depression from 1893 to 1896 checked the rapid growth of both towns and it soon became apparent that the best resolution to their problems would require the merging of the two towns to one. The two towns were incorporated by the county commissioners on December 19, 1898, under the name of Sedro Woolley. The town did some substantial building in the years immediately following this event. In recent years the town has shown its energetic nature and has been growing toward the north and northwest. A goodly share of the prosperity which flows from the county's lumber, agriculture, and tourist industries has always touched Sedro Woolley.

9. BURLINGTON

In 1882, John P. Miller and William McKay built a shack in the dense forests which would soon become the town of Burlington. McKay recorded his plat of the townsite on New Year's Day, 1891. This was the same year the first sawmill, a shingle mill, and the post office was built and the railroads arrived. Burlington was a site of much real estate speculation in its early days. Many acres of land were bought, subdivided and sold for suburban land at very reasonable prices. The existence of the railroads and the closeness to the agriculture and timber lands made this a hard deal to reject. The town grew in the ensuing years as a commercial and agricultural hub. In recent years, development has slowed along with the rest of the county.

10. LA CONNER

LaConner, as mentioned before, was the site of Alonzo Low's Trading Post in 1864. In 1869, John S. Conner began a mercantile business which became the foundation of the new town. In 1870, LaConner Post Office succeeded the old Swinomish Post Office, with Mr. Conner assuming the position of postmaster. The name was derived from the initials of Mrs. Conner's name as a prefix to the family name of Conner. In 1872, the town was plotted by J. J. Conner, a cousin of John.

LaConner prospered as a mercantile and shipping center. Its proximity to the crop lands of the early days and to the water made it a natural shipping terminus. The town was also the site of a large lumber mill and was also the county seat for a brief time after the formation of Skagit County. The town was left in the wake of the general boom eastward. The coming of the railroads, the establishment of the city of Anacortes as a port, and the establishment of Mount Vernon as the county seat, caused the town to remain somewhat the same throughout the years. However, its architectural style and scenic location may have made it the most interesting town in the county.

11. OTHER TOWNS

Many other towns have come and some of them are now gone. Their development for the most part, has waned in recent years. Although they all have interesting histories, to trace each one would be a monumental task. Let it suffice for now to name some of these small communities. They include Concrete, Marblemount, Lyman, Hamilton, Rockport, Edison, Bow, Alger, Avon, Conway, Bayview, Fir, Skagit City, Clear Lake, McMurray, Montborne, and Baker.

DEVELOPMENTAL COST ESTIMATES

Estimating the future costs of various alternative plans can be a very difficult and often ambiguous task. Cost estimates, whether they are "ball-park" figures or precise and exacting, are a necessity when comparing the viability of one alternative over another. One alternative may cost more in terms of public expenditure, but the final outcome may be more favorable to the people than another less expensive alternative or vice versa.

In estimating developmental costs for the four alternative plans presented in this report, maximum saturation population limits for each alternative were used. This means that the cost estimates are a reflection of each alternative at its maximum population load. (These estimates are approximated and shown in the section containing the explanation of each alternative plan).

ESTIMATED WATER DEVELOPMENTAL INVESTMENTS

An estimate of the investment required to provide adequate water service for the various alternative land use plans was developed in the following manner:

The current per customer investment of Public Utility District #1 (PUD #1) of Skagit County was used as a constant against the multiplier of the anticipated holding capacity (i.e. population) of each alternative land use plan. It is estimated that each new "customer" (water connection) requires approximately $1,030* of investment by the PUD #1.

The population of the study area is currently 42,500 persons. The holding capacities of the alternative land use plans are: 1) Dispersed (56,700); 2) Composite (63,000); 3) Satellite (68,500), and 4) Nodal (74,500).

The PUD #1 is presently estimated to serve approximately 25,000 persons. This service is provided by means of 9,900* connections. Each connection, therefore, serves approximately 2.53 persons per connection.

It can be estimated that this service ratio of 2.53 persons per connection will remain stable and the investment required per connection will also remain stable. Using these assumptions the following formula can be used to estimate the total investment anticipated by each of the alternative land use models:

$$\frac{\text{additional population served}}{\text{persons/connection}} \times \text{investment required by connection} = \text{total investment required}$$

Land Use Plan	Additional Population		Person/ Connection		Investment Required		Cost
Dispersed	14,200	÷	2.53	x	1,030	=	$ 5,780,300
Composite	20,500	÷	2.53	x	1,030	=	8,345,100
Satellite	26,000	÷	2.53	x	1,030	=	10,584,300
Nodal	32,000	÷	2.53	x	1,030	=	13,027,440

*Information derived from Analysis of Operations, Public Utility District No. 1 of Skagit County, Washington for the Year 1972, by R. W. Beck and Associates, Seattle, Washington.

Two methods were used to estimate the sewage facilities developmental costs for each alternative land use plan.

One method used figures obtained from the sewerage plans of the various cities, and deleted and added costs accordingly for each alternative.

The other method took the increase of urban density of each alternative and multiplied that figure by a per-capita cost constant. *Increase high density x $299.19 - estimated sewerage developmental costs. The latter method was used in estimating the following costs:

Land Use Plan	Total Estimated Sewage Costs
Dispersed Plan	$ 2,548,799.00
Composite Plan	8,412,923.00
Satellite Plan	10,776,524.00
Nodal Plan	14,486,480.00

*Information from Cost Estimating Sewerage and Sewage Treatment Facilities, Department of Ecology, State of Washington.

ROAD COSTS

Roads are one of the most difficult facility areas to handle with respect to determining future costs. There are so many variables in terms of the engineering problems, (soils, slopes, vegetation, water bodies, etc.) that exact figures are hard to determine.

There are, however, some differences in roads under each alternative plan. A dispersed plan would have fewer total roads than an urbanized nodal situation, but the roads would be longer and right of way costs greater (not so much by unit value, but more in terms of actual miles of road). A nodal situation would have a greater concentration of roads and a higher quality, but they would be shorter than in a dispersed pattern. A satellite plan would probably accrue the highest road costs, due to the fact that each new community would require an entirely new road system. Another variable of significant importance is the concept of planned unit developments in which the developer constructs and maintains all of the roads within the development. Thus, if the planned development concept were to be utilized in the future, it would have a significant effect upon public road costs.

Road costs were determined with figures from the State Highway Department and the County Engineering Department: two lane - $292,000/mile, four lane - $431,000/mile. Right of way costs averaged approximately $2,000/acre. Structures were not figured in estimating costs per mile. A map was prepared, Map U, showing possible road configurations under each plan. All of the SR20 alternative routes under consideration are also shown on this map. Approximate road mileages were computed using this map.

Alternative Plan	Total Estimated Road Construction Costs
Dispersed	$16,006,760.00
Composite	12,380,260.00
Satellite	16,560,400.00
Nodal	10,397,260.00

LIBRARIES

Library costs for each alternative plan were developed using standards received from the American Library Association. The number of square feet of library space per capita was determined to be approximately .6 square feet. This figure, when multiplied by the added population of each plan, gives the total square footage of library space needed in each plan. The total square footage was then multiplied by $26.47, the median library construction cost per square foot, to attain the total building costs for each model. The standard number of books per capita is 3.5. When this figure is multiplied by $8, the average cost per book, the average cost of books per capita is attained ($28). The total cost of books added to the total construction costs gives the total library costs for each plan.

Alternative Plan	Total Estimated Library Construction Costs
Dispersed	$ 464,084.00
Composite	669,981.00
Satellite	849,732.00
Nodal	1,045,824.00

According to location standards backed by the American Library Association (see Policy constants; Community Facilities) libraries are best located in the busiest section of a city, among the retail stores, banks, and municipal buildings. Using this criteria, library location would not differ a great deal among the various alternative plans. The existing business and commercial centers would remain as such in each of the plans. The only differences in location might be in the satellite plan, where there is a possibility of new towns and in the dispersed plan where a bookmobile service might be used more extensively.

Also, as mentioned in the Policy Constants Section, a state or regional system would better serve a greater number of people, than a few municipal systems. However, library locations would still be best suited in the business and commercial centers.

Standards received from the Washington Survey and Rating Bureau indicate that fire stations in urban residential areas should be not more than two road miles apart. The distance is less (1.5 miles) in urban commercial areas. Rural areas are not as critical, with the distance between stations being around eight miles. In terms of these locational standards, Skagit County is well protected. Each municipality has a fire station within its boundaries. The outlying areas also have a relatively even distribution. Because of this, there is probably little need for any new stations in any of the models. However, there may be a need for a substation in the northeast area of Mount Vernon and one north of Sedro Woolley if the Nodal Plan is carried to near saturation. The Satellite Plan would also have need of small stations at Pleasant Ridge and Bow Hill. Most fire protection expenditures would be in form of new equipment, added personnel, and additions to existing structures to house them. These would be needed in proportion to the population and distribution pressures experienced under a certain plan. Existing fire districts and their stations are shown on the Community Facilities Map, Map L, in the map section of this report.

Costs

Fire Station Construction	Approx. $24.37 per sq. ft. (median)
Ladder Truck	Approx. $90,000
Pumper	Approx. $60,000
Small Truck	Approx. $35,000 - $40,000
Aid Car	Approx. $ 6,000

POLICE PROTECTION

Police protection is a very difficult element to quantify and project in monetary figures. The many variables involved in providing good police protection aid in making this an uncertain task. Not only do population pressures and changing patterns of development cause different needs in the level of police protection, but changing attitudes about the police and their role in society also cause these variations. The sheriff is an elected official whose budget has to reflect the attitudes of the people. Even the cost of adding a patrolman to a department may vary depending on who one is talking to. One would be tempted to add simply the cost of another salary to the payroll, but some feel it is not this simple. Besides the extra man's salary, there is the cost of training him, the cost of his uniform and equipment, and the costs of any mistakes he may make during the period it takes for him to become acquainted with a certain area (this cost will vary with each individual's talents and knowledge).

The Sheriff's Department is the primary law enforcement agency in the county, and will probably continue to be so through the time period of this plan. Because of this, attention has been focused upon the Sheriff's Department and its role in each alternative plan.

At the present time, the Sheriff's Department has a staff of 30. The Department handles almost all the investigative work for the county. It has the largest records system, a laboratory, a total of 13 cars of varying types (patrol, detective, command car, etc.) and maintains the county jail. The following table shows 1970 Budgets for all the law enforcement agencies of the county.

Under each plan, the exact distribution of duties among these various police agencies may vary. In a nodal situation, with more concentration of people in the cities, the municipal police departments will naturally have a larger scope. The exact ratio between municipal and county increases is very difficult to ascertain because of the spillover effects

Table 1

BUDGET INFORMATION, SKAGIT COUNTY
LAW ENFORCEMENT AGENCIES

Law Enforcement Agencies	1970 Budget	Budget Per Capita
Skagit County Sheriff	$216,014.65	$ 8.18
Mount Vernon	162,862.00	18.49
Anacortes	118,620.00	15.40
Sedro Woolley	81,815.00	17.79
Burlington	65,793.00	20.96
Concrete	12,080.00	21.08
LaConner		
Lyman		
Hamilton	Law enforcement furnished by the Skagit County Sheriff's Department	
TOTAL	$657,184.65	Avg. $16.98
Average Urban $18.74		
Average County 8.18		

Figures received from North Puget Sound Region 1971, A New Plan for Law and Justice, by Northwest Regional Council.

of an urbanized situation into the surrounding areas. On the other hand, a dispersed or satellite situation, where the population is distributed in the various areas outside the cities, may require an increase in the utilization of the County Sheriff's Department. Satellite communities would, more than likely, contract services from the Sheriff's Department. There are other situations such as the location of a highway near a town, or the location of a major shipping complex, which cause increases in the level of police protection that may or may not be related to the land-use pattern adopted.

Thus, as an estimated computation of police protection costs for each alternative plan, the corresponding population increases are multiplied by the average cost per capita; keeping in mind that variations are inevitable with each law enforcement agency, according to each plan.

Table 2

COST ESTIMATES FOR POLICE PROTECTION, SKAGIT COUNTY

Alternative Plan	Urban (Avg. 18.74/capita)		County (Rural) (8.18/capita)		Total
Dispersed	$ 468,500.00	+	$259,306.00	=	$ 727,806.00
Composite	835,804.00	+	150,512.00	=	986,316.00
Satellite	983,850.00	+	130,880.00	=	1,114,730.00
Nodal	1,216,226.00	+	78,528.00	=	1,294,754.00

Costs per capita based on 1970 figures.

SCHOOLS

Although the various schools within the county are operating below maximum load conditions and should be able to accommodate future enrollment pressures within the population projections (presented earlier in this report) without any substantial new construction, total saturation of the land-use plans presented may cause pressures for new construction. New construction hinges upon the maximum utilization of existing structures. The point at which this occurs is debatable because of the varying public sentiment and interest in the public school system. Further discussion about educational facilities within the county can be found in Education Facilities Section of this report.

Major school construction will most likely be limited to additions and rehabilitations of existing structures. More of the school buildings within the county will become obsolete by the year 2000.

MEDIAN SCHOOL CONSTRUCTION COSTS

Elementary - $25.00 per square foot or $2,250 per pupil (90 sq. ft. per pupil)

Junior High & Senior High - $22.00 per square foot of $1,980 per pupil

HOSPITALS

The health care section of the public services element discusses hospitals in more detail. The two hospitals within the planning area, United General Hospital and Skagit Valley Hospital, have the potential of being able to supply health care services to the year 2000. Future out-patient service levels are, to a great extent, determined by public sentiment and cannot be easily estimated in monetary terms. Building construction costs for hospitals can be estimated as costing from $17 per square foot to as high as $85 per square foot, with the median cost being approximately $37 per square foot.

Table 3

CONSTRUCTION COSTS 1973 (Update 6%/yr.)

	Use	Median Cost/Sq. Ft.
1.	Apartments	$16.80
2.	Auditoriums	24.06
3.	Automotive Sales	38.01
4.	Banks	35.77
5.	Churches	24.06
6.	Clubs (Y.M.C.A., Fraternal, etc.)	20.96
7.	College (classrooms & administrative)	29.14
8.	College (Science, Engineering, Laboratories)	31.00
9.	College (Student Union, activities, etc.)	27.90
10.	Community Centers (recreation, etc.)	22.63
11.	Convents	24.30
12.	Courthouses	33.60
13.	Department Stores	15.13
14.	Dormitories	49.86
15.	Factories	12.21
16.	Fire Stations	24.37
17.	Fraternity Houses (& Sorority)	21.58
18.	Funeral Homes (& Mortuaries)	18.41
19.	Garages, Commercial	15.69
20.	Garages, Municipal	13.14
21.	Garages, Parking	7.32
22.	Gymnasiums	19.28
23.	Hospitals	37.20
24.	Housing (for the elderly)	25.11
25.	Housing (projects, public, low rent)	17.11
26.	Libraries	26.47
27.	Medical Clinics	26.28
28.	Medical Offices	25.36
29.	Motels	21.33
30.	Nursing Homes	24.43
31.	Offices	25.05

	Use	Median Cost/Sq. Ft.
32.	Police Stations	32.92
33.	Religious Education	18.97
34.	Research (laboritories & facilities)	32.98
35.	Restaurants	30.75
36.	Retail Stores	14.51
37.	Schools (elementary)	24.61
38.	Schools (junior and senior high)	22.32
39.	Shopping Centers	13.39
40.	Supermarkets	14.38
41.	Town Halls (city halls and municipal buildings)	25.91
42.	Warehouses (& storage bldgs.)	9.67

Table 4

COMPARATIVE COST ESTIMATES*

	Dispersed Plan	Composite Plan	Satellite Plan	Nodal Plan
Water	$ 5,780,300	$ 8,345,100	$10,584,300	$13,027,440
Sewer	2,548,799	8,412,923	10,776,524	14,486,480
Roads	16,006,760	12,380,260	16,560,400	10,397,260
Schools	See Educational Facilities and School Cost Estimates			
Libraries	464,084	669,981	849,732	1,045,824
Police Protection	727,806	986,316	1,114,730	1,294,754
Parks	See Parks and Open Space Element			
TOTAL	$25,527,749	$30,794,580	$39,885,686	$40,251,758

*All costs are computed in terms of the saturation limits of each alternative plan.

ECONOMIC BASE ANALYSIS

The diverse elements which comprise the economic base of the Skagit Regional Planning Area have been investigated and analyzed by a number of organizations and agencies. Some of the reports have dealt with specific aspects of the Skagit economy, while other reports have been oriented toward the general composition of the total regional economy.

A list of these reports, studies, and analysis of Skagit's economy are available at the Skagit County Development Association office. Numerous other studies have been performed by private corporations or developers, which are not available for public consumption.

The latest economic studies relating to the Skagit Planning area are as follows:

I. Skagit County Agriculture: An Economic Mainstay
II. Skagit County Industrial Site Survey
III. A Tourist and Recreation Strategy for Skagit County with Recommendations for Implementation
IV. The Urban Land Institute Report on Skagit County
V. The North Cascades Highway: A Study of Its Impact on Local Community Economics
VI. Overall Economic Development Plan (Skagit County, Washington)

These reports and studies represent the most recent and detailed analyses of the Skagit Regional economic structure. All of these studies, except the Overall Economic Development Plan (Skagit County, Washington), were developed concurrently with this review of the Skagit Regional Comprehensive Plans. The above listed reports deal with the three primary elements of Skagit's regional economic structure: 1) agriculture; 2) industry-commerce, and 3) tourism-recreation. To bring these economic elements together, the services of the Urban Land Institute were acquired by the Skagit County Development Association, together with the Washington State Department, and the Economic Development Agency of the Federal Government.

The goals and objectives of all of these reports can be summarized as six points:

A. Preserve the existing agricultural economic structure of the Skagit area.
B. Promote compatible diversified industrial development for the Skagit area.
C. Expand and promote tourism and the recreational attributes of the Skagit area.
D. Provide additional flood protection for existing urban areas.
E. Develop safe and adequate sewer, water, and drainage systems for the Skagit area.
F. Pursue area-wide planning and economic development.

The alternative land use plans contained in this report all propose an abundance of land areas to fulfill the goals and objectives of the various economic base and market analysis studies mentioned above studies. These land area surpluses are "built-into" the alternative land use plans to guarantee an adequate supply of land areas to allow industrial diversification with the Skagit Regional area. Designating more area than is required for industrial, commercial, and residential development prevents the artificial inflation of land values and promotes economic efficiency in the use of land areas for development.

The adequacy of the surplus land areas is an indication of the philosophy of the Skagit Regional Planning Council that diverse and compatible land uses which do not damage existing economic activities are encouraged to locate in the Skagit area.

These surpluses of designated land areas will enable the various community development and industrial development organizations and agencies to continue their promotional activities with the full assurance that sufficient land areas are available for continuing economic development within the Skagit area.

To further benefit from and continue cooperation with development organizations and agencies, the reports listed above are the economic development element of this report. It is the intent of this plan to conform to the goals and objectives contained in those reports. Those goals and objectives are summarized in Table 1-7 of this section.

Table 1

SUMMARY OF ECONOMIC GOALS AND OBJECTIVES

From Skagit County Development Association Reports

<u>Report No.</u>

I. Skagit County Agriculture: An Economic Mainstay

II. Skagit County Industrial Site Survey

III. A Tourist and Recreation Strategy for Skagit County With Recommendations for Implementation

IV. ULI Report on Skagit County

V. The North Cascades Highway: A Study of Its Impact on Local Community Economics

VI. Overall Economic Development Plan (Skagit County, Washington)

The recommendations of these six reports are summarized on the following pages. This summary is indexed by the number of the report, as indicated above, and the page and paragraph on which the recommendations are more fully described.

Table 2

SUMMARY OF ECONOMIC GOALS AND OBJECTIVES

From Skagit County Development Association Reports

Report Number	Page Number	Paragraph Number	
I	x	1	-- retain agricultural land
I	x	2	-- use agricultural specialists
I	x	3	-- continue agricultural research
I	x	4	-- investigate use of irrigation
I	x	5	-- co-op or lease agricultural equipment
I	x	6	-- use time left to make land resource decisions
I	x	7	-- develop agricultural labor force
I	xi	1	-- work with and cooperate with environmental protection agencies
I	xi	3	-- expand log and broiler chicken industries
I	xi	4	-- expand fresh market capabilities
I	xi	5	-- increase use of commodity commissions

Table 3

SUMMARY OF ECONOMIC GOALS AND OBJECTIVES

From Skagit County Development
Association Reports

Report Number	Page Number	Paragraph Number		Cost per Acre	# of Acres
II	7	1	-- Anacortes Industrial Park	$ N/A	140
II	10	1	-- March Point	4,330	400
II	16	1	-- Summit Park-Swinomish Res.	2,866	1,360
II	21	1	-- W. Padilla Bay Tidelands	21,563	900
II	25	1	-- Swinomish Channel Tribal Tidelands	18,750	40
II	29	1	-- E. Padilla Bay Tidelands	21,476	1,100
II	34	1	-- Bayview Airport	1,450	1,930
II	38	1	-- Fredonia	8,080	550
II	43	1	- North Mount Vernon	2,233	60
II	47	1	-- West Burlington I-5	5,667	195
II	51	1	-- S. Burlington-I-5 - US 99	6,438	235
II	55	1	-- Port of Skagit County Industrial Park	6,571	105
II	59	1	-- Burlington	3,703	37
II	63	1	-- Burlington Northern RR Site	8,765	170
II	67	1	-- W. Sedro Woolley S. SR20	4,486	35
II	71	1	-- E. Sedro Woolley	6,345	55
II	75	1	-- Far W. Sedro Woolley South SR20	4,935	160

Table 4

SUMMARY OF ECONOMIC GOALS AND OBJECTIVES

From Skagit County Development
Association Reports

Report Number	Page Number	Paragraph Number	
III	13	2	-- identify or develop destination attraction
III	13	2	-- improve attractions easier-convenient
III	13	2	-- provide tourist services
III	13	2	-- promote attractions and services
III	20	3	-- advertising & promotion program
III	25	4	-- steam railway excursion
III	27	1	-- resort development
III	62	4	-- control location of commercial
III	62	5	-- prevent high-density recreational developments
III	62	6	-- support Wild & Scenic Rivers Act
III	62	7	-- establish park and open space systems
III	62	8	-- strengthen Concrete commerical role
III	62	12	-- expand use of Lake Shannon
III	63	1	-- public agency campground upriver
III	63	2	-- develop and lease vacation lots to general public
III	64	3	-- develop resort facilities on Baker Lake
III	68	3	-- expand motel facilities 20-30 rooms (mid river)
III	68	4	-- establish campground near I-5 - SR20
III	84	2	-- tourist resort complex at Ship's Harbor
III	84	3	-- coordinate & develop public & private marinas

Report Number	Page Number	Paragraph Number	
III	84	4	-- construct Lone Tree Point resort facility
III	84	5	-- preserve LaConner
III	84	6	-- commercialize State Ferry System

Table 5

SUMMARY OF ECONOMIC GOALS AND OBJECTIVES

From Skagit County Development Association Reports

Report Number	Page Number	Paragraph Number	
IV	57	5	-- flood control for urban areas
IV	57	5	-- sewer and water for development
IV	57	5	-- rebuild I-5/SR20 interchange
IV	57	5	-- area-wide planning and economic development
IV	58	1	-- protect areas environmental assets
IV	58	2	-- ships harbor
IV	58	2	-- classify river
IV	58	2	-- promote recreation
IV	58	2	-- increase recreation potential of ferry system
IV	58	2	-- accommodate increased and expanded marina activity
IV	58	3	-- preserve agricultural land
IV	58	3	-- apply agricultural research
IV	58	4	-- industrialize Bayview
IV	58	4	-- Anacortes Urban Renewal
IV	58	4	-- Sedro Woolley industrial park

Table 6

SUMMARY OF ECONOMIC GOALS AND OBJECTIVES

From Washington State Parks &
Recreation Commission

Report Number	Page Number	Paragraph Number	
V	90	4	-- cluster commercial development
V	91	2	-- State of Washington assume leadership & coordination State Parks & Recreation
V	92	5	-- private developer should look long range
V	92	6	-- regulate signing
V	93	1	-- coordinate promotional activities
V	93	2	-- upgrade substandard sections of highway
V	94	2	-- U.S. Park & Forest & State Highway should protect ecology of wilderness area
V	94	3	-- in-park facilities must integrate and be secondary
V	97	3	-- Washington State Parks & Recreation expand Rockport
V	97	4	-- Washington State Parks & Recreation coordinate and plan for Diablo
V	98	5	-- if Washington State Parks & Recreation coordination doesn't work: a. expand Rockport Park b. interpretive center at Rockport c. comprehensive park facility near Marblemount
			-- upriver towns should coordinate development to maximize employment activities

Table 7

SUMMARY OF ECONOMIC GOALS AND OBJECTIVES

From Skagit County Overall Economic Development Plan

Report Number	Page Number	Paragraph Number	
VI	72	2	-- construct adequate sewer facilities
VI	72	4	-- develop plans for industrial use of Bay-view
VI	73	1	-- implement plans for development of Bay-view area
VI	73	3	-- develop Anacortes Industrial Park & deep water facilities
VI	73	4	-- develop solid waste management plan
VI	74	2	-- continue construction of & improve arterial network
VI	74	4	-- develop Swinomish Salmon Plan
VI	75	2	-- develop Swinomish Boat Marina and Storage Facilities
VI	75	4	-- expand Manpower Training Program
VI	75	6	-- provide adequate housing in Skagit County
VI	76	2	-- continue with development of new crops
VI	76	3	-- research in extending harvest season
VI	76	5	-- prepare comprehensive park, recreation & facilities plan
VI	77	2	-- identify resource & non-resource oriented industrial development (feasibility study)
VI	77	4	-- expand and alter Skagit County Courthouse facilities

COMMUNITY FACILITIES

The previous three portions of this report have dealt with a variety of characteristics which together form the environment of the community. This portion deals with the improvements that have been made to make the characteristics of the community better suited to the needs of its residents.

The existing utilities, roads, schools, etc., are delineated here; an inventory of this type is necessary to determine what should be changed or expanded to serve the projected needs of the community.

The Community Facilities portion of this report is composed of the following:

1) Education Facilities
2) Personal Services
3) Sewer, Water, Drainage Facilities
4) Roads, Circulation Pattern (Map M)
5) Open Space - Recreation

EDUCATIONAL FACILITIES

1. INTRODUCTION

The maintenance of a sound school system is not only a benefit to the children of an area, but it is also an asset to the area as a whole. Besides the primary result of supplying a child with the best possible education, there are secondary and tertiary effects of a good school system. The schools tend to unite the community through P.T.A., sports events, school concerts, joint use of school and public facilities, and other activities. The community is also benefited by the increase in the overall education of its present and future members. In this way, the people can be better prepared to determine their own future.

2. INTERMEDIATE SCHOOL DISTRICT 108

Education in the study area is conducted under the general supervision of Intermediate School District 108 (ISD 108) headquartered in Bellingham. ISD 108 is a four-county organization of school districts, which encompasses the school districts of Whatcom, Skagit, Island, and San Juan Counties.

Intermediate School District 108 has a records keeping function as mandated by state law and acts as a review agency for second and third class school districts. Conway is the only third class district in the study area, while LaConner and Concrete are both second class districts. The remaining districts, Sedro Woolley, Burlington-Edison, Mount Vernon, and Anacortes are all first class districts. ISD 108 acts primarily in the capacity of a coordinating and service agency for the public and private school districts in the four-county North Sound area.

3. THE STUDY AREA

Of the seven school districts in Skagit County, five and one half fall within the confines of the study area. These are Sedro Woolley, Mount Vernon, Burlington-Edison, Concrete, Conway, and half of LaConner. LaConner School District is divided by the Swinomish Channel, the western boundary of the study area. These school districts provide education for a total 10,344 students ranging in level from kindergarten through the twelfth grade. In addition, Skagit Valley College provides academic and vocational training for the freshman and sophomore level of college students.

There are a total of 27 schools in the study area, consisting of six high schools, two junior high schools, and 19 elementary schools. The school districts of Skagit County account for approximately 50% ($6,282,488.89) of the total county tax (1972).

Finding ways of objectively and accurately examining existing educational facilities is a great problem. Any evaluation of educational facilities, unless conducted by an unbiased expert, will contain biases and weaknesses. It is for this reason that it is up to the people of each school district to join with their educators in evaluating their own goals and priorities.

By focusing attention on each school district separately, it is possible to get a clearer idea of existing facilities and future needs. A population analysis for each district can be found at the end of this section.

3A. Mount Vernon School District #320

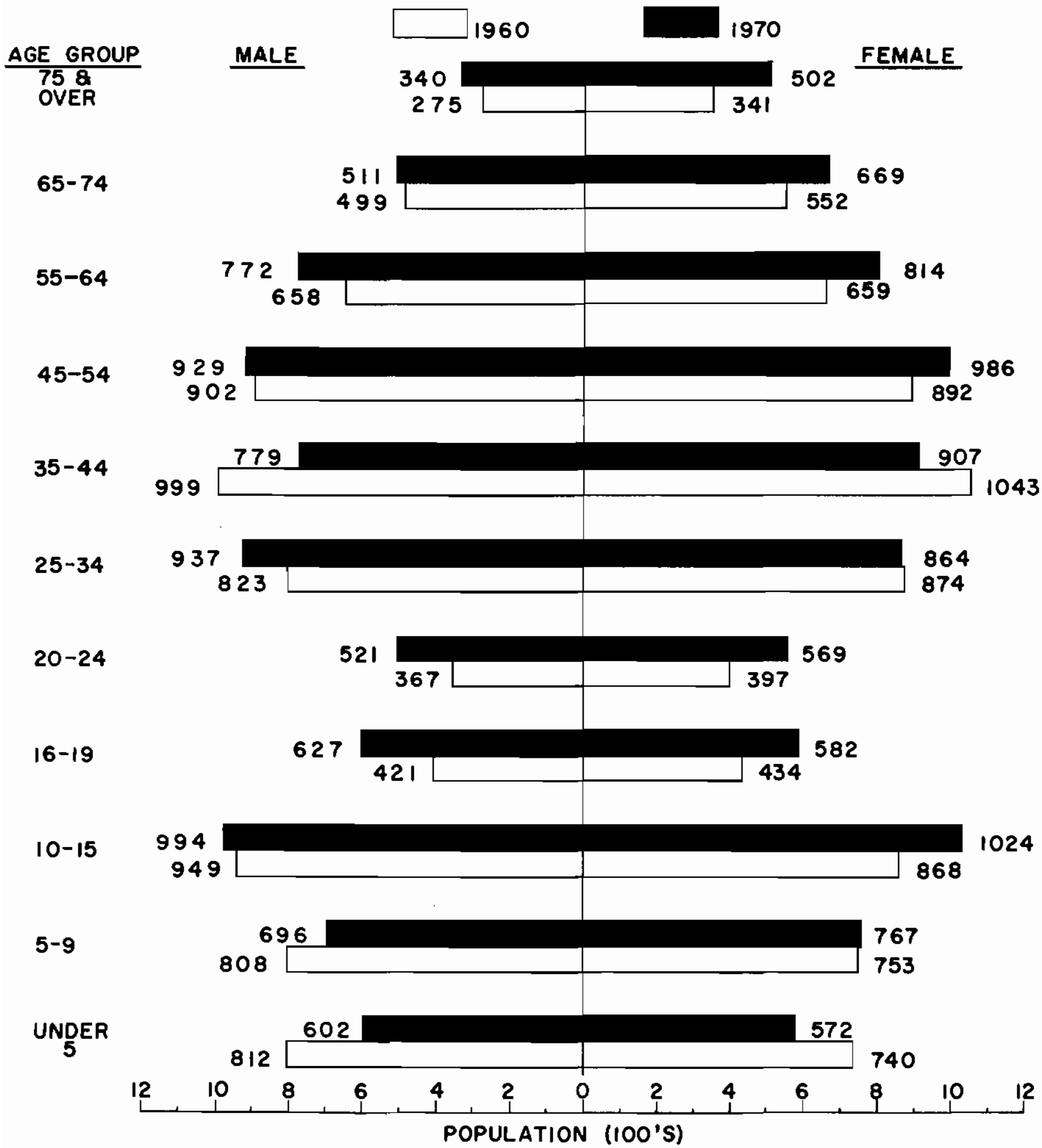
Mount Vernon School District serves an area having an estimated population of 15,964. The total number of students within the district in 1972 was approximately 3,150. There are a total of 175 teachers which results in a student/teacher ratio of 18/1.

There are six schools within the district; four elementary, one middle school, and one high school.

School (Grades)	1972 Enroll-ment	Sq. Ft./Sq. Ft. Per Pupil	Acreage	Year Built/ Additions
Lincoln (Elem. K-6)	406	39,791/98.0	3.3	1938
Jefferson (Elem. 1-6)	403	39,021/96.8	10.0	1956/'60
Washington (Elem. K-6)	349	28,858/82.6	6.8	1950/'53, '61
Madison (Elem. 1-6)	336	23,647/70.3	18.6	1954/'61
LaVenture (7-8)	500	73,000/146.0	20.0	1971
High School (9-12)	1,149	173,691/151.1	28.8	1922/'36, '51, '53, '62, '71
Roosevelt (Administration)		19,000	3.5	1906

The 1960 population of the district was approximately 15,085. This figure had increased to 15,964 in 1970. This is a net increase of 879, or 1.7%. An age/sex pyramid for each school district was prepared using U.S. Census Bureau data. These are found at the end of this section. As can be seen when examining the data for Mount Vernon #320, the number of children under five declined sharply between 1960 and 1970. There is a less dramatic decline in the 5 - 9 age group and an increase in the 10 - 15 year olds. However, the under five group is the most significant in terms of future student enrollment trends. Within the district itself between 1960 and 1970 the number of women of child-bearing age has increased over the previous decade, while the number of births (plus the net migration) has fallen. These decreases, coupled with the state's figures showing a recent leveling off of the birth rate, could have an effect on future enrollment trends. Thus, the overall population increase shown in the data could be attributed to other elements besides the birth rate. These would include an increase in people of older age groups and possibly a rural to urban migration pattern.

MOUNT VERNON NO. 320 AGE & SEX DISTRIBUTION 1960-1970
Including (CONWAY NO. 317)



TOTALS 1. 1960=15,085
2. 1970=15,964
3. NUMBER OF WOMEN OF CHILD-BEARING YEARS (16-45) - 1960=2,748, 1970=2,922
4. NUMBER OF BIRTHS (PLUS NET MIGRATION AGES UNDER 10) - 1950-'60=3,113, 1960-'70=2,637

In attempting to make future projections, the district data should be coupled with the overall county population trends (see Population Element). A projection would need to be predicated on the same assumptions as were discussed in the Population Element. This would mean that if there are any unforeseen economic changes in or near the county, it would obviously have an effect on population trends. Using these assumptions, the enrollment in Mount Vernon District #320 should increase only slightly. The elementary grade levels seem to be decreasing in enrollment, while the upper grade levels have shown an increase, due to the impact of the latter years of the baby boom.

District #320 has completed a recent building program, which included the construction of a new cafetorium at the high school and the new LaVenture Middle School. As stated before, enrollment pressures alone would warrant little new construction in the foreseeable future. The district will be selling the old Cleveland School site to acquire a better piece of property for future needs.

Due to the age of some of the structures within the school district, the major renovation program that is scheduled to begin should be the main thrust of attention. Such aspects as lighting, heating, painting, addition of special facilities, and other design and structural elements, should be considered as an ongoing program that is linked with the changing needs of the educational process.

3B. Burlington-Edison School District #100

The Burlington-Edison School District serves an area having an estimated population of 8,941. The 1972 total enrollment was 2,725. The total number of full time teachers in the district was 134. This results in a student/teacher ratio of approximately 20 to 1.

There are six schools within the district; five elementary and one high school.

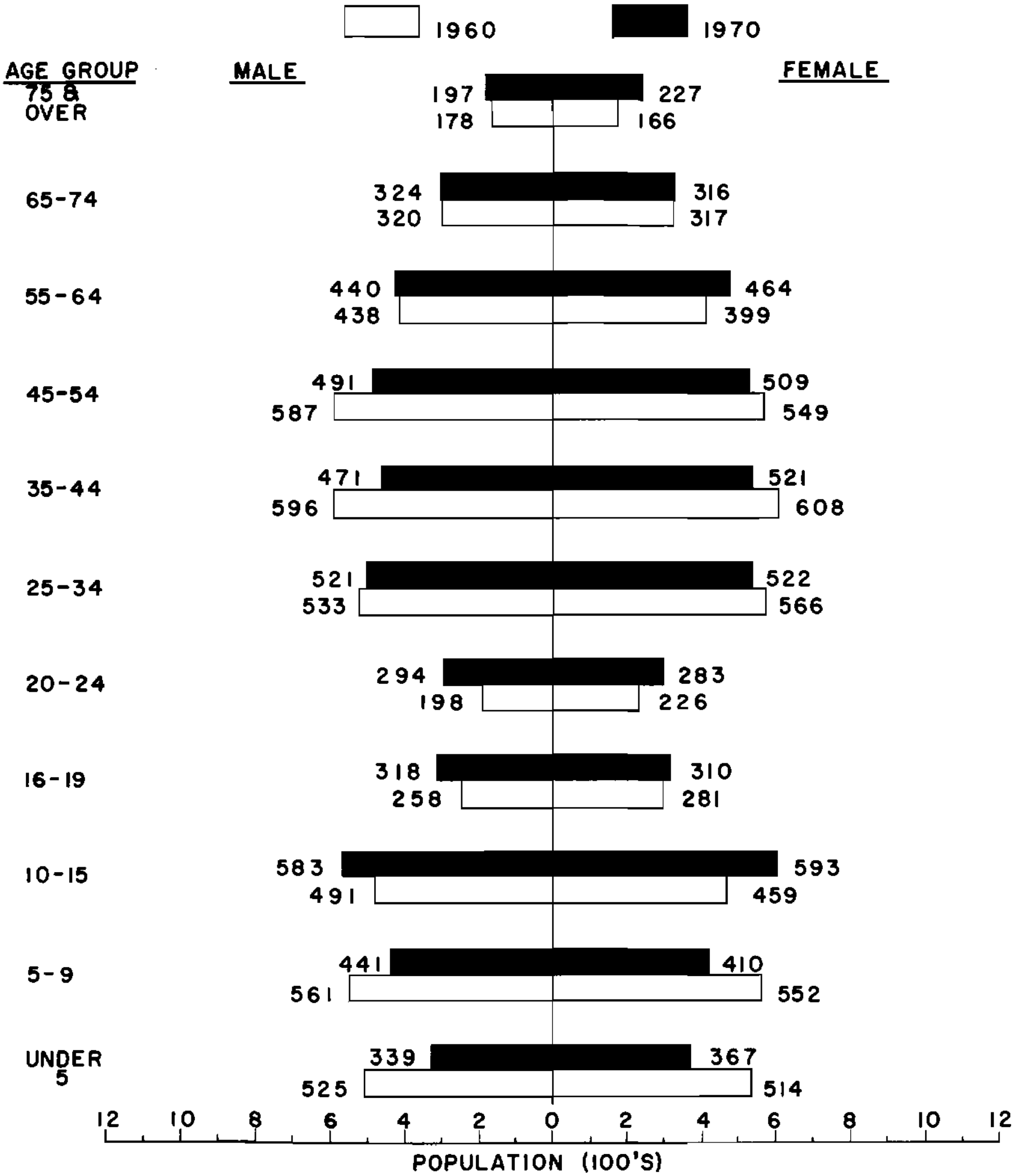
School (Grades)	1972 Enroll-ment	Sq. Ft./Sq. Ft. Per Pupil	Acreage	Year Built/ Additions
Roosevelt (Elem. K-3)	118	7,438/63.0	1.0	1936
Allen (K-8)	492	35,758/72.6	12.0	1967
Edison (K-8)	262	24,000/91.6	8.0	1924
West View (1-8)	481	37,000/76.9	10.0	1953
Lucille Um-barger (1-8)	514	38,000/73.9	10.0	1959
Burlington-Edison H.S. (9-12)	858	136,000/158.5	29.0	1926/'59, '65, '71

The 1960 population of the Burlington-Edison District was 9,322. In 1970 this figure decreased to 8,941. This was a net decrease of 381 or approximately 4%. By examining the age/sex pyramid at the end of this section, we can see that the number of children under five years of age declined sharply during the last decade. The number of children between the ages of five and nine also decreased. As mentioned in the previous analysis of Mount Vernon School District, this decrease in the younger age groups has a significance in terms of the future needs of the district. As can be seen in the table, the number of women of child-bearing age and the number of births in the district have also decreased.

These figures, combined with the state estimations of Skagit County's population growth, point to a basic reduction in the growth trend in the district. There may be sporadic increases which cause a slow overall growth rate. This would seem to be the case, providing that no major economic changes affect the county.

The center of attention should be a program to keep in pace with obsolesence. The high school is the primary target, with construction

BURLINGTON/EDISON NO. 100 AGE & SEX DISTRIBUTION 1960-1970



TOTALS 1. 1960 = 9,322

2. 1970 = 8,941

3. NUMBER OF WOMEN OF CHILD-BEARING YEARS (16-45) - 1960 = 1,679, 1970 = 1,636

4. NUMBER OF BIRTHS (PLUS NET MIGRATION AGES UNDER 10) - 1950-'60 = 2,152, 1960-'70 = 1,557

beginning soon on a new main building. All aspects of educational facilities should be examined, to determine their relevance to the continuing educational excellence of the district.

3C. Sedro Woolley School District #101

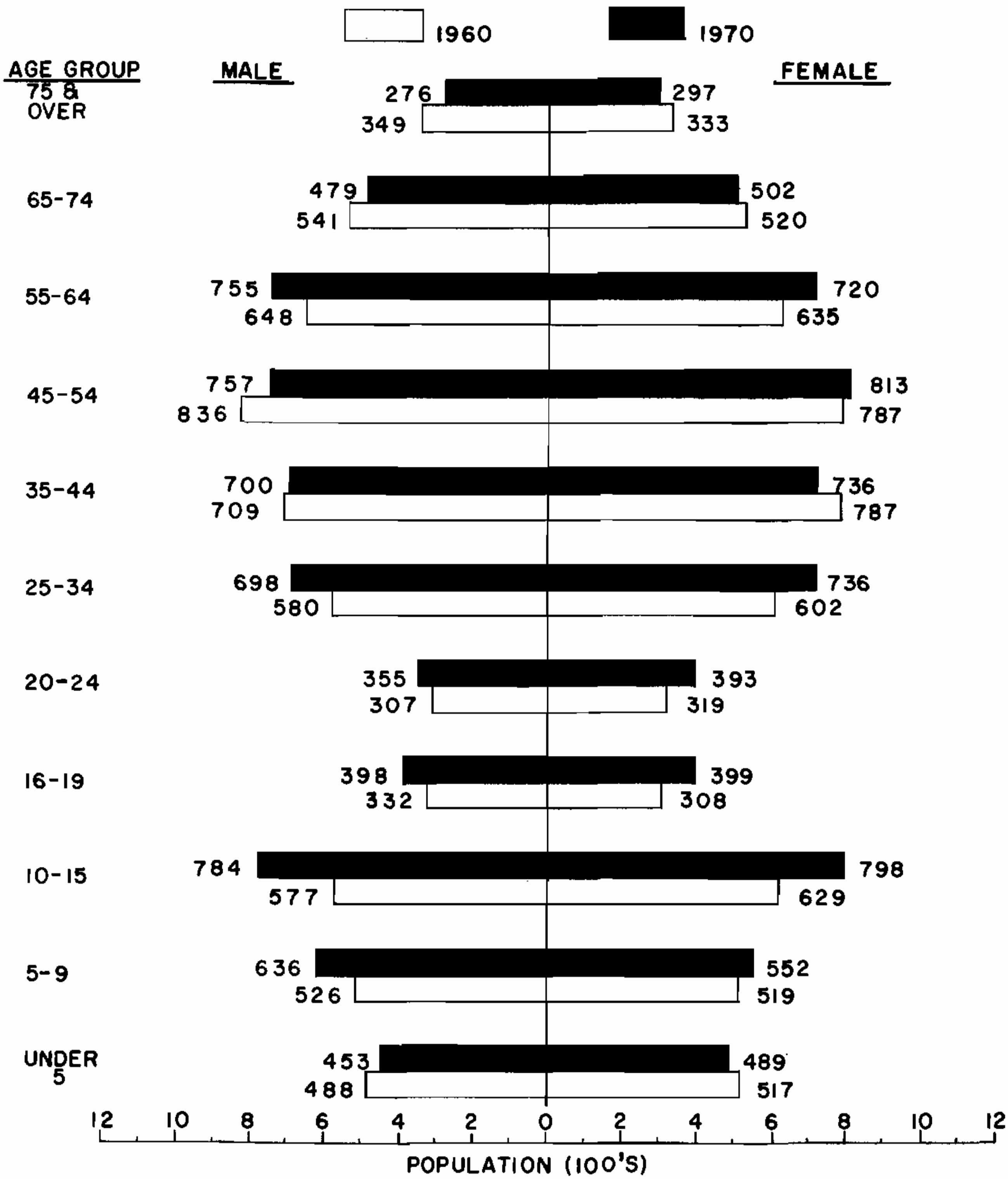
Sedro Woolley School District serves an area having an estimated population of 12,727. The total number of students in 1972 was approximately 3,093. There are a total of 166 teachers within the district, which gives a student/teacher ratio of approxiamtely 18 to 1.

There are nine schools within the district, including seven elementary schools, one junior high school, and one high school.

School (Grades)	1972 Enroll-ment	Sq. Ft./Sq. Ft. Per Pupil	Acreage	Year Built/ Additions
Big Lake (K-6)	136	16,854/123.9	9.2	1935
Clear Lake (K-6)	189	23,123/122.3	4.3	1962
Lyman (K-3)	91	12,865/141.3	7.0	1935
Mary Purcell (K-3)	594	35,504/59.7	4.7	1951
Samish (1-6)	114	10,211/89.5	4.3	1962
Central (4-6)	546	43,447/79.5	2.4	1925
Hamilton (4-6)	93	19,549/210.1	7.0	1920
Cascade J. H. (7-9)	783	75,277/96.1	12.8	1957
Senior High (10-12)	644	----	14.0	1915

In 1960 the population of the district was approximately 11,849. By 1970 this figure had grown to 12,727. This represents a net increase of 878 people, or 7.4%.

SEDRO-WOOLLEY NO. 101 AGE & SEX DISTRIBUTION 1960-1970



TOTALS 1. 1960 = 11,849

2. 1970 = 12,727

3. NUMBER OF WOMEN OF CHILD-BEARING YEARS (16-45) - 1960 = 2,016, 1970 = 2,264

4. NUMBER OF BIRTHS (PLUS NET MIGRATION AGES UNDER 10) - 1950-'60 = 2,050, 1960-'70 = 2,130

When examining the age/sex pyramid for the Sedro Woolley School District, it is seen that the number of children under five years of age has fallen only slightly in the last ten years. The number of children in the age groups above five all show increases. These figures, combined with the rise in population within the district, the rise in the number of women in child-bearing years, and the rise in the number of births, points to the fact that Sedro Woolley is not typical of most of the other school districts in the county. The 7.4% district population increase is even above the 2% figure felt by the county between 1960 and 1970.

This growth factor combined with the eventual need to replace some of the older school buildings in the district points toward the importance of building and renovation programs. Recently, Sedro Woolley School District #101 retained the services of Johnston-Campanella-Murakami-Brummitt & Company to develop a master plan for the school district. This plan specifically concerns itself with the examination of district educational objectives, the existing facilities, the district's financial status and capacity, and alternative plans for development within the district.

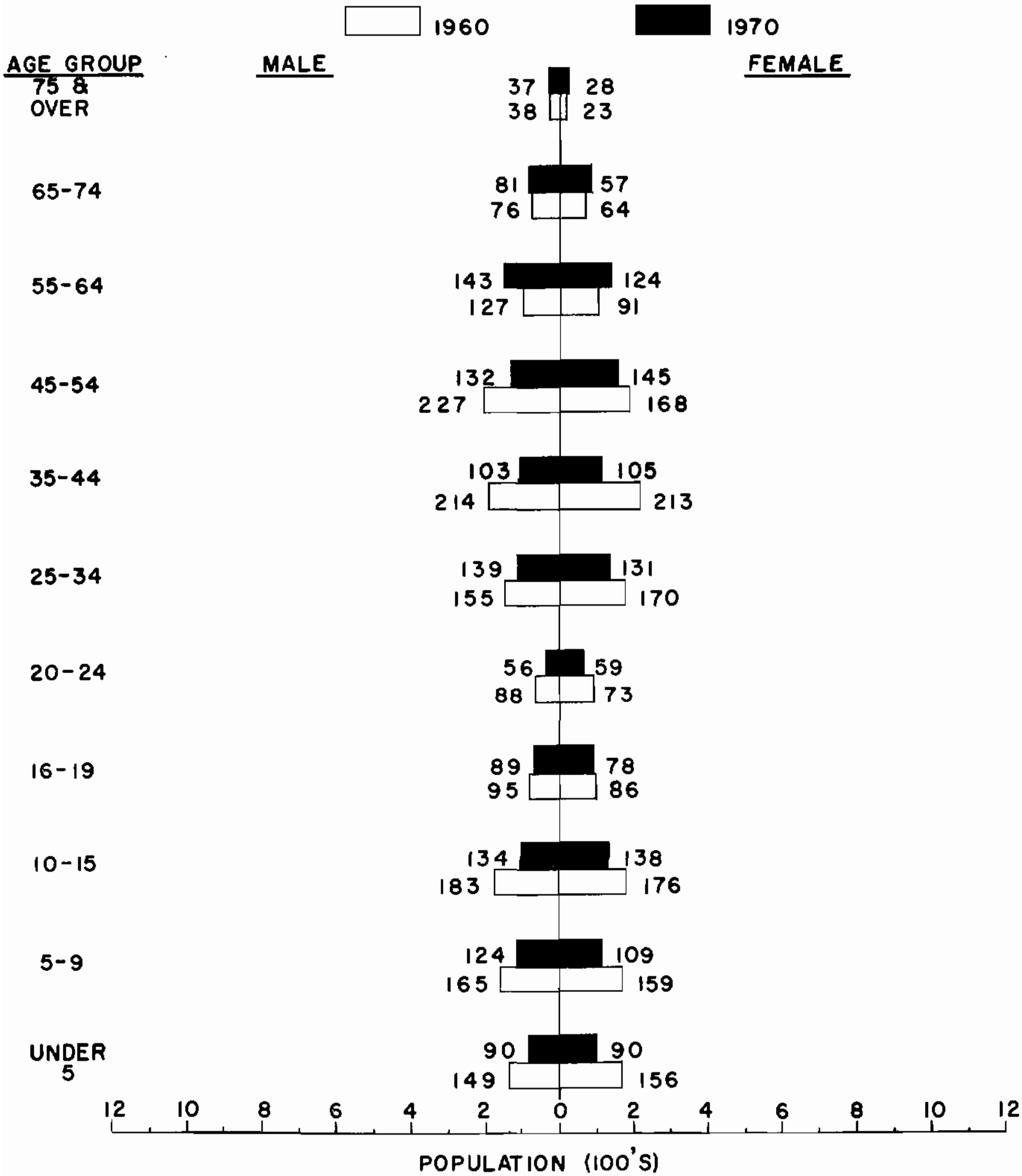
3D. Concrete School District #102

Concrete School District serves an area having an estimated population of 2,192. The total number of students in 1972 was approximately 580. There are a total of 35 teachers within the district, which gives a student/teacher ratio of approximately 16 to 1.

There are two schools within the district; both are located within the town of Concrete. One is an elementary school serving the grade levels kindergarten through seven and the other is Concrete High School, with grade levels 8 through 12.

School (Grades)	1972 Enrollment	Sq. Ft./Sq. Ft. Per Pupil	Acreage	Year Built/ Additions
Concrete (K-7)	310	N/A	8.0	1917/'38
Senior High (8-12)	200	N/A	20.0	1952

CONCRETE NO. 102 AGE & SEX DISTRIBUTION 1960-1970



TOTALS 1. 1960 - 2,896
2. 1970 - 2,192
3. NUMBER OF WOMEN OF CHILD-BEARING YEARS (16-45) - 1960 = 542, 1970 = 373
4. NUMBER OF BIRTHS (PLUS NET MIGRATION AGES UNDER 10) - 1950-'60 = 629, 1960-'70 = 413

The 1960 population of the district was 2,896. In 1970 this figure had decreased to 2,192. This is a net decrease of 704, or 24.3%. The age/sex pyramid for the district also shows decreases in almost every age group. As can be seen in the graph, the younger age groups are a part of this overall decline. The number of women of child-bearing age and the number of births have dropped off sharply. All of these figures can probably be attributed to the closing of the cement plant in Concrete and the reduction of the work force needed in forestry practices. Elementary schools at Marblemount and Rockport have been used in the past but are not being used at present due to lack of enrollment.

With these facts in mind, the district has no pressing need for new facilities. However, the elementary school is rather old. This would mean that such things as lighting, heating, electricity, and similar aspects should probably be examined to insure a proper level of adequacy. As stated earlier, the need for other educational and special educational facilities should be determined by the district itself and its constituents and a program for resolving these needs subsequently developed.

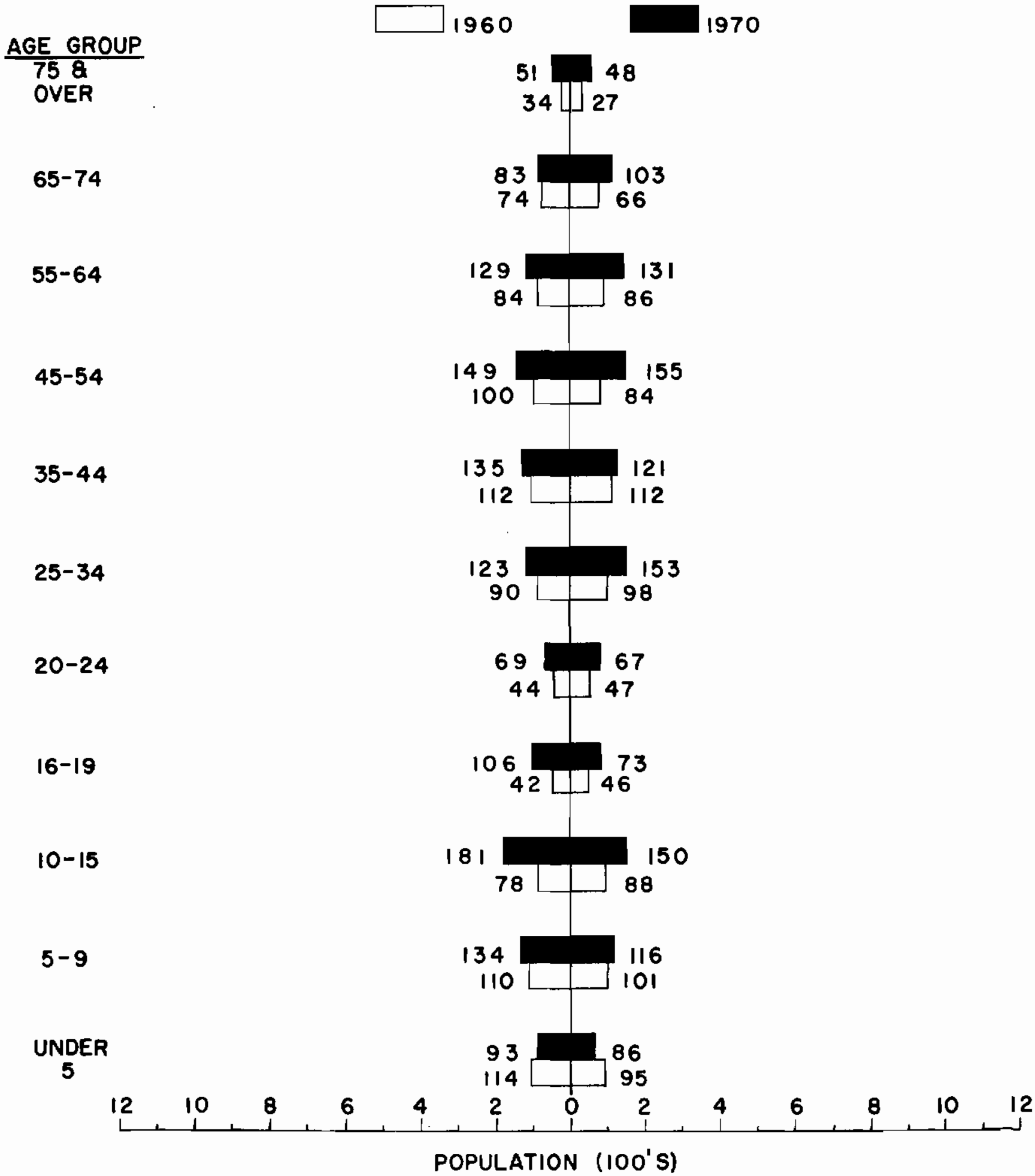
3E. LaConner School District #311

LaConner School District serves an area having an estimated population of 2,456. The total number of students in 1972 was approximately 463. There are a total of 26 teachers, which results in a student/teacher ratio of 17 to 1.

There are two schools within the district. These include LaConner Elementary (K-8) and LaConner High School (9-12).

School (Grades)	1972 Enrollment	Sq. Ft./Sq. Ft. Per Pupil	Acreage	Year Built/ Additions
LaConner (K-8)	320	N/A	11.0	1936/'61, '64
Senior High (9-12)	150	N/A	10.0	1921

LA CONNER NO. 311 AGE & SEX DISTRIBUTION 1960-1970



TOTALS 1. 1960 = 1732

2. 1970 = 2456

3. Number of women of child-bearing years (16-45) – 1960 = 303, 1970 = 414

4. Number of births (Plus net migration ages under 10) – 1950-'60 = 420, 1960-'70 = 429

* Figures may be slightly distorted due to changes in census enumeration district boundaries between 1960-1970. Thus 1960 figures may be somewhat higher than shown here.

programs. State funds are made available to school districts which qualify by placing them on a "priority of needs" list, which is referred to as the state "Gray Book." This book lists the school districts which are entitled to assistance and the corresponding percentage of state participation that they may expect.

The state standards for financial assistance are based upon a square footage allocation for each unhoused pupil in the school district. The allocation for elementary students is 70 sq. ft. per pupil and the allocation for junior high school students is 90 sq. ft. per pupil. In addition, the state also sets a ceiling for construction costs beyond which they will not participate. The state will participate with the school district in the percentage previously mentioned, up to a total cost per square foot of $27.11. Thus, any construction costs exceeding $27.11 per square foot would have to be assumed by the school district.

The formula for state assistance would be:

$$\text{A percentage of the number of unhoused students} \times \begin{matrix} 70 \text{ sq. ft./pupil} \\ \text{or} \\ 90 \text{ sq. ft./pupil} \end{matrix} \times \$27.11/\text{sq. ft.}$$

5. SUMMARY

Nearly all public school districts in Skagit County are experiencing a diminishing rate of growth in so far as student population is concerned. This is primarily a reflection of two unrelated events: 1) birth control is overcoming the cyclic effect of the WW II baby boom, and 2) there are relatively few promotional opportunities for young adult families in the planning area. Thus, young career oriented county residents must migrate to urban centers where greater opportunities exist.

This diminished rate of growth is allowing school districts to reduce student per classroom ratios and this reduces the demand for additional classrooms. Nearly all school districts are at 100% of capacity and some of this capacity is housed in substandard facilities which reduce educational opportunities and substantially increase the maintenance cost per student. However, recent voter reluctance to approve levies and the existence of high interest rate of bonds for long range capital acquisition combine to create great difficulties in updating educational facilities.

6. SKAGIT VALLEY COLLEGE

6A. History

Skagit Valley College began as adjunct to Mount Vernon High School in 1926. It was originally called Mount Vernon Junior College. In 1948, the name was changed to Skagit Valley Junior College. Its present name was adopted in 1958 and is the second oldest two year community college in the state.

For many years the college moved from place to place. In 1955 a permanent site of 35 acres was purchased on the northeast edge of Mount Vernon. In 1959 the first complex of six buildings was completed, but student enrollment pressures necessitated further annexation of land. The campus, at present, covers an area of 85 acres, with two new facilities added in 1971.

The Whidbey Island Branch of the college was created in September, 1970, as a cooperative endeavor of the college and the Naval Air Station in Oak Harbor. The Whidbey Branch is located on the Navy's Sea Plane Base.

Skagit Valley College is accredited by the Northwest Association of Secondary and High Schools and approved by the Washington State Department of Public Instruction and the Veteran's Administration. The district that the college now serves includes Skagit, Island, and San Juan Counties. It is financed by state and federal funds and by student fees. Total enrollment for the winter quarter of 1973 was approximately 4,200.

6B. Present Objectives

The 1972-73 college catalog states that, "The prime objective of Skagit Valley College is to offer educational and cultural service to the community. This carries a commitment to offer a variety of educational programs for students and adults of varying abilities, interests, and occupational objectives. Specifically, the college offers course work and programs in the following broad areas:

a. Lower division pre-professional curriculum for transfer to senior universities, applicable toward the Baccalaureate Degree.

b. Occupational fields for entry into specific vocations and further training for increasing occupational effectiveness while pursuing a vocation.

c. Developmental education for students who are not prepared to pursue college or occupational programs.

d. Continuing education for citizens in the community who may desire further preparation in general education, in a vocational field, or in an avocational venture. The programs and courses can be varied and modified to meet the needs and demands of the people in the community."

6C. Existing Facilities

Total - Nine buildings, including the heating plant:

The Campus Center - Administrative Offices, the Student Services Center, Bookstore, Student Union, and Publications Office.

Lewis Hall - Classrooms and offices for Business Administration and Secretarial Science, the Mid-Management Program, Social Sciences, English, and Foreign Languages.

Angst Hall - Divisions of Physical and Life Sciences, Practical Nursing Program, Electronics Technology section of the Vocational-Technical Division.

The Fine Arts Building - Offices and facilities for Art, Music, and Drama. The Skagit Valley College Theatre.

The Gymnasium - Indoor competitive sports, Physical Education activities, office for the faculty of the Division of Health - Physical Education - Recreation.

The Library Media Center - Built in 1964. Seats 250 students. Contains over 30,000 books. Provides listening, copying, typing, and studying facilities.

The Old Post Office Building - Added in 1966. Serves as a downtown occupational center.

The Technical Building - Classrooms and some shop facilities and offices for the Occupational Division.

The Vocational Building - Classrooms and some shop facilities and offices for the Occupational Division

PERSONAL SERVICES

1. EMERGENCY SERVICES

A revision of the Skagit County Emergency Services Operations Plan was completed in October 1972 by the Skagit County Department of Emergency Services. Further details involving emergency services may be obtained by consulting the above cited document and the Emergency Services Department.

The emergency services operation plan is primarily used as a guideline to develop a county civil defense network that is prepared for both military attack and natural disasters. Coordination of the activities of all the organizations and manpower that may be involved in an emergency is a major element of the plan. It would also provide for effective utilization of all resources available from sources outside Skagit County.

Although Federal and State levels of government have responsibilities and controls in an emergency, the Skagit County Department of Emergency Services is the coordinator of all county and city officers and employees, together with those volunteer forces enrolled to aid them during a disaster, and all groups, organizations, and persons who may by agreement or law be charged with the protection of life and property during such an emergency.

Direction and control during a disaster would channel from the governor's office to the County Board of Commissioners.

For the purposes of coordination with the land use plan for the Skagit Region, this report adopts the Emergency Services Operations Plan for Skagit County by reference.

2. LAW AND JUSTICE

The following recommendations are cited from An Improvement Plan for Law and Justice, 1971, developed by the Northwest Regional Council, which is adopted by reference in this report. The Northwest Regional Council is a four county association composed of Skagit, San Juan, Island, and Whatcom Counties. The primary function of this council is to develop and adopt plans and recommendations to improve law and justice service throughout the region.

The expertise of this council in this detailed and critical area of public service has been utilized in the development of this planning program, therefore, the following summary recommendations and conclusions are used as the basis for the Law and Justice Section of this report.

2A. Planning Recommendations

1. Full governmental and law enforcement agency participation in the minimum recruitment and training standards of the Washington State Law Enforcement Training Commission will be encouraged. A regional goal will be that by 1973 all law enforcement personnel will have satisfactorily completed a basic training program prescribed by the Washington Law Enforcement Officers Training Commission.
2. County and local police jurisdiction will devise "back up" programs to assist all agencies in participating in the minimum standards training program.
3. Recruitment programs in high schools, vocational schools, colleges and universities will be undertaken to interest highly motivated and qualified young men and women to pursue law enforcement careers.
4. This region strongly recommends that the Washington State Legislature, the Washington State Law and Justice Committee, and the Washington State Law Enforcement Training Commission expand the capacity of the State's basic law enforcement training program so that there are more basic training sessions available for local law enforcement agencies.

Note: The Skagit County Sheriff's Department is the largest law enforcement agency in the county (a staff of 30). It has assumed a great deal of responsibility within the county, including almost all of the criminal investigative work. The future development of the region will obviously put more demands on this department, although these demands will vary somewhat according to the pattern of development. A more nodal urbanized situation would cause municipal departments to grow with the increased population and concentration of development. The Sheriff's Department would also have to increase its personnel to assist the cities and to handle the spillover effects of an urbanized situation. A more rural dispersed pattern of development would obviously cause an increase in the demand for direct law enforcement services supplied by the Sheriff's Department.

It is difficult to predict the exact needs of county law enforcement agencies in the future for much of the level of service provided is determined by public sentiment and availability of qualified personnel. Standards pertaining to law enforcement levels for various densities of development also seems to be quite rare, if not non-existent.

3. HEALTH SERVICE DELIVERY

The field of Health Services Delivery is addressed more fully in the documents developed by, and being developed by, the Comprehensive Health Planning Council of Whatcom, Skagit, Island, and San Juan Counties. This Council is a four county organization of elected officials and interested citizens, as well as health delivery professionals. The council is partially supported by a grant from the U.S. Public Health Services.

The Skagit Regional Planning Council has endorsed the ongoing activities of the Comprehensive Health Planning Council. For this reason, the Regional Planning Council defers all recommendations regarding Health Service Delivery to the Comprehensive Health Planning Council of Whatcom, Skagit, Island, and San Juan Counties.

In 1960 the population of the district was 1,732. By 1970 this figure had grown to 2,456, a net increase of 724, or 42%. However, this figure is affected by the fact that the census enumeration district boundaries used in computing the 1960 population were changed in 1970 adding more land and population to the 1970 figures.

The age/sex pyramid for LaConner School District shows a slight reduction in the number of children under five years of age between 1960 and 1970. All the other age groups show increases. The number of women of child-bearing age also increased while the number of births between 1960 and 1970 remained about the same.

This slight growth pattern, combined with the age of the high school, points to a need for an examination of the goals and priorities within the school district. It is upon the firm establishment of these elements that a district planning program should be based.

3F. Conway School District #317

Population data for Conway School District is reflected in the figures for Mount Vernon #320. Since the district contains only one elementary school and its junior high and high school students attend Mount Vernon schools, the Mount Vernon data can be, in part, applicable to Conway.

The elementary school, serving grade levels kindergarten through eight, had a 1972 enrollment of 358. There are a total of 17 teachers, for a student/teacher ratio of 21 to 1. The site of the school covers about eight acres and was built in 1938.

4. STATE ASSISTANCE REQUIREMENTS

The state plays an important role in school district planning because of its assistance in financing projects. Financial capability and capital outlay expenditure is dependent upon bond monies. A ceiling, amounting to 20% of the assessed valuation for school bond indebtedness, has been established by state law. School districts must be bonded to at least 10% of their 20% capacity to qualify for state assistance in their construction

WATER, SEWAGE, AND DRAINAGE FACILITIES

The Skagit County Water, Sewerage and Drainage Facilities Plan, was recently completed for the Skagit Regional Planning Council (June, 1970), by Stevens, Thompson & Runyan. This planning alternative report adopts the recommendations of that document, with the assumption that it will be revised as a part of the River Basins Study, and thus conform to the alternative plan chosen from this report.

As a result of this planning alternative report, it is hoped that water, sewer, and drainage systems will orient toward the uplands areas of the county in future utility development efforts. It should be noted here that prior to construction of any facility or segment of a facility, a detailed feasibility study for that particular feature must be made, encompassing not only engineering and financial aspects, but also needs and future physical and social ramifications of such a facility. The point here is that a long-range plan or initial idea is not a substitute for a detailed analysis of each specific proposal.

There is a need for countywide coordination in community facilities including sewer, water, and drainage facilities. There is a great need to attain an optimum level of services for the greatest possible number of people in the most efficient and economically manner possible. Many times an organization will create an "economy of scale" that would not have been realized under a traditional fractionated district form, thereby effecting a savings of a certain amount of tax dollars.

The Water, Sewerage and Drainage Plan, as presented, shows estimated requirements up to the year 2000. In a sense, however, the year is quite arbitrary. The assumed population and its distribution (these figures are quite high according to present state and county population projections) is the most important parameter on which the plan is based. Therefore, the plan may be adequate beyond 2000, or could become inadequate prior thereto, depending on actual population changes, federal and state requirements, and public sentiment. Distribution of population in the county in a way other than that assumed in the Water, Sewerage and Drainage Plan, would affect each different area according to its role within the county. Changes in projected distribution would require changes in the relative capacity of facilities serving the various areas of the county. Recommendations and costs can be found in the scenarios of each of the alternative land use plans, and their development costs section, respectively.

The following conclusions and recommendations from the Skagit County Water, Sewerage and Drainage Facilities Plan conform with the goals and objectives of the alternative plans presented in this report and are adopted by reference:

1. Organizations to provide water, sewage and drainage services should be as broad-based as possible, and few in number, to efficiently manage these services and to coorindate with state and federal agencies in programs of financial assistance and environmental quality contorl.
2. Because of the large capital expenditures required, care should be exercised in setting of rates to be charged users for the services provided, to insure that fair shares are paid by residential, commercial, and industrial users.
3. The Skagit River should be developed as the major future source of water for the county. An ample quantity of high quality water is available without the necessity of providing a storage reservoir on the river.
4. The City of Anacortes and Skagit County Public Utility District #1, as the major suppliers of water in the county, can most economically develop the large supplies required in the future by the use of a water intake and treatment facility serving both agencies, with staged construction of additional increments of capacity to meet the demand for water.

5. Major transmission of water throughout the county should be the responsibility of the two major agencies above noted. Retail distribution could in some areas be accomplished by cities and local agencies, and in other areas by the two major agencies themselves.
6. Additional waste collection, treatment, and disposal facilities are urgently needed in several places within Skagit County to avoid undesirable pollution of surface waters, including fresh water streams and saltwater bodies.
7. A large part of the immediate need is for treatment of industrial wastes. Generally, such treatment can be most expediently provided by a municipally (or county) - owned and operated facility, even though the waste from food processing is best treated separately from domestic sewage.
8. For most of the smaller communities in the county, the only feasible systems of sewerage during the plan period are separate facilities serving only the one community and its immediate environs. Regionally interconnected systems appear feasible in the central county area. For either type of sewage system, responsibility for construction, operation and maintenance would be most efficiently performed under a large countywide agency (with exception of the municipalities having existing systems).
9. For the low land agricultural areas, the existing general level of drainage appears to be in balance with the economics of crop production at present.
10. For urban and suburban developing areas, standardized design criteria and standards for drainage and flood protection facilities are warranted. The adoption and enforcement of such standards will result in comparable levels of protection for all areas. Administration and enforcement of the standards can best be performed by a countywide agency. Within municipalities, the agency would work through existing city governments to coordinate efforts.
11. Management of the floodplain. The state and federal governments are also involved in floodplain management; coordination with those levels of government could best be performed through a countywide flood control and drainage agency.

OPEN SPACE

1. DESCRIPTION OF PLANNING AREA

The Skagit Planning Area is coterminus with the boundary lines of Skagit County. Skagit County is the 13th largest county in Washington, having an area of approximately 1,735 square miles. The majority of the easterly portions of the Skagit area is rough mountainous terrain. Much of the area is owned or managed by private forest products concerns and or public agencies.

The Skagit River and its tributaries, the Sauk, the Suattle, and the Cascade Rivers, form the most significant physical feature of the readily accessible area in the eastern end of the Skagit area. The middle portion of the county is dominated by a large (100,000 + acre) extremely fertile river delta. This delta is well drained and used intensively for various agricultural activities. The western end of the county is composed of a number of large and small islands (part of the San Juan group) in Puget Sound.

The physical characteristics and the developmental characteristics of the Skagit area are fully detailed in Sections I, II and III of this report. These sections include discussions and analysis of the following characteristics:

1. soils
2. slope
3. septic suitability
4. geology
5. population
6. housing
7. land ownershio patterns
8. existing land use
9. flood characteristics
10. economic conditions

2. GOALS AND OBJECTIVES OF OPEN SPACE - RECREATION
In Skagit Regional Planning Area

1. Locate and define potential recreation areas and outdoor recreation activities.
2. Determine and evaluate the recreation needs of resident and non-resident populations.
3. Preserve and maintain the aesthetic qualities and interesting attractions of the Skagit area.
4. To examine potential outdoor recreation areas as to their:
    a. feasibility for acquisition and ownership.
    b. prior history of recreational and/or other activities.
    c. the need for urgency of acquisition.
    d. relation to transportation corridors for public access.
5. Develop a trails plan as a subsection of the overall recreation plan.
6. Indicate the need for suitable indoor recreation areas.
7. To provide both urban and rural open space recreation areas.
8. To explore the functional interrelationships between local, state, and federal recreational programs and coordinate programs whenever possible.

3. DEMAND-SUPPLY AND NEED FOR OPEN SPACE

The following table summarizes the recreation activity needs for the Skagit area to the year 1990. The data included in the table is a refinement of detailed information developed by the Skagit County Planning Department for the Skagit County Parks and Recreation Commission. The detailed information is contained in two volumes 1) Park Study - Demand; 2) Park Study - Standards, Needs, Costs. These studies are available for review at the Skagit County Planning Department.

4. POTENTIAL OUTDOOR RECREATION AREAS

The potential park sites in Skagit County were subjected to two levels of analysis. Two summer work-study students were assigned to the task of identifying, photographing, and analyzing the potential open space

Table 1

OPEN SPACE - RECREATION SUPPLY AND DEMAND TABLE

Activity	Standard	Supply	Demand 1970	Demand 1980	Demand 1990	Need 1970	Need 1980	Need 1990
Boating Moorage	.01 acres/unit	10.79 ac.	8.30 ac.	9.52 ac.	10.77 ac.	2.49 ac. (excess)	1.27 ac. (excess)	.02 ac. (excess)
Boating Trailered	.04 acres/unit	29.32 ac.	33.20 ac.	38.08 ac.	43.08 ac.	3.88 ac.	8.76 ac.	13.76 ac.
Boating Canoeing	.02 acres/unit	203.83 ac.	7.26 ac.	8.32 ac.	9.42 ac.	196.57 ac. (excess)	193.99 ac. (excess)	191.35 ac. (excess)
Camping	.14 acres/unit	117.46 ac.	625.80 ac.	861.00 ac.	1,101.66 ac.	508.30 ac.	734.54 ac.	984.20 ac.
Field Sports	1 field/6,000 pop.	32 flds.	8.6 flds.	9.0 ac.	10.6 ac.	23.4 ac. (excess)	23.0 ac. (excess)	21.4 ac. (excess)
General Recreation Playground/parks	1.25 acres/1,000 opo.	155 ac.	130 ac.	142 ac.	160 ac.	25 ac. (excess)	3 ac. (excess)	5 ac.
Golf	144 person/course	3-18 hole 1-9	10.4 ac.	12.0 ac.	13.0 ac.	6 ac.	8 ac.	9 ac.
Hiking	.05 miles/unit	600 mi.	11.10 mi.	17.10 mi.	23.25 mil.	588 mi. (excess)	582 mi. (excess)	576 mi. (excess)
Picnicking	.01 acres/unit	18.70 ac.	29.60 ac.	34.00 ac.	38.50 ac.	10.90 ac.	15.3 ac.	19.8 ac.

			Demand			Need		
Activity	Standard	Supply	1970	1980	1990	1970	1980	1990
Swimming	.02 acres beach/unit	15 ac.	46.20 ac.	60.00 ac.	74.84 ac.	31.20 ac.	45.00 ac.	59.84 ac.
Winter Sports	30 people/acre	none	27.2 ac.	31.3 ac.	35.4 ac.	27.2 ac.	31.3 ac.	35.4 ac.

There were four activities that had a high need for creating more facilities; whether to expand existing facilities or to create new ones. These activities were: camping, swimming, golf, and picnicking; with several other activities also having a need to a lesser extent.

For the county, camping, swimming, and picnicking areas should be high on a priority. These activities' need could be met with just a minimum of site expansion as these activities are linked to each other. Golfing should not be as great of concern because of the nature of the activity and the people it serves, plus a greater chance of the private sector to invest in golf courses.

recreation areas in the Skagit area. The results of this cursory analysis are available at the Skagit County Planning Department. The second level of analysis was performed during the inventory phases of this comprehensive land use planning project. This analysis was performed on seventeen (17) potential park sites.

The second level of analysis included determination of the best open space/recreational uses for the site; size of the parcel, ownership and desirability for acquisition. Also included in the evaluation was a description of the site, and a casual rating of the desirability of the natural features and the development of the site. Preliminary site plans were developed and each potential park site was analyzed.

Only analysis of the sites in the county's five-year program are included in this section of the report. The remaining information is available on file at the Skagit County Planning Department.

5. OVERALL PARK PROGRAM FOR THE SKAGIT PLANNING AREA

5A. Through analysis of the above inventories and studies, the County Park Board together with the County Planning Department, have developed a list of proposed park projects for the planning area. Land purchases and development are programmed for a fifteen year period and include recommendations for city, county, state, and federal agencies.

This breadth of recommendation became increasingly important in the analysis because of the high degree of spread in the recreational demand. Much of this demand originated in the metropolitan centers of the state. Thus to a large degree, Skagit County serves as a recreational center for the Puget Sound Region. This fact has complicated the analysis of demand projections so that these projections should be used as general guidelines and not as specific forecasts.

Projects are listed below by section of county (upriver, and downriver) and are broken into five year increments.

The projects that are listed for local, state, and federal agencies are recommendatory only, but nevertheless represent important elements of a well balanced and diversified overall program.

5B. Recommended Overall Park Development Program for all Governmental Levels by Geographic Area. (See on following Page).

6. OPEN SPACE - RECREATION PLAN

See Map 'N', in the map section accompaning this report.

7. FIVE YEAR PARK PROGRAM FOR SKAGIT COUNTY

The overall park program resolves into ten recommended projects for Skagit County over the next five year period. These projects are each described below:

7A. Steelhead Park Expansion

Steelhead County Park lies in Sec. 26-35, Township 35 North, Range 9 East. The existing site is approximately 12 acres in size, and has 20 campsites. There is a dumpstation, picnic tables, boat launch, fireplaces and restrooms. A historical area is set aside on which lies a log cabin, a dugout canoe and the Rockport Ferry. The park has some alder and cottonwood on it but most of the area is grass.

The park is used year round by campers, picnickers, and fishermen.

The great use justifies expansion of the park. The land west of the park would be desirable for this purpose. The 10 acres immediately west of the park are owned by W. V. Taylor and is for sale at the present time. The 10 acre site could be developed now to ease the strain on the existing park.

The land to the immediate west of the Taylor property is owned by Summit Lumber Company and is recommended for purchase an an extension of the Rockport State Park. Ideally the two parks could then be merged under state management to provide for increased efficiency of

Table 2

15 YEAR PROGRAM FOR OPEN SPACE - RECREATION

UPRIVER

Project	Acquisition Agency	Phase Acquisition - P Development - D
1 - 4 Years		
Rockport Park Expansion to River (Including Steelhead Park)	State	P & D
Sauk Mountain Interpretive Center	State	P
Concrete Park	City	P & D
Bacon Creek Campground	Federal	Expand
Ann Wolford Park Expansion	County	P & D
Sauk Park Expansion	County	P & D
Concrete - Rockport Trail (On Railroad R/W)	County	D
Lake Shannon	State	D
Marble Creek Campground Expansion	Federal	D
5 - 10 Years		
Rocky Creek	County	P
Mills Creek	County	P
Minkler Lake	County	P
Lyman Park	City	D
Goodyear Nelson	County	D
Grandy Creek	County	D
Minkler Fossil Quary	County	D
11 - 15 Years		
O'Tool Creek		P
Trail, Rockport to Marblemount		
Sauk Park	County	D
Rocky Park	County	D
Mills Creek	County	D
Minkler Lake	County	D

Table 3

15 YEAR PROGRAM FOR OPEN SPACE - RECREATION

DOWNRIVER

Project	Acquisition Agency	Phase Acquisition - P Development - D
<u>1 - 4 Years</u>		
Clear Lake Park	City & County	P & D
Olympic Pool at S.V.C.	C. Co. Sch. & College	D
Gages Park (Burlington)	City	P & D
Big Lake Conservation Area	State	P
Woolley River Park	City	P
College Park	City	P
Conway Boat Launch	State	P & D
Lake Ten State Park & Lookout	State	P
Railroad Bike Lane	State	P
Friday Creek	County	D
Big Rock Park & Lookout	County	P
Division Street Park	City	P
Samish Island Boat Launch	State	P & D
<u>5 - 10 Years</u>		
Barney Lake Conservation Area	State	P
Edgewater Park	City & County	P & D
LaVenture Bike Lane	City	P & D
Riverside Trail	County	P & D
Burlington River Park	City	P & D
Swimming Pools	C. Sch. & County	D
Woolley River Park	City	D
Burlington River Park	City	D
<u>11 - 15 Years</u>		
Donovan Park	County	D
Trail, Little Mountain to Big Rock	County	P & D
Lake McMurray Park	County	P & D
College Park	City	D
Lake Ten State Park	State	D
Railroad Bike Lane	County	D
Big Rock Park & Lookout	County	D
Division Street Park	City	D

operation. The total park complex would then feature 1 1/2 miles of riverfront at the confluence of the Skagit and Sauk Rivers. This scale of operation may also provide financial feasibility for a sewerage treatment plant to serve both the Town of Rockport and the expanded park facility.

Mr. Taylor has established a price of $30,000 for his property. The Park Board estimates $35,000 for site development based on previous experience in developing the existing Steelhead Park.

7B. HART LAKE (FIDALGO ISLAND)

Formally, this site is outside of the 701 Study area since it lies west of the Swinomish Channel. However, the site appears to be of high priority since it is currently school lands in trust to the state but will be subject to sale to private interests if it is not purchased by local government or transferred to State Parks in the near future. This would be unfortunate because the site is located adjacent to a large complex of lands owned by the City of Anacortes and contains a lake that is highly reputed by fishermen.

The site is approximately 340 acres in size and is typlified by rolling hills (including a part of Sugar Loaf Mountain), tall Douglas Fir and cedars (perhaps 'virgin' growth), and view points of the San Juan Islands. The State Department of Natural Resources has established a price of $80,000 for the parcel.

This parcel is an integral part of a proposed trail and park system that could run from north Whidbey Island through Deception Pass State Park to Lake Campbell. Then proceed on north to Mount Erie (in Anacortes ownership), past Hart Lake over to Little Cranberry Lake (also in Anacortes ownership), and on to Washington Park via trails, or streets and an abandoned railroad right-of-way. Altogether the system could link together nine lakes, several miles of waterfront on saltwater parks and several significant view points.

7C. CLEAR LAKE PARK

This site is located betwe-n the two higher population centers of the study area. It is approximately 40 acres in size with a preponderance of the land owned by Georgia Pacific Timber Company. Other ownerships include the City of Sedro Woolley who have a small swimming area at the south end of the site and a talc plant that has ceased operation.

The site is characterized by alder and brush cover and the ground is somewhat marshy, making it undesirable for more urban development. The shore bottom is firm in this area, and the lake is too small for high speed power craft, leaving it ideal for swimming purposes.

This site when developed will provide the major lake swimming facility in the county. Other than the small Sedro Woolley park described herein, there is currently no public swimming area in the county. Other facilities proposed to be provided here at a later date include picnic areas, play fields, boat rental (especially for fishing) and other day uses.

A major expense in site development will be the installation of one to two feet of fill to stabilize the ground in areas that are selected for development. The Park Board estimates $250,000 to purchase the more desirable portions of the site with $150,000 allocated to fill, bathhouse, and swimming apparatus.

7D. OLYMPIC POOL AND PAVILION AT SKAGIT VALLEY COLLEGE

This two million dollar project is currently being promoted by the Parent's Club of Mount Vernon. There is presently only one public pool in the entire county - a rather small pool at the Mount Vernon YMCA.

The pool will be housed in a multiple use recreation complex to be located on the Skagit Valley Junior College Campus. Previous discussion with college administrators has revealed their strong support.

The proposal herein recommends that the facility costs be shared equally by the school district, the college, the county, and the City of Mount Vernon. A two million dollar estimate has been established by the Parent's Club as necessary to accomplish the objectives of this program.

7E. ANN WOLFORD PARK

The Goodyear Nelson property is about two miles west of Concrete. It extends from Highway 20 South to the Skagit River. It is situated on a bend of the river. The land is completely in the flood plain of the Skagit River.

Access from Highway 20 to the property is poor, and the land is flat and in some areas marshy. The vegetation is mostly cottonwood, alder, and vine maple with an understory of vines, ferns, moss and brush. The beach along the river is rocky with a few sandy areas.

The land on the North side of Highway 20, across from the Goodyear Nelson property is owned by the county and the State Forest Board. There has been some speculation on the acquisition of this land to increase the park property. Access to a park which is on both sides of a highway is dangerous. The land to be acquired should be the land directly East of the existing park property. It is presently owned by George L. House and the Simpson Logging Company. With the acquisition of this land, it would give the park better access and more property to work with assuming the Steelhead Park will be transferred to state managment, the Ann Wolford Park will be the primary county park in the Up-River Area.

Based on past experience with the purchase of the adjacent Goodyear Nelson property, the Park Board estimates a cost of $80,000 for purchase of the easterly properties.

7F. FRIDAY CREEK

This 15 acre site is located 5 1/2 miles north of Burlington on Friday Creek adjacent to the State Fish Hatchery. It is currently in county ownership and is proposed to be developed as a picnic area only. The Park Board estimates that approximately $30,000 will be required to provide a series of picnic areas, latrines, and a parking area.

7G. SAUK RIVER COUNTY PARK

Sauk River County Park lies in Section 30, Township 34 North, Range 10 East. It is located on the west side of the Sauk River at the junction of the East Sauk Highway and the Concrete, Sauk Valley Road. The existing park has approximately 60 acres. The vegetation is cedar, Douglas Fire, alder, cottonwood and maples. The attributes of the park are its proximity to Sauk River, the East Sauk Highway and to White Creek. The vegetation is adequate and in some areas unique. The land is fairly flat with a few steep rock out-croppings.

The development which has taken place to date is minimal. The roads are in, the campsites are roughed out, and there are two small restrooms on the property. At the present time, Sauk River Park is in poor repair. Much work is needed to bring this park up to standards.

Sauk River Park could be improved by acquiring land around the existing park to be used for trail systems, primitive campsites and picnic areas. The lands situated around the park site are owned by Skagit County, the Federal Government, the State Forest Board and the Scott Paper Company. A good deal of this land is suitable for camping (tent, trailer, and camper). The vegetation is good, the land is relatively flat and the soils could sustain some traffic. The area on the East Sauk Highway could be used for picnic areas and hiking trails. Most of the area on the west side of the river would be reserved for camping only; with the tent campers segregated from the trailers. The land to be acquired, would increase the size of the park to approximately 680 acres, 480 acres of this land are now in public ownership with the remaining 200 acres owned by lumber companies. If this land could be obtained, it would give the park a good inventory of potential sites to work with, and it would act to preserve the land from inappropriate development near the park. Also, if the size of the park is increased, there would be justification for having a full time maintenance person who could collect fees, maintain, and protect the area. A quarter mile section of the river frontage should be acquired from the state along with the island. A cost figure of $24,000 has been allocated by the Park Board for this purpose. Forty Thousand dollars ($40,000) is allocated for expansion of the camping facilities.

7H. CONCRETE - ROCKPORT BICYCLE TRAIL

This recreational facility would utilize an abandoned railroad right-of-way and will serve as a logical extension of the steam railroad passenger service that is presently being initiated. The rail service will run between Sedro Woolley and Concrete. The trail system will provide a continuation of this tourist facility to the Rockport - Steelhead Park, thus complimenting the tourism objectives of the communities of Rockport and Concrete. Motel and dining facilities are provided at both trail terminals, as well as campsites and grocery facilities for those interested in roughing it.

The trail links the park facilities of Concrete and Rockport, the proposed native interpretive center at Rockport State Park, the scenic trail to the top of Sauk Mountain, and several boat launching facilities, It would have prime use by hikers, bicyclists, and fishermen.

It is assumed that this property will remain in the ownership of Burlington Northern Railroad. A development cost of $6,000 per mile is estimated for spreading gravel on the trail surface. This cost totals $50,000.

7I. BIG ROCK PARK

This proposal involves a 400 foot high rock out-cropping that has been a practice facade for beginning mountain climbers as well as a popular challenge to local hikers for many years. From the top, one gains a territorial view of lakes, valleys, and hills of the mid-eastern part of the county.

The site as proposed would be approximately 40 acres in size. A price of $3,000 per acre has been estimated by the Park Board as representatives of land values in this vicinity.

7J. CAMPBELL LAKE - MT. ERIE TRAIL

This trail is described under item "b" above as an integral part of the Fidalgo Island Park system. The cost estimate includes some frontage on the west end of Lake Campbell.

8. TRAILS PLANS

The trails planning efforts of this study have been limited to the development of an inventory of existing trail areas. Discussions with special interest trail groups had developed a brief analysis of potential trail areas.

The existing trails and potential trail areas are displayed on the Open Space Recreation Plan in the map section of this report.

To fully develop a trails plan, the ownership along each trail area must be determined, the accessibility of the existing and potential trails should be evaluated, and priorities for acquisition and maintenance of the trails system should be developed.

9. CONCLUDING REMARKS ON OPEN SPACE PROGRAM

It is recommended that the enclosed open space program not be regarded as a final product, but a starting point for coordination with other governmental agencies, public input and refinement. The program as outlined will only be possible with the assistance of a county-wide bond issue in the approximate amount of $700,000. However, the bond will make over three million dollars available in state and federal grants (assuming the state programs do not change).

Further work should also be accomplished on the rating schedule which is being developed by the Planning Department for use in site selection and development priorities.

Table 4

SUMMARY OF FIVE YEAR PROGRAM FOR

SKAGIT COUNTY PARK EXPENDITURES

	Land Purchased ($)	County Share ($)	Development Costs ($)	County Share ($)
Steelhead Park Expansion	$ 30,000	$ 7,500[2]	$ 35,000	$ 17,500[3]
Hart Lake[1]	80,000	20,000[2]	--------	--------
Clear Lake Park	250,000	62,500[2]	150,000	75,000[3]
Olympic Pool & Pavilion	--------	--------	2,000,000	250,000[4]
Ann Wolford Park	80,000	20,000[2]	200,000	100,000[3]
Friday Creek	--------	--------	30,000	15,000[3]
Sauk Park	24,000	6,000[2]	40,000	20,000[3]
Concrete-Rockport Trail	--------	--------	50,000	25,000[3]
Big Rock Park	120,000	30,000[2]	--------	--------
Total	$584,000	$146,000	$2,505,000	$502,500

1. This lake is outside of the 701 Study area but is included at the request of the County Park Board.

2. These prices are based on a matching program with the State Inter-Agency Committee for Outdoor Recreation paying 75% of the cost.

3. Same as above footnote, but only a 50% match is available.

4. This cost assumes an even sharing of the 50% local cost by the 1) County, 2) City of Mount Vernon, 3) School District, and 4) Skagit Valley College.

COMMUNITY GOALS AND OBJECTIVES

Once the various sets of information relevant to the total physical, developmental, flood, and community facilities characteristics have been gathered and analyzed, it becomes necessary to temper that information with the desires and needs of the community. This section attempts to provide that tempering.

Citizen attitudes were explored by several techniques: simulation exercises, surveys, public hearings, and technical advisory committees. These are discussed in the Chapter on Planning Policy Objectives.

This portion of the report, Community Goals and Objectives, is composed of the following:

1) Land Use Simulation Exercise
2) Citizen Input Questionnaire
3) Technical Advisory Committees
4) Planning Policy Objectives

LAND-USE SIMULATION EXERCISE

1. INTENT

The Land-Use Simulation Exercise is a Land-Use Game which evolved from a need for alternative forms of citizen involvement. It performs a number of duties, helpful both to the planning program and to the general public. Benefits resulting from participation in the simulation exercise include:

1A. Expression of Public Goals

When citizens become involved in the Land-Use Game it gives them an opportunity to directly express their ideas and concerns about the development of the Skagit County area.

1B. Public Awareness of the Planning Process

The Game also provides a chance for the citizens to observe some of the intricacies and ultimate conflicts of interest within the planning process. They can see how these relate to the location of various land-uses and ultimately affect visual and social images of the planning area.

1C. Determination of Public Sentiment

The Game aids the Planning Department in determining public sentiment on various land-use proposals. It enables the Department to see a variety of views and often provides a different view which had not been considered.

1D. Provides Public Exposure for Planning

Often, planning is felt to be an isolated process. With the help of this Game, the planning process can be exposed to the public. This exposure is more positive than the generally negative day-to-day business of regulation with which planning has been historically associated.

The following pages contain a brief summary of the guidelines or rules of the Land-Use Simulation Exercise. A large map of the more populated section of the 701 Study Area was mounted on a piece of sheet metal then fixed to a board. The map was colored to indicate existing land-use with an overlay of slope information added. Information on all other physical characteristics is provided by the staff during the exercise. The pieces used to signify the various uses consisted of magnetized plastic cut to varying sizes. These sizes were determined by ratio of various land-uses to land needed for development of a proper facility, the amount of existing land in a particular use, population projections, and design characteristics for proper development of each use.

2. GAME RULES

2A. Purpose

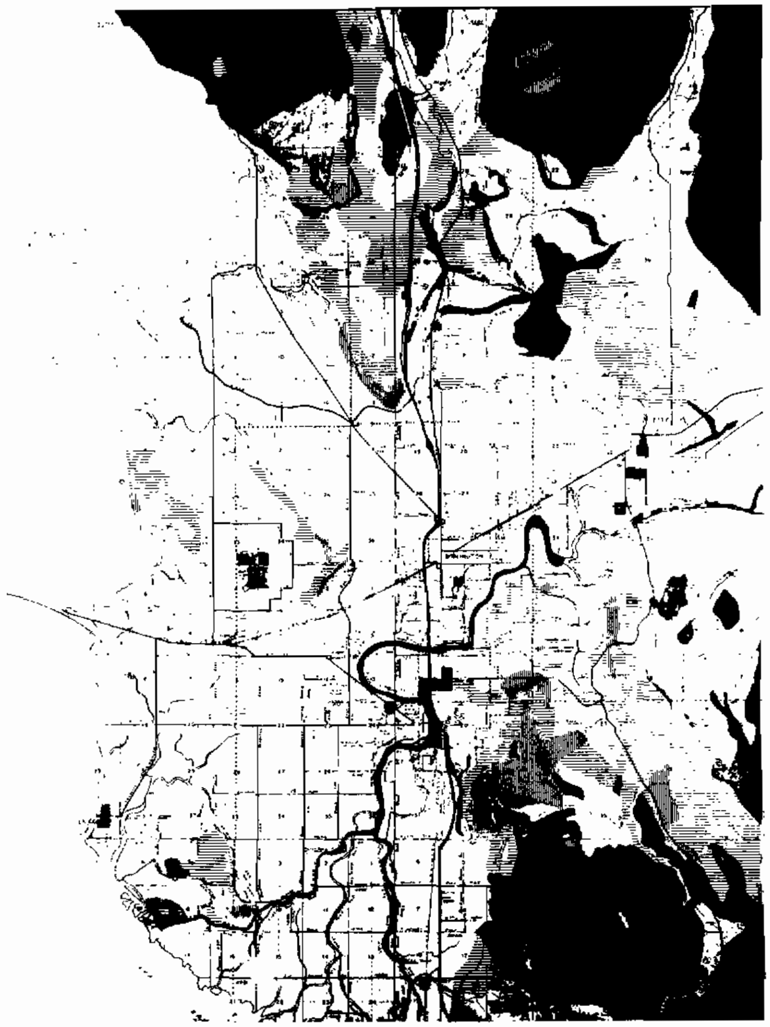
To develop the "best" land-use pattern for Skagit County based on a population projection of 75,000 people by the year 2000 (an approximate increase of 25,000 people).

2B. Guidelines

1. Existing land-use patterns are indicated by the colored areas on the simulation board.
2. Assume that the various densities, such as residential, are governed by the physical and economical characteristics of the particular area.
3. The uses involved are agriculture/forestry, industry, commercial, residential (various forms), and public (open space, parks, utilities, schools, police, fire, and other community facilities).
4. The group determines the sequence of moves to be used throughout the simulation (i.e. which use moved 1st, which 2nd, and so on).
5. Each use will have a certain amount, size, and color of pieces according to population/land area ratios. (Industry - 3 or more pieces = Industrial Park; Commercial - 3 or more pieces = Shopping Center Complex)
6. Each person involved randomly selects a "Use-card," which depicts his land-use function during the simulation.

7. Begin Phase 1 of the Simulation with the head of the group or moderator choosing a card (number 1-10) from the deck.
   a. The person who was designated first moves the number of his pieces onto the map corresponding to the number on the card drawn. The others follow in the proper order.
8. Phase 2 through 9 are done in the same manner.
   a. After Phase 1, moves can include moves involving up to 1/2 "on-board" pieces. (i.e. if there are 10 moves to make, then up to 5 of them may be pieces already on the board that may be shuffled to other areas.)
   b. A person may opt not to take all the moves he is entitled to.
9. If a conflict of uses arises (a person puts his use on land already assumed by another use) . . .
   a. If a person puts his piece on land controlled by an <u>existing</u> use, the person whose use corresponds to that being challenged must top the challenger's piece on his next turn. If not, the challenger assumes control of the area.
   b. If it is topped, the staff supplies the physical characteristics of the land in question. Also, any other pertinent data.
   c. The people involved act as a "Board of Review," and decide which use should be allowed, or whether both are compatible in that area. Each side gets a chance to explain his reasoning on the issue.
   d. Remember, topping a challenger is only necessary when challenges are aimed at existing uses on the board prior to the start of the simulation.
10. <u>Again</u>, a person may feel his use is at a desired level at any time and use his remaining pieces to protect his existing holdings from challengers.
11. Every other phase during the simulation the moderator will draw a card from a deck marked "Flood." This will represent the probability of no flood, high water, 5 year flood, 25 year flood or a 100 year flood happening during the period set for exercise.
    a. A short cost/benefit summary of flood and flood protection will be given by staff.

b. Pieces will be removed from the board according to degree of flood, specific use affected, and location of that use with respect to the floodplain.



3. GAME ANALYSIS

3A. Exposure

The land-use simulation exercise has had a variety of types of exposure in the brief time it has been utilized. Due to the time constraints of the 701 Program, it has not been played as often or as much as we would have preferred. However, the types of exposure mentioned add up to a substantial number of people having at least had knowledge of the game. This is felt to be an indirect form of public involvement, that was aided primarily by the numerous and widespread coverage in the newspapers. This exposure has not only reached a large number of in-county residents, but also a great many people out-of-county and out-of-state. It must be emphasized that this game is only one segment of the citizen participiation element of the 701 Study.

3B. Developmental Patterns

The game has been played enough to make some generalizations about the results. Naturally, not every group arrived at the same results but there have been a number of similarities and ideas worth mentioning. The photo recordings of all the games played have been analyzed to provide detailed locational land-use input for the development of the alternative land-use plans.

Two general developmental patterns have occurred in most of the games played to date. One pattern being that of dispersed development throughout the county and the other being a rather concentrated nodal type pattern. There were varying degrees to which each game adhered strictly to either of these two patterns, often due to disagreeing ideologies among the individual players.

The dispersed pattern of development usually showed residential, as well as commercial and industrial uses, spread out over a wide range of areas. Concentration of development was usually infrequent. with residential uses being located near the view properties south and north of Mount Vernon, on Bow Hill, on Bayview, on Pleasant Ridge, near Sedro Woolley, and on Conway Hill.

The concentrated or nodal form of development that was depicted, expressed a value in existing urban services and thus showed concentration in and around the existing municipalities. There was some dispersal, but it usually occurred in the prime view property near the urban areas. It is interesting to note that residential uses in both developmental patterns seemed to locate off of the floodplain, rather than add any new additional houses.

None of the games played to date have demonstrated a desire for any forms of new town development within the planning area. The planning staff is of the opinion that such a proposal (new town, planned community) could be accommodated in the planning area, however, due to the unique characteristics of new towns.

A high regard for agriculture was shown in many instances when players would place agriculture in strategic areas so as to attempt to curtail urban encroachment. However, in other games commercial and industrial development was allowed into the agricultural land to some extent. Some of this, however, was meant to represent existing uses such as pea processing locations, fertilizer plants, nurseries, bulb processing, and other agriculturally oriented industrial and commercial activities.

Two areas where heavier industry seemed to locate were Bayview Airport and north Sedro Woolley. Both are off of the floodplain and away from the agricultural areas. It seemed to be the concensus that industrial parks could be successfully located in these areas. The Bayview area was considered to have more potential as an industrial park than as a large airport. There were also areas within existing cities in which industrial and commercial areas were located. The idea of locating industry to the north and south of Skagit County, in Whatcom and Snohomish Counties, was assumed several times. The whole idea of Skagit County as a viable alternative lifestyle to the more populated metropolitan areas was at the root of many of these ideas.

Some players expressed a concern for the Swinomish Channel area by locating marinas and residential uses on it near LaConner.

Parks and open space were most often oriented to the Skagit River, the Samish River, and the coastline. Other non-water oriented areas most often designated for this type of use were Little Mountain, Bayview, Devil's Mountain, and Chuckanut Mountain. In general, the rivers, the coastline, and the hills were seen as particularly fine assets which the county should carefully develop or non-develop, whichever the case.

A number of the games reflected extension of various utilities within the county. For example, extension of sewer systems were generally located in the Mount Vernon area, the Big Lake area, and the Sedro Woolley area. Less often, but still proposed as a possibility for sewer systems, were the Bow Hill area, the Conway Hill area, and the Bayview area. Some of the roads that were suggested were the new alignment of SR20 to Sedro Woolley, a road from I-5 to the southern tip of the Fir Island Delta, and various scenic roads, including a rather expansive route along the coastline connected to the Conway Lake McMurray Road. Often, as in reality, such services only grew as pressures from increased density increased.

3C. Summary

A detailed study of the results of all the games has been undertaken in the last months of this 701 Program. In summation, the games to date have shown a considerable degree of concern for Skagit County's natural beauty, as well as its agricultural economic base. The commercial and industrial development has been located in the existing cities, Bayview and north Sedro Woolley, all of which, if properly developed and controlled, are seen to have little or no effect or impact upon agricultural, social, and recreational pursuits.

Probably more important than anything else is the dialogue that arises between the players of the game. They soon become aware of the importance of their decisions and the trade-offs that have to be made when determining land-use policies. Through the game they became familiar with various developmental decisions.

Not only do they attain some kind of awareness of their developmental decisions, but they also are faced with opposition and future ramifications of their proposals. So the game is both a method of measuring public attitudes and a learning device. A tool whereby the Planning Department learns about citizen attitudes and the citizens learn about the various interfaces of the planning process.

CITIZEN INPUT SURVEY

1. INTRODUCTION

The citizens input survey on the following page is one of a number of devices used to ascertain public attitudes. Other devices such as public hearings, discussions with service organizations, and the land-use simulation exercise discussed in the preceding section, as well as this survey, have facilitated the development of alternative land use plans that reflect the goals and objectives of the citizens of Skagit County.

This survey was printed on Wednesday, February 28, 1973, in the Skagit Valley Herald as a public service.

The questionnaire required approximately 30-40 minutes to complete and the completed questions were returned primarily by mail to the Skagit Valley Herald.

The completed questionnaires were tabulated by Skagit County Planning Department staff. The results served to redirect the development of the alternative land use plans with regard to recommended lot sizes, the distribution of developmental areas, and the concept of promoting development of the upland, flood safe areas of the study area.

A similar questionnaire used on an annual or semi-annual basis, will promote the continuing viability and effectiveness of the plans of the Skagit Regional Planning Council and its member agencies.

2. ANALYSIS

The opinion survey undertaken with the cooperation of the Skagit Valley Herald, was another means of attaining citizen input. There were a total of 351 responses or 0.6% of the total population of Skagit County.

What the people think

How did you score? Did you mark your survey with the majority? Or did you vote with the minority? On some issues or on all? Never mind, it makes no difference, your opinion will count, your voice will be heard.

Published here (in bold faced percentage figures) are the results of the area-wide survey presented as a public service by the Skagit Valley Herald Feb. 20. We were seeking to determine your view of where our area is going; what you want our county to look like 20 years from now. And you responded in large numbers. The survey was designed to help the Skagit Regional Planning Council develop the best possible Comprehensive Land Use Plan for our county through citizen input.

More than 350 citizens answered by filling in the survey form, giving what public opinion researchers consider to be a good cross section sampling.

Can you imagine the impact at a public hearing on each of these issues if 350 people were to turn out in person and if more than 60 per cent were to speak out in favor or against any given item on the agenda? It would make a tremendous impression upon the officials conducting the hearing.

In order to devise a plan sensitive to the public, the Skagit Regional Planning Council has conducted a series of land use simulation exercises and has held public hearings to encourage such citizen input. The Board of County Commissioners will conduct more. The results of this survey will be put to use. Not only will the opinions expressed here become a basis for major county decision making, but your responses will give administrators a genuine, first hand idea of what the people are thinking, perhaps for the first time.

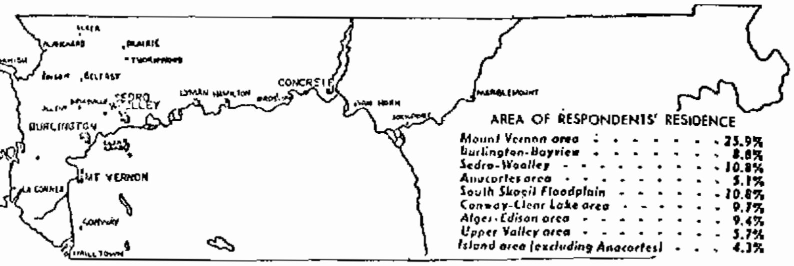
The opinions on this page probably represent the most authoritative response yet to the issues before us. They provide for the first time an authentic sampling of the way the general public feels. It is also the first opportunity a large number of citizens have had to express their views to the planners. It is difficult to get a sizeable, representative number of citizens to attend public hearings and express themselves — and then, at most, only a dozen or so speak their minds; there is always a limit on time, and a certain amount of deadly repetition.

Here, then, is a true public response, a cross section and representative view, not just the opinions of a vocal few.

We are pleased to have had a part in what well may be the first such widespread attempt to gain public input into land use planning. It would be our suggestion and hope to make it an annual effort. Thank you for participating.

What do you think about Skagit County?

Here are your answers



Citizen's input for Comprehensive Land Use Plan

OPINION SURVEY

GENERAL

1. Where in the County do you live? (Mark an X on the Map)

2. What is your approximate age? (Check one)

— 1.4% —(0-15) — 10.5% —(36-45)
— 6.3% —(16-25) — 21.7% —(46-55)
— 19.9% —(26-35) — 13.7% —(56-65)
— —(66-65

3. How long have you lived in Skagit County? (Check One)

— 9.1% —(0-2 yrs) — 16.2% —(11-20 yrs)
— 10.5% —(3-5 yrs) — 53.3% —21 + yrs)
— 10.8% —(6-10 yrs)

4. What do you like most about: (Check as many as you like)

Your Area of Residence		Other Parts of Skagit County
21.6%	neighborhood(s)	8.0%
12.9%	school(s)	9.0%
9.5%	shopping	13.1%
28.4%	lifestyle	23.4%
20.3%	*recreational opportunities*	37.7%
4.9%	employment opportunities	5.4%
2.4%	(Other)	3.4%

5. What do you dislike most about your area? Check as many as you dislike)

Your Area of Residence		Skagit County
10.0%	climate	8.9%
12.3%	limited shopping facilities	3.4%
25.7%	limited career opportunities	27.4%
11.7%	lack of public services	10.7%
15.0%	too crowded	16.9%
1.3%	not enough people	.4%
10.2%	limited entertainment facilities	21.0%
4.9%	(other)	8.4%

APPEARANCE

1. Should Skagit County's general appearance change?

— 27.6% —yes — 60.1% —no

2. What kind of change would you prefer?

— 7.4% - more urbanization
— 3.7% —more suburbanization
— 29.1% —more rustic (rural)
— 13.7% — Other

3. What are the especially attractive physical aspects of: (Check as many as you like)

Your Area of Residence		Other Parts of Skagit County
21.2%	mountains	20.0%
11.7%	climate	9.4%
15.1%	agricultural activity	14.2%
16.0%	Puget Sound	17.4%
15.7%	Skagit-Samish Rivers	16.8%
18.0%	forested areas	20.0%
2.0%	(other)	2.3%

4. What are the unattractive physical aspects of: (Check as many as you like)

Your Area of Residence		Other Parts of Skagit County
30.9%	urban clutter	28.3%
10.6%	refineries	19.2%
42.3%	poorly maintained residences	39.7%
16.2%	(Other)	12.8%

5. What do you think of the appearance of the following cities? Check as many as you think appropriate.

	Mount Vernon	Burlington	Sedro-Woolley	Anacortes	LaConner	Concrete
a. Quite attractive, needs little work	6.8%	10.8%	8.9%	7.8%	16.4%	5.3%
b. Attractive, but needs some improvements	27.1%	27.3%	24.8%	18.8%	29.4%	16.5%
c. Unattractive, but not too bad	14.0%	20.9%	22.1%	18.4%	9.1%	17.6%
d. Very unattractive	6.8%	3.2%	6.3%	12.5%	4.8%	15.7%
e. Too many signs	10.6%	9.1%	7.2%	9.4%	5.1%	3.7%
f. No landscaping	13.0%	13.3%	11.7%	11.0%	9.4%	13.3%
g. Too few buildings	1.0%	3.3%	.5%	1.9%	2.5%	2.4%
h. Building not kept up need painting, cleaning repairs, etc.	20.1%	13.8%	18.3%	19.3%	23.6%	24.4%

HOUSING

1. How do you feel about the type and variety of housing available in Skagit County?

— 12.8% —Good — 17.7% —Poor
— 51.6% —Average — 5.7% —No Opinion

2. How do you feel about allowing more residential development on the Floodplain of the Skagit River?

— 18.5% —Approve — 14.8% - Unsure
— 62.7% —*Disapprove* — 3.4% —No Opinion

3. Should low-income housing be built in Skagit County?

— 33.9% —yes — 13.1% —Unsure
— 45.9% —no — 4.6% —No opinion

4. Do you feel low-income housing can be compatible with your neighborhood?

— 26.5% —Yes — 9.1% —Unsure
— 61.3% —No — 2.3% —No Opinion

5. About how old is your home?

— 7.1% —(0-2 yrs) — 25.2% - (11-20 yrs)
— 8.6% —(3-5 yrs) — 42.5% - (21 + yrs)
— 14.0% -6-10 yrs)

6. What condition do you feel your home is in?

— 39.6% —Excellent — 11.1% —Fair
— 43.0% —Good — 2.6% —Poor

7. What size building lot do you prefer?

— 30.2% —8 000 sq. ft. (¼ acre)
— 33.5% —40,000 sq. ft. (1 acre)
— 10.8% —82 000 sq. ft. (2 acres)
— 25.5% —200 000 sq. ft. (5 acres)

8. How large should the building lots be in:

Your Area of Residence

— 47.4% - 8 000 sq. ft. (¼ acre)
— 25.0% — 40 000 sq. ft. (1 acre)
— 7.7% —82,000 sq ft (2 acres)
— 20.0% — 200,000 sq. ft. (5 acres)

Other parts of Skagit County

— 20.6% —
— 29.4% —
— 15.0% —
— 35.0% —

FLOODING

1. Do you see flooding as a serious threat to you personally?

10.0% -Yes 15.7% —Minor 73.5% - No

2. Do you see flooding as a serious threat in other areas of the county?

— 50.1% —Yes — 24.2% —Minor
— 17.1% —No — 6.8% —Unsure

3. Are you aware of the availability of flood insurance for unincorporated areas of the county?

— 56.1% —Yes — 31.3% —No

— 10.3% —Don't Care

4. Would you be in favor of improving flood protection in some areas of the county?

— 67.8% — Yes — 23.1% —No

5. If the answer is yes and the county were to improve flood protection, would you be willing to share in the expenses of those improvements?

— 29.3% —Yes — 47.9% —No

4. If no, who should?

— 20.4% —Federal Government
— 19.0% —State Government
— 38.9% —Persons benefiting
— 13.3% —Skagit County
— 8.4% —Per cent by Population

7. Did you live in Skagit County at the time of the 1951 Flood?

31.6% —Yes 47.9% —No

1909 Flood?

8.0% —Yes 90.3% —No

AGRICULTURE

1. Do you see agriculture in Skagit County as being:

— 6.0% —Unimportant
— 2.0% —Slightly important
— 13.3% —Moderately important
— 83.2% —Very Important

2. If answer is unimportant, why? ....

....

....

....

3. Would you like to see agriculture (farming, pasture, etc.):

— 40.2% —Expanded as much as possible
— 16.5% —Expanded moderately
— 5.7% —Expanded only slightly
— 34.5% —Remain about the same
— 1.7% —Reduced

4. Do you think agriculture in Skagit County could ever be threatened by urban related speculation and development?

— 86.0% —Yes — 12.3% —No

5. How do you feel about various levels of government developing policies and standards to help preserve agricultural lands?

— 57.0% —Approve — 14.8% —Unsure
— 22.5% —Disapprove — 2.3% —No Opinion

6. Are you directly financially dependent upon any form of agricultural practices?

12.5% —Yes 22.5% —Partially 65.5% —No

RECREATION-TOURISM

1. How often do you use outdoor recreation facilities within the county as opposed to those elsewhere?

33.3% Almost always 3.3% —Never
37.0% About 50 per cent 9.0% —Don't ever recreate outdoors
— Seldom

2. What existing recreational areas in the county do you like best?

14.8% Rockport State Park 6.7% -Steelhead Park
13.7% Bayview State Park 9.6% -Washington Park
13.9% Mt. Erie 13.3% -Sauk Mountain
8.1% -Little Mountain 14.9% —Other

3. What new or additional areas do you think would make good recreation sites?

....

....

....

....

4. What, if any, are the recreational areas existing now, which could stand some improvements?

10.7% Rockport State Park 9.7% -Steelhead Park
15.0% Bayview State Park 7.6% -Washington Park
12.7% Mt. Erie 17.2% -Sauk Mountain
24.4% Little Mountain 7.6% —Other

5. Are there areas in the county that you would like to see preserved as they are now?

— *61.0%* —Yes — 11.4% —No

6. If yes, where?

....

....

....

7. Do you think Skagit County should:

a. Pursue a vigorous recreation-tourism program	22.8%
b. Pursue a moderate recreation-tourism program	27.0%
c. Pursue a light recreation-tourism program	11.8%
d. Proceed at about the same level	15.6%
e. Not try to increase recreation and tourism	20.2%
f. Unsure	2.3%
g. Don't care	.6%

8. Check whichever is appropriate—Skagit County needs:

a. More campsites	18.8%
b. More swimming pools	19.6%
c. More gymnasiums	5.9%
d. A variety of indoor recreational activities	15.9%
e. Little in respect to indoor recreation	2.7%
f. More day use areas	10.3%
g. More day use areas	3.7%
g. More outdoor recreation areas	17.9%
h. None of these	5.1%

INDUSTRY

1. Do you *feel that industrial development* should be restricted as to the type of development that will take place?

— 72.6% —Yes — 20.2% —No

2. Should existing industry be urged to improve their sites?

— 74.6% —Yes — 11.1% —No

3. Do you think Skagit County should pursue a policy of:

a. Attracting more industry of all kinds	24.6%
b. Attracting more of only a few industries	32.7%
c. Attracting only a few industries	24.9%
d. Not attracting any new industry	14.6%
e. Undecided	3.2%

4. Do you feel the type of industrial use should be restricted to:

a. A mixture of industrial parks and light *fabrication industries*	28.1%
b. Primarily well-planned parks	20.3%
c. Distribution warehouses (trucking, railroads, shipping)	6.5%
d. Agriculturally related industry	45.1%

5. Should Skagit County promote expansion of existing industrial development in areas adjacent to the county?

— 40.7% —Yes — 37.9% —No

6. Should Skagit County promote expansion of industrial development in Skagit County?

47.9% -Yes 32.5% -No — Unsure

7. Should a superport be developed in Skagit County?

26.5% -Yes 46.4% -No 19.0% -Unsure

8. Should a nuclear power plant be developed in Skagit County?

64.1% -Yes 18.5% —No 13.7% —Unsure

When examining the ages of the respondents, and comparing them with the age/sex pyramids in the population section of this study, one can see that the questionnaire was fair representation of the population of Skagit County. As mentioned in the population section, the county's population is growing older, and the level of responses to the survey from older age groups was significant.

It is also significant that 53.3% of the respondents have lived in the county over 21 years. Often it is said that the longer a person lives in an area the more apathetic he becomes about its problems. This was obviously not the case here, with so many long-time county residents taking the time to complete and mail the opinion survey.

People like the lifestyle of Skagit County. This is interpreted to mean that they like the rural flavor that Skagit County provides. They like the neighborhoods, which could correspond to their approval of the lifestyle. People in Skagit County like the recreational opportunities that prevail in the county.

Among the major dislikes of county residents is the lack of career employment opportunities. A very small percent of the respondents were in disfavor with the number of people in Skagit County. Only 1.3% felt that there were not enough people. Fifteen percent (15%) thought the county was too crowded already. A contradiction seems to arise between the acceptance of the rural lifestyle, and the disfavor with the low level of career opportunities, entertainment facilities, shopping facilities, and crowds.

Sixty and one tenth percent (60.1%) of the respondents did not want a change in the general appearance of Skagit County. This was felt to be a very significant figure, especially when it is noted that of those who wanted a change, a majority wanted a more rustic appearance. This strengthens the idea that people live in Skagit County because of its rural, rustic atmosphere, and if it weren't preserved as such, they would probably live somewhere else. (It could be, however, that if it were not preserved, it would be like anywhere else, so they might as well stay.)

The attractive physical aspects that people most like are rather obvious, but again tend to reinforce an argument for the preservation of the rural lifestyle. The physical aspects most often cited were the mountains, forested areas, and the Puget Sound.

Poorly maintained residences and urban clutter rated as the two most popular unattractive aspects of the county. It is interesting to note that people did not perceive the refineries as an especially unattractive aspect of the county.

In measuring attitudes about the appearance of the cities, LaConner seemed to fair the best, with more people answering that it was more attractive than the other cities. LaConner was, however, more often cited as needing building clean-up, painting, and repairing. Concrete seemed to fair the worst, with 17.8% feeling it was unattractive and 16.7% feeling it was very unattractive. All of the other cities seemed to fall in between these two with varying degrees of similarity and difference.

Most people seemed to be satisfied with the type and variety of housing available in the county. They did not want low income housing, except for the elderly. Forty two point five percent (42.5%) of the respondents' houses were 21 years or older. However, most felt their houses to be in good to excellent condition.

A very significant 62.7% of the respondents felt that future residential activity in the floodplain should be curtailed.

The preferred size of building lots was a split between the 1/4 acre lot and the one or more acre size. This would indicate that people want a wide distribution of lot sizes throughout the county, allowing for a great deal of latitude in the choice of a building lot. Many respondents also wrote in this section that they were in favor of a 30 acre agricultural zone.

Seventy three and five tenths percent (73.5%) of the people questioned did not feel floods represented a serious threat to them personally. However, 50% felt flooding is a threat to other areas of the county. It is even more interesting to note that 68% are in favor of increasing flood protection, but were not agreeable to sharing the expenses. Thirty eight and nine tenths percent (38.9%) felt that the costs should be paid by the persons benefitting from the added protection.

Agriculture in Skagit County was very important to 83% of the respondents. A surprising 40% felt agriculture in the county should be expanded as much as possible. This is significant when 65% of the respondents were not financially dependent upon any form of agriculture. This trend continues when 86% felt that agriculture in Skagit County, could at some time in the future, be threatened by urban related speculation and development. A majority (57%) were also in favor of developing policies and standards to help preserve the agricultural land.

The outdoor recreation qualities of the county rated high with the people who responded to the survey. Little Mountain, Bayview, and Sauk Mountain Parks seemed to attract the most citizen concern for some improvements. The interest in preserving certain areas in the county (61% felt there were areas that needed preserving) can be correlated with the interest in outdoor recreation, preserving the agricultural land, and enjoyment of the rural lifestyle. The question on the recreation/tourism program received a majority of favorable response between not trying to increase recreation/tourism in the county, to pursuing a moderate program. However, 22.8% did want to pursue a vigorous recreation/tourism program. The respondents seemed to feel Skagit County is in need of a public swimming pool, and a variety of indoor recreation activities. This could possibly be realized within a community recreational complex. The need for more day use areas and campsites also was a popular comment in this section of the survey.

Within the industrial section 72.6% of the respondents felt that some restrictions should be placed on the type of development that takes place. Seventy four and six tenths percent (74.6%) of the respondents felt that existing industry should be urged to improve their sites, and a majority of the people felt that attracting new industry should be done with care and forethought. All of these answers tend to strengthen the assumption that people in this county prefer that industry be of a certain quality so as not to conflict with the beauty and lifestyle of the area. This is further strengthened by the fact that almost 50% of the respondents were not in favor of developing a superport in the county.

The question relating to the expansion of industrial development in areas adjacent to the county was probably misunderstood by many. There was a fairly even split between those in favor of such a policy and those against it. However, 40.7% were in favor, further adding to the fact that county residents may be selective as to the type of industry they prefer.

A significant 64.1% of the respondents were in favor of the development of a nuclear power plant. This demonstrates a certain amount of trust in the utility company to develop the plat properly and safely.

3. SUMMARY

In summation, the Comprehensive Plan should most likely reflect a variety of lifestyles within the overall basic rural atmosphere of the county. This would place a considerable amount of importance upon the proper development of existing urban areas. The people of the county want and need all of the conveniences and services of an urban situation, but not to the detriment of their environment. The plan should strive to protect the rural atmosphere, protect the agricultural lands and expand both outdoor and indoor recreation facilities, while allowing for reasonable, well-planned industrial and commercial growth. Hopefully, this survey will be part of the beginning of an intense interest in planning and the successes that can be realized by its support, through public participation, and cooperation among various levels of government.

TECHNICAL ADVISORY COMMITTEES

Technical Advisory Committees, involving various available areas of expertise (natural resources, community development, regulatory and personal protection, transportation and utilities and cultural and personal services) were formed to aid and advise the planning staff. The members included experts in various fields, as well as interested local citizens. It is felt that these committees should continue to supply technical advice to the Skagit Regional Planning Council beyond the time span of this study.

The members of the Natural Resources Committee, the Transportation and Utilities Committee, and the Cultural and Personal Services Committee were of particular value in examining such questions as the effects of certain developments upon fish, wildlife, and the environment in general, alternative means of flood protection, alternative road and highway alignments, and various future social and cultural needs.

Although the meetings held were quite fruitful, the overall success of the technical advisory committee approach was rather disappointing. Time allotted for this function was not sufficient to complete a thorough investigation. However, the success of both the land-use simulation exercise, and the opinion survey more than compensate for any deficiencies in the technical advisory approach to public involvement.

PLANNING POLICY OBJECTIVES

The planning policy objectives delineated below result from the attitudes expressed by citizens in public hearings, land-use simulation exercises, and the citizen input questionnaire, as well as the attitudes expressed by the members of the technical advisory committees, and by the members of the Skagit Regional Planning Council.

The following planning policy objectives are the general perimeters used to establish the alternative models and the alternative plans which are discussed in the following sections of this report.

These planning policy objectives are the foundation upon which the specific recommendations were developed:

1. To provide and maintain lifestyles which best preserve the natural beauty of the county, minimize public investments, and which allows private investment the greatest possible latitude within the interests of community health, safety, and welfare.
2. To preserve and expand the agricultural base of the county, so as to retain both the primary economic base and the rural atmosphere of this area.
3. To protect agricultural lands from flooding to a 20 year frequency.
4. To protect existing urban areas from flooding to a 50 year frequency.
5. To exclude further development in the agricultural lands for economic, safety, and aesthetic reasons; and conversely, to encourage the location of future development in suitable well-planned uplands areas.
6. The location and quantity of land designated for urban related uses, i.e. residential, commercial, and industrial, should be

based upon estimates of present and future needs, environmental impact, various private and public economic criteria, and the resulting social ramifications.

7. To provide the public services required to fulfill state and federal regulations in a manner compatible with the general attitudes of the people of Skagit County.
8. The coordination of urban services should be handled on a metropolitan level to insure efficiency and economy of operation, and to provide specialized regional facilities.
9. Coordination of municipal, public, quasi-public, and private standards, plans, regulations, and efforts with those of the county and region, realizing that successful integration of development cannot be accomplished without coordination of efforts.
10. Future municipal annexations should consider such elements as flood problems, drainage, topography, soils, septic suitability, population, the ability of the city to provide proper sewer and other utilities and services, regional land-use policies, and future land-use ramifications of the annexations.

ALTERNATIVE LAND USE MODELS FOR THE DOWNRIVER AREA

1. INTRODUCTION

This section of the report is a comparison of uplands versus lowland land use models. This is a hypothetical discussion of alternative forms of development. The major comparison made is between the cost of developing in the floodplain versus the cost of developing in naturally flood proof areas.

The alternative land use models presented on the following pages were developed to facilitate an analysis of the desirability of each form of development. After analysis of the economic, environmental, and cultural aspects of these models using the data and resources developed by the Physical, Flood, Developmental and Community Facilities Sections of this report, as well as public input, the uplands development pattern was selected as the land use pattern that would best serve the Skagit Regional area.

2. UPLANDS ALTERNATIVE DEVELOPMENT MODEL FOR THE DOWNRIVER AREA
(See Map O in Map Section accompanying this report)

A. Goals & Objectives

1. To maintain existing levels of flood protection for all areas in the floodplain.
2. To concentrate development in areas free from danger of flood and high water table. (i.e. uplands)
3. To protect the agricultural economic base of the county.
4. To allow for reasonable development in accord with population growth while maintaining the general rural atmosphere of the county.
5. To plan for existing cities to carry the major portion of population growth in areas away from the floodplain. (This is economically important due to the proximity of various utilities and services.)

B. Land Use Patterns

1. Floodplain Management

   a. Provide and maintain the degree of flood protection attained to date.

   b. Residential development patterns:

      1. The main areas of growth would be centered in those parts of the larger cities which are out of flood danger. These would be areas of the denser "urban-type" growth (i.e. east Mount Vernon, north Sedro Woolley, Anacortes, etc.)
      2. Other more "rural-type" development would be scattered throughout the upland areas in much the same manner or density as presently occurs.
      3. The area south of Mount Vernon along the ridge would be developed as low density residential.
      4. The area east of Conway and south to the county line would be developed as low density residential. (This includes the Lake McMurray area)
      5. The Big Lake area would also be low density residential. (This includes the area north of Big Lake)
      6. Other areas of low density residential development include portions of the Clear Lake area, of the Samish River, Bow Hill, Samish Island, Bayview, and the Pleasant Ridge-Fish Town area.

   c. Commercial development:

      1. Commercial development for the Mount Vernon/Burlington area would consist of expanding present facilities out of the floodplain.
      2. Some major commercial expansion would be necessary in north Sedro Woolley.
      3. Smaller neighborhood commercial areas would be necessary according to certain patterns of growth. These were detailed as the land-use models reach a refined stage.

   d. Industrial development:

      1. The existing Marches Point industrial area, although not within the boundaries of this study, must be acknowledged

as having an impact on the region as a whole, and thus is mentioned for industrialization here.

2. The Bayview Airport Industrial Park, if properly developed, could add extensively to the region's present industrial lands. Its location above the floodplain also adds to its overall feasibility.
3. The area east of Sedro Woolley and north of SR20 would also be developed as industrial park.

e. Agriculture and Pasture
   1. All land on the floodplain presently used for agriculture and pasture purposes should remain as such, to assure the continuation of this economic activity, and to deter the possibility of great losses of life and property due to flooding.

f. Transportation
   1. A new scenic road should be constructed through the pass between Little Mountain and Devils Mountain, terminating at Big Lake.
   2. I-5 should continue to be upgraded.
   3. SR20 should continue to be improved.
   4. The development of a limited access Highway 536, with only two interchanges at Bayview and the Swinomish Channel, should continue.
   5. A connector road between Bayview Airport and the proposed SR536 Project be developed. (Possible upgrading of existing SR537 should occur)
   6. The development of adequate circulation systems in proportion to the intensity of future development in east Mount Vernon, north Sedro Woolley, and also the areas of less intense development should continue.

g. Community facilities
   1. Parks - besides the continued maintenance of existing parks, certain additional areas should be set aside as park or open space.
      a. Little Mountain area should remain as active

recreational open space, connected on the north by an Urban Trails System and Hillcrest Park.

b. The Devils Mountain area south of Little Mountain should remain undeveloped as a passive type of recreational open space.

c. Parts of Bow Hill north to Chuckanut should be used as open space park areas.

d. A narrow strip around Bayview Ridge (connected to Bayview State Park) should be developed for a trails park. This would serve as a buffer between the proposed industry and other incompatible existing uses, as well as provide a different type of recreational opportunity.

2. Schools

a. The proper educational facilities should be provided in proportion to the growth of certain areas. Maintenance and expansion of existing facilities is also important.

3. Utilities and other services (fire, police, hospitals, community facilities, etc.)

a. The higher densities around Mount Vernon and Sedro Woolley are predicated on the fact that the extension of urban utilities and services is desirable in these areas.

b. Likewise, the areas depicted for lower density were predicated on the limiting features of soils, slope, land value, and the lack of sewers and other urban-type facilities.

c. Some areas depicted for lower density actually lie in a state of transition, they could proceed to a higher density, given a certain amount of growth and availability of urban services. The areas that most likely fit into this unstable transition stage are: Big Lake, Conway Hill, Butler Hill area, Bow Hill, and parts of Bayview.

3. UPLANDS MODEL EXTENSION

   A. Expansion of the Uplands Model far into the future depicts some of the ramifications of this type of development.

      1. Most development has occurred out of the danger of flooding.
      2. The most likely centers of concentrated economic growth would be Mount Vernon and Sedro Woolley.
      3. Other areas most likely to evolve into higher density situations (given the expenditures of proper facilities to allow such development) would be the Big Lake area, the Conway Hill area, and possibly the Bow Hill/Alger area. The extension of commercial activities in these areas was seen both as a result of this evolution and as highway convenience commercial areas.
      4. The lighter forms of residential use are seen as a result of the continuation of the rural life-style of the county as a whole.
      5. Note that these are merely conceptualizations and will be combined later with citizen input, and the various physical, social, and economic characteristics of the study area, to further delineate the boundaries of particular uses.
      6. Most of the industrial activity would also take place off of the floodplain; i.e. Bayview Airport, March's Point, Anacortes, and the Butler Hill area.
      7. Agriculture would remain the dominant activity on the floodplain due to its more resistent characteristics with regard to flooding.

4. LOWLANDS ALTERNATIVE DEVELOPMENT MODEL FOR THE DOWNRIVER AREA
   (See Map P in map section accompaning this report)

   A. Goals and Objectives

      1. To give 200 year flood protection, thus allowing more diversified development of the low floodplain areas.
      2. To use existing facilities such as roads, water lines, and sewer lines in determining the pattern of development.
      3. To develop the lowlands according to market and other economic demands.

   B. Land-Use

      1. To attain the amount of flood protection needed for a lowland pattern of development:

         a. The proposed route of Highway 20 (Alternative C) would act as a levee along the Skagit between Mount Vernon and Burlington.

   b. Additional storage capacity provisions on all dams upriver should be added.
   c. The proposed Sauk River Dam should be built.
   d. Extensive levee and channel improvements near the cities, and especially south of the proposed Avon Bypass.
   e. The Avon Bypass should be reactivated and constructed to expand the level of flood protection for the Delta area of the Skagit River.

2. Residential Development Patterns:
   a. The existing road network should be used for single family residential development.
   b. Subdivision type development should locate near existing cities or interconnecting roads.
   c. The area west and southwest of the proposed bypass is suitable for both subdivision and roadway types of residential development.
   d. This is also true for the area west of Burlington.
   e. The land between the River Bend Road and Mount Vernon should be subdivided for residential use.
   f. The area north of SR20 between Burlington and Sedro Woolley should be another area of considerable residential expansion.
   g. The cities themselves will actually account for a major percentage (approx. 40%) of the residential growth.
   h. Residential marinas should be developed along the Swinomish Channel and along the Avon Bypass whenever possible.
3. Commercial Development
   a. Expansion of the existing Mount Vernon Shopping Center should continue.
   b. Additional commercial land should be provided in west Mount Vernon.
   c. A new shopping complex should be constructed near the intersection of Wilson Road and Memorial Highway, near the freeway.

This would service the residential areas west and north of Burlington. It should be in proportion to the needs of these areas.

d. An increase in commercial area in LaConner should be provided.

e. An increase of commercial area between Burlington and Sedro Woolley on SR20 should be provided.

4. Industrial Development

a. Industrial development should be encouraged south of Burlington.

b. Additional industrial land should also be provided south of Mount Vernon, along the rail line and freeway.

c. The proposed Bayview Industrial Park should be developed.

d. The proposed port facility in Padilla Bay should be encouraged.

e. Additional industrial land should be provided east of Sedro Woolley and north of SR20.

5. Agriculture and Pasture

a. Agriculture and pasture should remain the dominant use in the Fir Island area (even with extensive flood protection this area might still be in danger).

b. Agriculture land should be retained.

C. Transportation (Proposed)

1. SR20 (Anacortes to Sedro Woolley Alternative C) should be limited access.

2. Other secondary roads should be improved to handle increases in volume caused by residential, commercial, or industrial development in that area.

3. The road crossings at I-5 should be made safer. This might include the addition of some overpasses.

D. Community Facilities

1. Parks - the area along the proposed bypass should be developed as a park. Burlington Hill should also be used as a park. The area east of Sedro Woolley along SR20 should contain some park or open space. The coastal area along Skagit Bay, including McGlinn Island, should be used as park or open space. A strip of land along Bayview Ridge should be saved as a trails park.

This will also act as a buffer between the industry and other uses.

2. Schools - additional schools must be provided in the areas of heaviest residential growth.
3. Utilities - proper adequate utilities must be provided to all areas of potential development. They may easily parallel existing roadways.
4. Fire, police, hospitals, communtiy facilities, etc. - according to population locations and densities.

5. LOWLANDS MODEL EXTENSION

A. Expansion of the lowlands model into the future depicts some of the ramifications of this alternative.

1. Given the $200 million required to floodproof the river, all development would have to take place in the lowlands to approach a justification of the expenditure in the Region.
2. As a result, the agriculture land in the floodplain will be infiltrated by strip residential development along the roads. This will gradually evolve into high intensity residential areas expending out from the cities.
3. The commercial areas of the cities will also expand outward due to the same economic pressures of full flood protection.
4. This situation leaves the development in the uplands in a state of "limbo". Economically speaking, expenditures on new residential, commercial, or industrial developments and the services needed for their proper expansion, would be highly unfeasible, given the need to justify the money spent on flood-proofing.
5. This is very true of industry, specifically the Bayview Airport. The Airport, along with everything else, would have to be located in the areas for which the money was spent. This causes a great increase in industrial activity in and out from the existing cities.
6. A superport facility would be justified because:
   a. The spoils from the dredging of the Avon Bypass could be used as fill for the port facility.

b. The impact of a successful facility would cause a demand for growth and expansion of the floodplain to support its existence.

6. FEASIBILITY STATEMENT - LOWLANDS MODEL
   A. High cost of flood protection greatly exceeds potential value of developing lowlands.
   B. Population projections indicate not enough growth to justify the immense expenditure for this type of protection.
   C. Encroachment of development into agriculture land while allowing for some personal gain, is an overall liability to the general public:
      1. Because it destroys the agricultural economic base by which this county prospers.
      2. Because the high water table and poor septic suitability soils would still exist, causing extra dollars in utility provisions and maintenance.
      3. Despite immense flood control spending the possibility of flood damage still remains.
      4. Increased development could cause disruption of ground water recharge, affecting water supplies for irrigation of remaining agriculture land.
      5. The pocketing and enclosure of agricultural land would cause growers to fail to attain economies of scale. And vice versa the developers could only meet costs by filling in the strip type development, thus pushing out the agricultural land altogether.
      6. Because extensive development could cause pollution of the ground water.
   D. The Padilla Bay Port Facility, a necessity for lowlands development, would be unfeasible because:
      1. The ecological impact on the shellfish and other marine flora and fauna would be devastating.
      2. The number, location, and quality of other port facilities in the Puget Sound Region cause the development of such a facility to be highly unfeasible.

3. The existence of many acres of vacant industrial land combined with population projections for Skagit County and lack of support industries seems to create a rather large economic gap.

7. SUMMARY COMPARISON OF ALTERNATIVE LAND USE MODELS FOR THE DOWNRIVER AREA

The evaluation of the uplands versus the lowlands alternative land use plans is primarily an evaluation of the economic demands required to floodproof the river delta areas, as compared to the total potential for developing the lowlands area.

The analysis of the data and conclusions in the Physical Characteristics, Flood Characteristics, Developmental Characteristics and Community Facilities Sections of this report all point to an uplands development pattern.

The Land-Use Simulation Exercise, the citizens input questionnaire results, the technical advisory committees, and the public hearing process all advocate the use of an uplands form of development.

Additionally, the existing Skagit County Comprehensive Plan adopted by the Skagit County Board of Commissioners in 1968, established a precedent for upland development trends.

The following section, discussing and evaluating alternative upland land use plans, describes in considerable detail the characteristics of four alternative uplands land use plans.

Table 1

CAPITAL COST INFORMATION OF ALTERNATIVE LAND USE MODELS

Lowlands	
Water	
Lines and pumps	$ 5,093,500
Sewage	
Lines	4,777,400
Secondary Waste Treatment At: Mount Vernon, Burlington, Sedro Woolley, Bayview, and LaConner	18,137,800
Package Plants At: Bayview, Samish Island, Big Lake, Conway, Clear Lake	1,873,400
Drainage	
Lines	4,369,600
TOTAL	$ 34,251,700
Flood Control - Alternative "A" of Puget Sound and Adjacent Water Study for 100 year protection	
Levee - Improvements	$ 10,080,000
Sedro Woolley Levee	4,320,000
Hamilton Levee	4,032,000
Avon Bypass - 60,000 c.f.s.	41,616,000
Sauk Dam	184,000,000
	$244,048,000
Plus water, sewage and drainage	34,251,700
TOTAL	$278,299,700
Additional Flood Control Projects	
Avon Bypass - 100,000 c.f.s.	$ 52,272,000
Nookachamps Levee - 135,000 c.f.s.	3,600,000
Upper Baker Dam - Increase Storage	133,000*

*Annual power losses in 1968 dollars

Table 2

CAPITAL COST INFORMATION OF ALTERNATIVE LAND USE MODELS

Uplands	
Water	
Lines and pumps	$ 5,640,500
Sewage	
Lines	4,755,700
Secondary Waste Treatment At: Mount Vernon, Burlington, Sedro Woolley, Bayview, Bow-Alger, LaConner, Big Lake	18,308,200
Package Plants At: Bayview, Clear Lake, Samish Island, Conway, Pleasant Ridge	2,209,800
Drainage	
Lines	3,641,900
TOTAL	$34,556,100

Additional Costs to be Considered

(Information was not available in time for the computing of costs for the two alternative models)

1. Hospitals
2. Schools
3. Libraries
4. Police Protection
5. Fire Protection
6. Community Centers

ALTERNATIVE LAND USE PLANS FOR THE DOWNRIVER AREA

1. INTRODUCTION

The four plans presented in this section are alternative land use plans for Skagit County. They project various land-use patterns which the region could assume in planning to the year 2000, and beyond. The amount of land shown in each land-use classification is greater than the actual projected need in all cases. This was done to prevent the plans from becoming overly restrictive and artificially inflating land values.

It is also recognized, however, that overemphasizing the projected need for any one land use category produces a false sense of higher valuation for many landowners. This situation might also tend to spread investment resources too thin. This demonstrates the necessity for scaling land-use patterns when developing alternative plans.

In computing the areas required for residential use and the subsequent population loads of each plan the following general factors were used:

	High Density	Low Density
Lot Size	.25 - 1.00 Acre	1 - 5 Acres
Average Lot Size	.50 Acre	2.5 Acres
Average Family Size	3.2	3.20
Housing Units Per Acre	2.0	.44
Persons Per Acre*	6.4	1.40

*Average Family Size x Units/Acre = Persons/Acre

In each of the four alternative land-use plans, there are a number of added buffers to the population holding or load capacities. These include: the Fidalgo Island area; the agricultural/pastoral areas, and the upland forest/pasture areas. The Fidalgo Island area is dynamic and its population developmental patterns will be studied at a later date. The other two areas are considered to be holding areas with a fairly constant population holding capacity. When examining the population capacities of each of the alternative land-use plans, these areas should be considered.

The population of the Fidalgo Island area is approximately 11,000 persons. The agricultural/pastoral areas contain approximately 7,500 persons. The upland forest/pasture areas contain approximately 2,500 persons. Even without projecting additional population expansion for the above areas, the holding capacity of each of the alternative land-use plans is substantially higher than current population projections for the project area.

2. PLANNING POLICY CONSTANTS

The following land-use planning recommendations are felt to be of great significance to Regional planning regardless of which alternative land-use plan is chosen. Any of the strategies leading to a Comprehensive Plan for the Skagit Region should adopt these conclusions and recommendations.

2A. General Recommendations and Conclusions

1. Existing agriculture and pasture lands, in the floodplain, should be protected from encroachment by other land uses.
2. This study recognizes that the Open Spaces Taxation Law of 1970 is a viable and popular land-use control method within Skagit County and should be retained, unamended.
3. Existing urban areas should be protected from flooding to a 50 year frequency, either by means of dikes, or by additional up-river storage.
4. Future commercial and industrial development should concentrate in the uplands areas, away from the prime agricultural/pastoral lands, and out of the danger of flooding and the seasonal high ground water table.
5. Future urban expansion, especially residential, should focus on adjacent upland areas.
6. Expansion of city limits within flood hazard areas should not be proposed unless protected from floods to a 50 year flood frequency level.

7. The unincorporated upland areas with good physical characteristics are suitable for light residential use. These areas are shown on the composite map of slope and septic suitability (Map G) in the map section of this report. The degree to which these areas are utilized varies with each alternative plan.
8. Some unincorporated areas within the floodplain are shown in a particular use category because they presently exist as such. Expansion in these areas is not recommended.
9. The areas shown as high intensity residential should have all the urban services including sewer systems. The light residential areas should have septic tanks or package plants.
10. The county as well as the various municipalities should adopt specific design standards for industrial park areas.
11. New commercial development, especially along major arterials and highways should not be of the 'strip' type. Highway commercial uses should be located in 'cluster' form at strategic interchanges.
12. The county and various municipalities should adopt specific design criteria for commercial districts.
13. Five years after the adoption of a Regional Comprehensive Plan, the land zoned for industrial use on the floodplain that has not been utilized for industrial purposes, should be backzoned to its previous use.
14. The Shoreline Master Plan and River Basins Plan will be integrated into this plan at the time of their completion.
15. Planned unit developments could be used to create cluster neighborhoods in new residential areas, if possible.
16. The Shoreline Master Planning Program will develop a similar set of planning alternatives for the Fidalgo Island and tidelands area of the Skagit Regional Planning area, as well as evaluate proposals for the propagation of fisheries in the area.
17. The steam excursion railroad proposed by the Skagit County Development Association with terminals located in Sedro Woolley and Concrete would facilitate the expansion of the tourism industry in the Skagit Region.

2B. Urban Land-Use Recommendations (Downriver Areas)

1. The City of Mount Vernon

   a. Mount Vernon's greatest growth potential lies eastward. The city should adopt policies which reflect a 'filling-in' of the present eastern boundary extensions as a first phase of development.

   b. Where possible, existing woodlots should be retained as an integral portion of a planned unit development approach to this portion of the city. They could also be used as common ground in proposed multi-family complexes.

   c. The western boundary of the city should not be expanded, avoiding further problems with agriculture and floodproofing. The areas beyond the present western boundary shown as higher uses, depict present usage only, and should not be further developed.

   d. The areas just west of Interstate 5 at the river bend should be used as floodproofed commercial only. Further growth westward into the river bend agricultural area should not be allowed.

   e. Major commercial expansion should take place in the area between Interstate 5 and the Burlington Northern Railroad line, adjacent to the existing Mount Vernon Mall areas.

   f. The existing central business district area should undergo an indepth study in which plans are adopted and vigorously adhered to.

   g. The city should not develop in a 'strip' form south of the present southern boundary in non-flood protected areas.

   h. Industrial expansion should take place largely in the form of well-planned industrial parks which are compatible with an urban area. The areas most suited for this type of use are shown on the alternative land-use plans in the map section. The importance of specific design standards must be reiterated, especially when considering the impact of industrial land upon adjacent residential areas and the tourist economy of the entire countywide area.

2. The City of Burlington

   a. Burlington's major growth areas are to the south toward the Skagit River, and on Burlington Hill.

   b. Burlington should adopt a policy of 'filling-in' to its existing boundary.

   c. The task of providing sewers in the Burlington Hill area should be pursued to allow for a planned residential development.

   d. Burlington should not annex west of Interstate 5. This would cause development pressures upon the existing agricultural lands besides presenting a large flood protection problem.

   e. The spots of residential land along the existing SR20 Highway east of Burlington represent existing usage only and should not be considered as a viable growth area for Burlington.

   f. The new State Route 20 should not be routed south of Burlington Hill or farther north at Cook Road. The former alternative would in effect cut off the Burlington Hill area (the major flood safe area for residential expansion in the city) from the rest of the city. Also, depending upon traffic volumes, the noise level caused by the proximity of the Hill may reach levels beyond the norm. The latter alternative would cause an encroachment into agricultural land, beginning with the backlotting of development adjacent to the proposed Cook Road alignment.

   g. Two alternatives for SR20 for the City of Burlington better than those previously mentioned, are available. One would be a southerly route close to the river, which could act as a dike to provide flood protection for the city, would provide a good view of the river for tourists, use less prime agricultural land, and would not cut through the city's heart. The other alternative would be a route around the northern base of Burlington Hill, joining with the existing alignment at some point east of the hill. This would create a very tangible northern boundary for the city, avoid the heart of the city, allow expansion of the city to the north, and not encroach on the agricultural land. It would have to be a firm policy of the city, however, to limit the expansion of any use other than agriculture/pasture on the north side of this alignment.

h. The City of Burlington should study the future potential of its central business district and adhere to the plan adopted.

i. Commercial expansion should be located in the central business district south of Gages Slough between Interstate 5 and Old 99, and in cluster form at major highway interchanges.

j. Industrial expansion should occur south of Gages Slough between Old 99 and the Burlington Northern tracks.

k. The use of Gages Slough as a buffer between the industrial/commercial activities and the residential area should be explored.

l. The area south of the central business district between Spruce Street and the Burlington Northern tracks should be developed as an industrial park, using specific design standards.

m. Wooded areas and green-space along the Skagit River should be preserved as park or open space.

3. The City of Sedro Woolley

a. Sedro Woolley's major growth potential lies northward in the uplands areas. The city should encourage growth in this area.

b. The city should first 'fill-in' to its present boundaries, with the possibility of a redevelopment program south of the central business district, to include more multi-family units.

c. Sedro Woolley should study the future potential of its central business district and adhere to the plan adopted.

d. Sedro Woolley should follow a policy of non-growth in the east and west agricultural areas.

e. Only some industrial expansion should be considered south of the present southern boundary near SR9.

f. The wooded areas to the north should be used to their best advantage through a planned development approach.

g. The area along the existing SR20 should not become strip commercial.

h. Any commercial areas, especially those related to the proposed SR20 realignment, should be in cluster form having specific design specifications. A logical place for this type of development could be at the interchange of the proposed SR20 and SR9.

i. Industrial expansion near the central business district and east of the Skagit Corporation should be of the industrial park type, with the city having adopted specific design criteria for such uses.

j. The area just south of the existing SR20 and just west of SR9 should be seen as an industrial reserve area, to be used only as other land set aside for industrial activitiy reaches saturation.

k. The SR20 realignment should be located south of Sedro Woolley joining the existing route east of the city. This would provide flood protection, use less prime agricultural land, and not have the effect of severing Sedro Woolley from its major area of northerly expansion at some future point in time.

4. The City of LaConner

a. The main thrust of activity for the city of LaConner should be towards realization of the objectives of its historic district planning program.

b. Future land-use decisions in or near the city should be made with respect to the enhancement and not the detriment of the overall historic theme.

c. Future residential expansion is provided by the Shelter Bay Development, which will have an effect on the future commercial activity of the community.

d. Industrial expansion should be contained in or near its present location in the southwestern portion of the city, and should be subject to specific design standards. There is land south of the present city limits along the Swinomish Channel that could also be used for future industrial usage.

e. The type of industrial development should also be considered for its compatibility with the overall community and existing industries (primarily fishing).

2C. Geographical Areas (See Map B in Map Section on geographic boundary areas)

1. Mount Vernon Proper (excluding the city)

   a. The lowlands near Nookachamps Creek should remain in agriculture/pastoral uses.

   b. The area just west of Clear Lake is indicated on the various plans to show only existing uses. Further expansion into surrounding lowland agricultural/pastoral areas should not be allowed.

   c. The areas of Little Mountain and Devils Mountain should be preserved as a regional park.

2. South Skagit Floodplain

   a. The agricultural/pastoral land in this area should be maintained as such.

   b. The land along the east side of the Swinomish Channel, north of the proposed marina extension, should not be considered for higher usage without further study. This would pose a threat to adjacent agricultural lands, in the initial form of higher land valuations.

3. Burlington/Bayview Proper (excluding the city)

   a. All agricultural/pastoral land should be maintained as such.

   b. Regardless of the plan to be adopted, the Bayview Airport area should be utilized as a regional industrial park with specific design standards applied. The area between the hill and the rail lines should be considered as industrial park reserve, to be used only after the full utilization of the primary airport area.

c. The wooded areas surrounding the airport site should be kept as a buffer zone between the industrial park and the residential areas.

d. The recommendations and conclusions of the airport study conducted by Lee Johnson and Associates for the Port Authorities, are adopted by reference as they pertain to Burlington/Bayview Proper.

4. Bow/Alger/Samish Proper

a. The prime agricultural lands should be protected from encroachment by higher uses.

b. Regardless of the alternative plan adopted the small communities existing on the agricultural floodplain should not expand further into those lands.

5. Sedro Woolley Proper (excluding the city)

a. The prime agricultural lands should be protected from encroachment by higher uses.

b. The area north and east of Sedro Woolley which are out of the floodplain and have good physical characteristics should be developed for light density residential uses.

3. COMMUNITY FACILITIES PLANNING CONSTANTS

3A. Regional (Unincorporated Areas)

1. Plans for new utilities (sewer, water, solid waste) should be coordinated on a regional basis to attain more efficient, equitable, and cheaper levels of service throughout the community.

2. The use of package plant sewage systems should be utilized where possible in the rural areas of the county. Efficient systems at a reasonable price would greatly facilitate residential development in the outlying areas.

3. The Urban Arterial Plans and proposals of the county and the various municipalities are recommended for adoption by reference, where they conform to the provisions of the alternative land-use plans. The Urban Arterial networks combined with the existing arterial system provides an excellent circulation pattern for the area.

Additions to the existing transportation pattern are shown on the map entitled "Combined Road Configurations for Alternative Land-Use Plans," Map M in the map section of this report.

4. This plan adopts by reference most of the recommendations of the Skagit County Water, Sewerage, and Drainage Facilities Plan completed by Stevens, Thompson, & Runyan of Seattle in 1970, noting that it be considered as a general guideline, subject to frequent periodic revisions to keep pace with changing attitudes, standards, and growth patterns. This plan will be revised during the course of the River Basins Planning Program.
5. This plan adopts the recommendations of the Skagit County Solid Waste Management Plan formulated for the Skagit Regional Planning Council in 1972, also realizing the importance of regular updating and revision.
6. This plan adopts by reference the recommendations of the Skagit County Emergency Services Operations Plan prepared by the Skagit County Department of Emergency Services in 1972.
7. This plan adopts by reference the recommendations of the four studies completed under the auspices of the Skagit County Development Association, 1972. (These recommendations are summarized in the Economic Base Analysis Section of this report.)
   a. A report by the Urban Land Institute
   b. Skagit County Agriculture: An Economic Mainstay, Department of Agriculture, Washington State University.
   c. A Tourist and Recreation Strategy for Skagit County, Northwest American, Seattle.
   d. Skagit County Industrial Site Survey, The Latdurell Associates, Seattle.
8. This plan adopts by reference the New Plan for Law and Justice, North Puget Sound Region, 1971, prepared under the auspices of the Northwest Regional Council and the Whatcom County Council of Governments.
9. This plan adopts the recommendations of the Comprehensive Health Plan for Skagit County completed by the Comprehensive Health Planning Council.

10. This plan adopts the recommendation of the study, The North Cascades Highway: Its Impact on Local Community Economies, by Community Development Services, Inc., for Washington State Parks and Recreation Commission.
11. The Bayview Airport Plan recommendations developed for the Port Authorities by Lee Johnson and Associates are adopted by reference.
12. Library service within the county should become coordinated at the regional level to assure a more equitable, cheaper, efficient system throughout the county. This could also be accomplished through the proposed statewide library system (H.B. 170 and SB 2166). Once these are accomplished, a more comprehensive service plan can be developed.
13. The standards proposed by the Public Library Association and the American Library Association should be used in developing the service plans, as well as the actual physical plans for libraries in Skagit County.
14. The possibility of using bookmobiles within the outlying areas of the county should be examined. However, this could only be accomplished with a regional or state system. It may be possible to contract with the Sno-Island Bookmobile Service.
15. The various school districts which have not already prepared a comprehensive plan should do so. These plans, when completed, will be adopted by reference in the Comprehensive Regional Plan for Skagit County.
16. This study adopts by reference the Comprehensive Plan for the Sedro Woolley School District prepared by Johnston, Campanella, Murakami, Brummit, and Company in May 1972.
17. This Department will continue to give assistance to the various school districts, to aid them in their planning efforts.
18. The open Space-Recreation and Trails Plan in other sections of this report are recommended for adoption to expand the available level of community facilities in the regional planning area. Additionally, the need for indoor recreation facilities as expressed by the public opinion survey should be investigated to provide a better level of service.

4. COMPOSITE PLAN FOR DOWNRIVER AREAS (See Map Q in the Map Section of this report)

This alternative land-use plan assumes some portions of each of the other alternatives to produce the widest range of alternative lifestyles for the people of the county. It allows an ample opportunity for urban type growth, but still has a substantial degree of dispersed rural type development. The satellite pattern is also represented with the beginnings of a new community at Big Lake, and to a lesser degree on Bayview.

The population pattern is also more evenly dispersed between urban and rural with 44,600 people living within the higher density perimeters of the cities and 18,400 people in the various outlying areas. This creates a population level of approximately 63,000 people, which falls somewhere in between those of the other alternative plans.

	Composite Plan Costs
Water	$ 8,345,100
Sewer	8,412,923
Roads	12,380,260
Schools (See Educational Facilities and School Cost Estimates)	
Libraries	669,981
Police Protection	986,316
Parks (See Parks and Open Space Element)	
TOTAL	$30,794,580

For further details see chapter on Developmental Costs.

4A. General Conclusions and Recommendations

1. The planning policy constants outlined earlier are basic to this alternative land-use plan.
2. Future development would be directed into the uplands areas of the existing municipalities.
3. There would be a significant degree of low density development in areas where the physical characteristics and the desirability facilitate development.

4. This alternative land-use plan combines some of the features of each of the other three alternative plans in terms of dispersal of some residences and the maintenance of the vitality of existing commercial centers.

4B. Urban Areas

1. Mount Vernon
   a. The area east of the existing boundary would be developed as light residential.
   b. The Francis Road area, north of the city, would be used for residential purposes. The addition of sewers would facilitate higher densities.
   c. The area south of Mount Vernon along the base of the hills would be utilized as light residential, taking into consideration not only the fine view characteristics, but also the physical limitation of the land.

2. Burlington
   a. The adjacent agricultural land would be retained for farming activity.
   b. The numerous vacant or light agricultural areas within the existing corporate boundaries would be filled in with medium-to-high density residential and commercial services.
   c. Industrial development would occur in and around the southerly portions of Burlington.

3. Sedro Woolley
   a. Sedro Woolley would continue to provide commercial and industrial activities.
   b. Residential growth would occur in the Dukes Hill area, but would be limited to medium densities.
   c. Low density residential development would occur in the areas with good physical characteristics in the Hoogdal area.
   d. Small neighborhood commercial facilities would provide services to the neighborhoods that develop north of the city.

e. A tourist oriented highway service commercial area would develop near the intersection of SR20 and SR9 in the eastern end of Sedro Woolley.

4C. Geographic Area

1. The Big Lake/Walker Valley areas would be used for residential purposes, with the higher intensity development locating near the lake where the first phase of a sewer system is proposed.
2. The area at the north end of Big Lake would be considered for limited neighborhood commercial expansion.
3. The Conway Hill area would be developed as light residential in conformance with the physical characteristics, taking advantage of the fine views offered by this area.
4. The area south of Conway to the Skagit/Snohomish County border has areas conducive to residential development. It is felt that it could best be used as residential reserve.
5. The land areas around the perimeter of Bayview Hill would be used for light residential development.
6. The physically desirable areas on Bow Hill would be well suited for light residential activity.
7. Portions of the Alger area would be used for light residential purposes.
8. The Pleasant Ridge area would continue to be used for light residential activity.

4D. Community Facilities

1. Community facilities would be developed on a regional basis. Each existing community would provide the variety and type of service required by the population within their respective service areas.

2. The recommended goals and objectives in the preceding section on community facilities would apply to this alternative land-use plan.
3. The cities would expand their present service levels as the population grows.

4. Police and fire protection would increase their respective service capabilities to serve both urban high density areas and rural low density areas.
5. The schools, parks, and health services would be provided as specified in the Community Facilities Section of the nodal plan.

4E. Transportation

1. The regional circulation pattern described on Map M and discussed in the Planning Policy Constants apply to this alternative land-use plan.
2. The Urban Arterials Board plans of the county and the various cities and the relevant recommended additions to the existing traffic network in the Combined Road Configurations for Alternative Land Use Plans, will facilitate the implementation of the alternative land-use plan.

5. NODAL PLAN FOR DOWNRIVER AREAS (See Map R in Map Section of this report)

This alternative development strategy focuses upon a nodal form of growth pattern for the future. This means that a major portion of the development would take place around the existing urban areas or nodes, with relatively little growth in various outlying areas. It is an urban type development pattern, with a majority of the people receiving the related level of services that accompanies an urban situation. The population level of this plan is the highest (74,500) of the four alternatives, due to its more urban nature. An urban situation would attract more business and industry causing a greater influx of population. Of the 74,500 persons proposed by the alternative land-use plans, approximately 64,900 persons would reside in urban areas and an additional 9,600 persons would live in the upland low density areas.

	Nodal Plan Costs
Water	$13,027,440
Sewer	14,486,480
Roads	10,397,260
Schools (See Educational Facilities and School Cost Estimates)	
Libraries	1,045,824
Police Protection	1,294,754
Parks (See Parks and Open Space Element)	
TOTAL	$40,251,758

For further details see chapter on Developmental Costs.

5A. General Conclusions and Recommendations

1. The policy constants outlined earlier also would apply to this plan.
2. Future development should center around the existing cities. This would allow more people to receive urban level services.
3. Very little development would occur in the outlying areas away from the existing cities.

5B. Urban Areas

1. Mount Vernon
   a. The City of Mount Vernon would continue as one of the primary nodal areas. This plan shows more intense development centering in and around the uplands area of the city, as compared to the other plans.
   b. More multi-family residences might be utilized in a concentrated form of development such as recommended by this plan.
   c. There should be a higher density of residential development in the plateau area just south of the present city boundaries.
   d. The extent and level of urban services (sewer, water, police, fire, parks, etc.) would be greater for this plan than for a dispersed strategy of development.
   e. Commercial uses may be greater for this plan due to its concentrated urban nature. Small neighborhood commercial areas

in the eastern section of the city may become necessary as the city grows.

2. Burlington
   a. The City of Burlington would be another nodal area for population growth.
   b. Burlington, having a more complex flood problem, would remain relatively constant in its land-use regardless of a nodal or composite situation.
   c. More multi-family residences would be utilized to accommodate a high density of development.
   d. The amount of commercial land utilized within the city would also be greater than the other alternative plans due to the increase in density and the absence of commercial services in unincorporated areas.
   e. The city would have higher and more extensive level of urban services (sewer, water, drainage, parks, etc.) than in the other alternatives.

3. Sedro Woolley
   a. Sedro Woolley would be a third hub for development within this nodal plan.
   b. As in the other cities, Sedro Woolley's growth area would be larger with respect to this plan than in the other forms of development.
   c. The city would also have a greater extent of urban type services.
   d. The commercial area would also experience growth due to a higher concentration of population in the existing developed area.
   e. Small neighborhood commercial facilities north of the existing city limits would be in conformance with this nodal strategy. However, these should not be stripped along the roadways. They should be clustered to facilitate the development of desirable residential neighborhoods.

5C. Geographic Areas (See Map B accompaning the Geology Section)

1. The amount of development in the outlying areas should be minimal, thus producing little change from the present existing situation.

5D. Community Facilities

1. Regional

   a. Community facilities on a regional basis would remain at about the present level and extent due to the concentration of population in the nodal urban areas. Although the various utility plans for the future were cited earlier, there would be obvious differences in types and levels of services according to each plan. These differences are reflected on the maps and in the general cost information for each of the alternative land-use plans.

2. Urban Areas

   a. The cities would increase their level of services in accordance with the population projections for this alternative plan. They should expect to receive higher concentrations of population if this plan was adopted. Thus, water, sewer, and drainage extensions would be a primary concern, especially east of the city and above Barney Lake.

   b. Police and fire protection would be another service that could be expected to increase with the adoption of this plan of development.

   c. Schools would be affected most at the elementary level where there is a certain level of locational dispersion at the present. This situation would be altered under a nodal pattern of development, giving rise to more urban related neighborhood schools.

   d. The requirement for parks would increase with this plan. However, this need would be greatly relieved, as previously stated, by preserving some existing wooded areas through the use of a planned development approach to residential areas. (See Open Space - Recreation Section of this report.)

e. Health services would be altered according to a nodal development pattern. However, the number of hospitals in the area at present seems to be sufficient to provide a proper level of services for the projected population.

5E. Transportation

1. Regional

   a. The primary regional circulation recommendations are mentioned in the constants. Generally, however, the number of roads in the unincorporated outlying areas would remain at about the same level.

2. Urban Areas

   a. Urban arterial patterns would change according to this plan.

   b. The pattern which minor streets and collectors take would depend on the degree to which the planned development concept is followed.

   c. Where the grid system is used, a super-bloc appraoch would be encouraged.

3. The Urban Arterials plans of the county and the various cities and relevant recommended additions to the existing traffic network in the "Combined Road Configurations for Alternative Land-Use Plans" would expedite the development of the nodal development plan.

6. SATELLITE PLAN FOR DOWNRIVER AREAS (See Map S in the Map Section of this report)

This alternative development model assumes moderate growth in existing urban areas, coupled with the generation of smaller satellite communities in various outlying areas. Growth would occur primarily in these two forms. The level of services would be approximately the same in the satellite communities as in the existing urban areas. This plan would approach the population level of the nodal plan, with an anticipated capacity of 68,500 people. There are some areas throughout the county which would be well suited to a new community situation.

Of the projected 68,500 persons in the satellite plan, 52,500 would reside in an urban environment, while 16,000 would be accommodated in rural low density areas.

	Satellite Plan Costs
Water	$10,584,300
Sewer	10,776,524
Roads	16,560,400
Schools (See Education Facilities and School Cost Estimates)	
Libraries	849,732
Police Protection	1,114,730
Parks (See Parks and Open Space Element)	
TOTAL	$39,885,686

For further details see chapter on Developmental Costs.

6A. General Conclusions and Recommendations

1. The policy constants outlined earlier pertain to this alternative plan.
2. Future development would be concentrated in the various upland satellite communities shown on the satellite plan contained in the map section of this report.
3. These satellite communities could be created by planned development of both residential and commercial neighborhoods.
4. Minimal development should take place in the existing cities and the outlying areas.

6B. Urban Areas

1. Mount Vernon
   a. The City of Mount Vernon should concern itself primarily with 'filling-in' of its existing boundaries, and renewing some of its areas.
   b. Mount Vernon would essentially have the same amount of industrial and commercial activity in this plan as in the other alternatives. This is because the satellite communities would be more of a residential center than an independent urban center.

2. Burlington
   a. Burlington also would look more toward 'filling-in' and improving, than the actual utilization of new areas.
   b. The existing commercial and industrial areas would expand as needed, to accommodate the nearby satellite communities.

3. Sedro Woolley
   a. The same policy recommended for Mount Vernon and Burlington would hold true for Sedro Woolley as well.

4. LaConner
   a. LaConner's main thrust should be towards the historical district plan and its implementation.
   b. LaConner should, however, follow the same policy as prescribed to the other cities under this plan.

6C. Geographic Areas

1. The Big Lake/Walker Valley area would become a satellite community under this plan. This would mean the area would attain a level of services (sewer, water, drainage, schools, fire, police, etc.) comparable to an urban situation. A small community commercial area would be located at the north end of the lake near the junction of SR9 and Big Lake Road.
2. The Conway Hill area would also become a satellite community containing an urban level of services and a small convenience commercial area.
3. The Bayview area would also become a community under this plan, with the major concentration of people near the existing community on the west side. A small commercial area would also be located on the west side.
4. The Pleasant Ridge area would be another, but smaller, satellite community.
5. The Bow Hill area would be a satellite, with most of the high intensity development at the top of the hill near Bow Hill Road, and lighter residential along the hillside as the physical

characteristics permit. A commercial node would be located at the interchange of Bow Hill Road and Interstate 5, to serve both the community and highway travellers.

6. The Alger area would also be a satellite community with a small commercial area near Interstate 5, and also at Old 99. The latter would probably experience less growth because of the dual purpose of the Interstate 5 location.

6D. Community Facilities

1. Regional
   a. Community facilities would be comprised of a regional net of urban services within the existing cities and the various satellite communities.

2. Cities and Satellite Communities
   a. Each city and satellite community should attain a level of services which provide adequate sewer, water, drainage, police, fire protection, schools, parks, libraries, etc.
   b. The recommended community facilities discussed earlier in the section pertaining to community facilities constants would apply directly to the satellite plan.

6E. Transportation

1. Regional
   a. The existing road networks between cities and the proposed satellite communities should be upgraded where needed to accommodate higher traffic volumes.
2. Cities and Satellite Communities
   a. The existing urban areas would be primarily concerned with upgrading existing networks, especially around commercial and industrial areas, where the people from the satellite areas will tend to concentrate activity (jobs, shopping, etc.).
   b. Satellite communities should develop road systems harmonious with the overall development and the natural surroundings. This would mean minimizing the grid type system. This would also mean that the extent, appearance, function, and cost

of the road system would depend upon the development scheme and would vary with each community.

7. DISPERSED PLAN FOR DOWNRIVER AREAS (See Map T in the Map Section of this report)

A dispersed development plan would minimize growth in the urban areas, allowing for a more scattered rural type lifestyle. There would be fewer people receiving urban services than in any of the other alternative plans with larger scatterings of light residential throughout the uplands areas. This plan would contain the smallest number of people (56,700) due to its scattered, less urbanized character. It would tend to minimize the dynamic urban situation, causing a slower degree of population influx. This plan would project 25,000 persons in the urban areas, and 31,700 persons in the rural low density residential areas throughout the planning area.

	Dispersed Plan Costs
Water	$ 5,780,300
Sewer	2,548,799
Roads	16,006,760
Schools (See Educational Facilities and School Cost Estimates)	
Libraries	464,084
Police Protection	727,806
Parks (See Parks and Open Space Element)	
TOTAL	$25,527,749

For further details see chapter on Developmental Costs.

7A. General Conclusions and Recommendations

1. The policy constants recommended earlier would apply to this alternative plan.
2. Future development would be scattered throughout the uplands area on larger lots (1-5 acres, 2.5 acre average). See Map T in the Map Section of this report.
3. The existing urban areas would expect minimal growth, with 'filling-in' to existing boundaries and improving existing areas being the primary concerns.

4. The recommended areas were developed by an analysis of the various physical characteristics such as soils, slope, septic suitability, flood safety, and high desirability as expressed by the land-use simulation exercise.

7B. Urban Areas

1. Mount Vernon, Burlington, Sedro Woolley
    a. Minimal growth in these areas emphasizes the importance of improving existing areas.

7C. Geographic Areas

1. The dispersed plan in the map section of this report depicts areas suitable for a dispersed form of development.
2. Big Lake/Walker Valley would be very susceptible to this dispersed rural type residential development. However, the lake itself would be of a higher density.
3. The Conway Hill area would also be developed as light residential under this plan.
4. Pleasant Ridge and its adjacent flood safe areas would be susceptible to increased light residential use.
5. Bayview Hill would be another large area suitable to this dispersed plan. This would include much of the fine view property on the sides of the hill, which has good developmental characteristics.
6. Bow Hill would be another area whose physical characteristics make it attractive for residential uses.
7. The area approximately 2 or 3 miles north of Sedro Woolley would also be considered as having good potential for light residential uses.
8. Other areas of lesser size considered good for light residential use would be the Day Creek Road area east of Clear Lake, the Baker Heights area, the hillside area south of Mount Vernon, the Lake McMurray area, the hill area above Milltown (southern boundary, west of Interstate 5), Samish Island, the Bear Creek

area just south of Lake Samish, the Alger area, and parts of Butler Hill.

7D. Community Facilities

1. Regional
   a. Where possible, regional service and utility cooperatives would be formed to give the residents higher and more equal levels of service. This is especially important with respect to sewer, water, drainage, libraries, hospital, police, fire protection, and schools.
2. Community facilities for the dispersed plan would not be greatly expanded, except in areas which presently have deficiencies in existing levels of community facilities.

7E. Transportation

1. The Urban Arterials plans, and the relevant recommended additions to the existing traffic network in the "Combined Road Configurations for Alternative Land-Use Plans" would facilitate the development of the dispersed plan for land-use development.

ALTERNATIVE LAND USE PLANS UPRIVER

The Upriver areas of the Skagit River Floodplain and related Uplands, because of their unique characteristics, were treated as a special planning area. This area was analyzed using the same physical, flood, and economic characteristics as the other areas within the study.

The recent opening of the State Route 20 (SR20), the North Cascades Highway, has created special and rapidly developing pressure upon the use of desirable lands in this area. The Comprehensive Planning Alternatives developed during the course of this project are discussed on the following pages. Two alternative land use models for the Upriver area are displayed in the map section of this report.

The public hearing process and numerous meetings with interested citizens failed to develop a positive concensus for either of the proposed alternative land use models for the Upriver area. This lack of concensus has curtailed the possibility of developing a specific set of alternatives for the Upriver planning area, at this time.

By continuing meetings with the Upriver citizens groups, a plan that more nearly reflects the positive desires of Upriver area residents will be developed.

The constraints of time and finances have precluded the development of a satisfactory Upriver plan.

The interim one year period, proposed by this study, for reflection upon the planning alternatives outlined elsewhere in this report, will be used to follow through on the development of a comprehensive plan that meet the goals and objectives that follow this section and is satisfactory to the majority of the Upriver residents.

The subsection on Upriver Alternative Development Models is included in this report to establish the benchmark to be used in developing a satisfactory comprehensive plan for the Upriver area.

1. UPRIVER GOALS AND OBJECTIVES

Objective	Methods of Achieving Objective
1. To keep river setting as natural as possible.	1a. All land in the river floodway (below ____ year flood frequency) shall be designated for agriculture and open space uses only and residential structures shall be precluded.
	1b. All structures (except agricultural buildings) located within ____ feet of the mean high water line shall be approved by planned development procedures to insure: 1. that structures are not located unnecessarily close to the river or lake 2. that structures do not block the view of adjacent properties more than necessary 3. that trees and vegetation are used to reduce the visual impact of the structure wherever possible 4. that architecture is harmonious with adjacent structures and that community established architectural themes be honored (when established) 5. that bulkheads (and other protective devices) and docks be constructed only where necessary and and designed to be as visually unobtrusive as possible
	1c. Clear cutting should be limited to ____ acre stands in areas visible from major rivers, highways, and designated communities; and patterned in non-geometric shapes.
2. To insure the maximum recreational use of the river.	2a. A system of riverside trails should be established.

Objective	Methods of Achieving Objective
	2b. A system of public parks should be established to compliment the riverside trail system.
	2c. Riverside easements should be obtained wherever possible and however possible to compliment 2a.
3. To insure against pollution of the river.	3a. ____ acre minimum lot sizes should be established in the vicinity of waterways except when served by community sewerage systems.
	3b. Industrial land uses should be discouraged within ____ mile of waterways unless psecial anti-pollution measures are undertaken.
	3c. Only selective tree harvesting should be permitted within ____ feet of the river or major tributaries.
	3d. Minimum setback of septic drainfields should be ____ feet from the mean high water mark.
4. To promote the propagation of fish and wildlife.	4a. By promoting the establishment of fish hatcheries wherever possible.
	4b. By designing bank protection devices, channel modification, and river impoundments in a manner that has minimum impact upon fish runs, fish feeding, spawning, etc.
	4c. By encouraging the establishment of conservation areas for birds and game whenever feasible.
	4d. By legislating minimum flow standards for the dams on Skagit River.
5. To maintain the rustic qualities of the Upriver Area (an economic objective presented in the Northwest American Report).	5a. By establishing ____ acre minimum residential lot sizes in all areas not served by community sewer systems.
	5b. By regulating the cutting of large trees in residential and commercial districts.

Objective	Methods of Achieving Objectives
	5c. By establishing area-wide guidelines for architectural styles and/or materials especially for commercial development; enforced by the use of a design review board composed of local citizens and professional designers.
	5d. By adopting landscaping standards for parking lots, camping areas, mobile home parks, trailer parks, and commercial street frontages.
	5e. By adopting regulations on the design, size, and location of signs as approved by design review board. (See 5c)
	5f. By clustering all commercial development in existing centers located at: 1. Lyman intersection 2. Grandy Creek intersection 3. Town of Concrete 4. Rockport 5. Marblemount
6. To promote economic prosperity through development and management of tourist and forest resources.	6a. By promoting the development of tourist-recreational centers at: 1. Concrete 2. Rockport 3. Marblemount 4. Newhalem* 5. Baker Lake* (* out of county)
	6b. By encouraging a diversity of recreational activities at each tourist-recreational center including: 1. camping 2. hiking trails 3. fishing facilities 4. horse rental and trails 5. motor bike rental and trails 6. A.T.V. & snowmobile rental & trails 7. boat rental 8. complete guide services 9. tourist information centers

Objective	Methods of Achieving Objective
	6c. Encourage properly designed private campgrounds and recreational services by establishing competitive cost rates for public campgrounds and recreational services.
	6d. Establish nature interpretive center at Rockport State Park with a nature trail to the top of Sauk Mountain.
	6e. Promote the use of logging roads for motorized recreation vehicles.
	6f. Promote the use of abandoned right of ways and utility easements for horse trails, hiking, and bicycle trails.
	6g. Promote further processing of forestry harvest and wood products in the upriver area.
	6h. Explore the feasibility of mineral mining and processing in the upriver area (within the context of environmental objectives).
	6i. Join with other tourist-recreational centers of the four-county area in promoting the recreational attributes of the north counties on a nationwide basis.
7. Promote efficiency in providing public services to keep taxes at the lowest possible level.	7a. Permit higher density development only in designated service centers where sewers, water, fire, police, schools, playgrounds, streets, medical services, drainage, commercial services, etc., can be effectively and efficiently provided.
	7b. Permit ____ acre minimum lot sizes within ____ miles of a service center and ____ mile of a city or county road.
	7c. Limit all residential development outside of the ____ mile radius to ____ acre minimum tracts except forest lands which should be ____ acre minimum tracts.

Objective	Methods of Achieving Objective
	7d. Special areas for vacation homes should be provided at the ____ acre minimum lot size on the condition that full services will not be provided (winter road closures, no school services, gravel roads that are privately maintained, etc.).
	7e. Establish Sedro Woolley, Concrete, and Marblemount as major service centers serving the area to Newhalem with each having the following services: 1. police (sheriff) station 2. ambulance 3. towing 4. medical center 5. library 6. vocational training (including fire fighting) 7. social counseling
8. Promote health and safety.	8a. Adopt the standards of the County Health Department to be uniformily applied throughout the Upriver area.
	8b. Eliminate road intersections on SR20 wherever possible so that the necessary access points can be lighted and marked for reduced speeds and turning lanes installed.
	8c. Eliminate arterial - railroad crossings wherever possible and insure proper signalling of those that are necessary.
	8d. Discourage riverside recreation areas in places characterized by rapid current and/or fluctuating flows.
	8e. Prohibit untrained boaters from floating the river above Rockport.
	8f. Prohibit septic drainfields below the ____ year flood elevation unless protected by ____ year dikes.
	8g. Protect urban centers with dikes capable of withstanding ____ year floods whenever possible.

Objective	Method of Achieving Objective
	8h. Establish ____ acre minimum lot size in areas that are below the ____ year flood elevation.

2. ALTERNATIVE STANDARDS FOR RESIDENTIAL DEVELOPMENT IN THE UPRIVER AREA

A. Criteria Common to all Alternatives

1. All land below 15 year flood level in Open Space.
2. Areas over 15% slope not recommended for home construction.
3. Preference for development given to lands closer to urban centers and highways.
4. Must demonstrate need for lot division.

B. Recommended Alternatives

1. Five Acre - Planned Development Alternative (See Map U)
   a. All potential residential areas zoned in five acre lot size; keep five acre short plat standard.
   b. Reduce to one acre minimum lot size by planned development with design review accomplishing the following:
      1. Demonstrate sewerage capability - alternative systems possible.
      2. Preserve natural vegetation.
      3. Provide common recreation and open spaces (trails, picnic areas, etc.)
      4. Exception -- May incorporate areas below 15 year flood level for a portion of land area requirement.
2. Five Acre - One Acre Alternative (See Map W)
   a. Most suitable areas zoned to one acre density.
   b. Less suitable areas in the five acre zone.
   c. Increase short plat standard to ten acre.
   d. Planned development recommended when community sewerage systems are employed so houses may be clustered.
   e. Other lands may be rezoned to smaller lots upon approval of perculation or sewerage system.

3. ANALYSIS OF ALTERNATIVES

3A. Alternative A - Five Acre Planned Development

This alternative provides the maximum achievement of flexibility in design and maximum achievement of environmental objectives. Trees and natural foliage can be preserved and natural recreation areas (such as river frontage and natural meadows) can be allocated for maximum use. If successfully administered, the riverside areas can achieve a moderate density of development while protecting the rustic qualities that characterize the river.

Simplicity in land sales is achieved through retention of the five acre minimum standard (exception from the subdivision requirements). But short platting would be achieved through Planned Development only which should tend to discourage five acre sales when further division is contemplated.

3B. Alternative B - Five Acre - One Acre

Primary advantage to this alternative is convenience to the developer since large areas would be pre-zoned to the one acre density. The rezone policy for five acre areas would help forewarn land purchasers of potential septic problems. This alternative affords less environmental protection than "A" since there would be little or no control of tree cutting or land clearing practices.

The increase to the 10 acre minimum standard for short plat is recommended to slow division to one acre parcels via short plat and to encourage the use of formal subdivision practices for the division of larger tracts of ground. According to the short plat ordinance an interim period of five years would be required between the initial split of the 10 acre parcel to 2 1/2 or 3 parcels and the eventual split to one acre parcels.

Table 1

POPULATION PROJECTIONS FOR UPRIVER

District	1960	1970	1990 - Range
1	1,490	952	990 - 1,142
2	1,441	584	607 - 1,102
3	1,643	903	898 - 1,124
Lyman	400	317	295 - 369
Hamilton	271	195	182 - 234
Concrete	840	558	589 - 703
TOTAL	6,085	3,509	3,561 - 4,674

Skagit County Planning Department Preliminary Population figures 6.6% of the total population of Skagit County live in the Upriver Study area.

INTERIM PROJECTED POPULATION OF SKAGIT COUNTY
BY THE STATE OF WASHINGTON (O.P.P.F.M.)

1970	52,381
1975	52,700
1980	52,950
1985	53,200
1990	53,500
1995	53,700
2000	54,000

If 6.6% of the total population of Skagit County continue to live in the Upriver Study area, the projected population will be:

1970	3,457
1975	3,478
1980	3,494
1985	3,511
1990	3,531
1995	3,544
2000	3,564

4. COMMUNITY DESCRIPTIONS

4A. The City of Concrete is the gateway to the southern portion of the Mt. Baker recreation area. Concrete was first known as "Baker" until it was incorporated in 1909. The location of the Portland Cement Company Plant in 1905 changed the image of the community to "Cement City" and thus its incorporated name.

Concrete is located in the heart of the Skagit River Valley on a bench that overlooks the river itself. To the north and immediately behind the community, the land rises sharply forming the northern boundary to the community. The eastern and southern edges are formed by the Baker and Skagit Rivers, respectively. Concrete's pattern of development reflects its history as a company town. Most of the residential development is around two industrial areas. The high percentage of vacant land in between is due for the most part to topographic conditions. The downtown is a compact retail area of about two blocks in length and terminating on the east at the City Hall.

The Baker and Skagit Rivers form the east and south edges to the community. The community is located on a bench providing a vantage point from which to enjoy both of these natural assets.

The planned SR20 bypass of the main portion of Concrete has just been completed. While it might appear that the bypass could be a detriment to the downtown, it will serve to separate the travelers from the visitors to Concrete and to make access and parking in the downtown much easier and safer both for the visitor and resident.

The results of the demand/need analysis (Table 2), indicates both the need for expansion of existing facilities as well as some new facilities. The four highest demands for traveler services (gasoline service, restaurant-drive-in, gifts and hotel/motel) could be combined into generating a single complex rather than separate establishments. Also, it should be noted that because of the potential for additional outdoor recreation activities around Concrete, higher levels of damand for groceries and general merchandise are possible. The Baker Lake recreation area will become increasingly more important as a recreation attraction independent of the opening of SR20. Currently under study is the location of an Information Center for both the North Cascades National Park and the Mt. Baker National Forest. This development offers a great potential for Concrete to be more directly identified with the National Park and the surrounding National Forest.

Zone two extends east from Sedro Woolley to the east side of Concrete. Included are the smaller communities of Lyman, Hamilton, and Birdsview. Each of these areas has already some developable land. However, any additional commercial development in these unincorporated areas should be discouraged.

In order to allow for the continued compact character of Concrete's business area, it is recommended that any new commercial establishments be developed in or near the downtown area. By maintaining a close physical relationship to the downtown, the business venture as well as the downtown would benefit from this interaction.

As outlined in the analysis of Sedro Woolley, the Skagit County Development Association is pursuing an idea to have an excursion train as a part of Seattle's City Light Skagit Tours. With the train terminating in Concrete, the opportunity exists to identify and offer the community's facilities to visitors.

A link between the existing business area and the railroad station could be strengthened through establishment of a local Information Center. This could provide a logical reference point for the North Cascades traveler. With a potential demand for 20 to 25 motel units facilitated into the complex a strong highway orientation can be retained. Because Concrete has a compact downtown, the business community has the potential to provide for a stronger business identity. Adoption of a design motif is not necessarily the only approach. Coordinated cleaning, painting and remodeling that realizes each

Table 2

DEMAND/NEED SUMMARY

CONCRETE

Expenditure Category	Allocated Expenditures (000) 1973	1975	1980	1990
Gasoline	$ 88.2	$107.3	$123.9	$194.1
Groceries	42.0	50.0	64.5	94.7
General	35.5	40.6	54.2	70.3
Gifts & Curios	22.4	26.5	33.4	49.6
Restaurant & Drive-in	42.7	44.8	52.3	82.0
Sub-total	$230.7	$269.2	$328.3	$490.7
Direct jobs*	3.1	3.7	4.5	6.9
Hotel-Motel	$ 17.5	$ 20.9	$ 25.0	$ 37.7
Campgrounds	15.5	18.1	21.5	31.6
Sub-total	$ 33.0	$ 39.0	$ 46.5	$ 69.3
Direct jobs	.3	.4	.5	.7
Total Expenditures				
Low	$263.7	$308.2	$374.8	$560.0
High	296.7	346.7	421.7	630.0
Total Direct Jobs				
Low	3.4	4.1	4.8	7.6
High	3.8	4.6	5.4	8.6

*Full time, year-round job equivalents

business has a business neighbor can be accomplished without strict uniformity of design. The thrust of remodeling, however, should be to project a more common identity. Examples of this would be coordinated signing, street furniture, and landscaping and compatibility of colors and materials among business structures.

4B. Rockport - Zone 3

Rockport is an unincorporated community located at the intersection of the Skagit and Sauk Rivers. The site is on a small sloping bench of land at the foot of Sauk Mountain. Rockport enjoys a panoramic view of the river basin.

The land use pattern in Rockport is characterized by scattered residential units and a few small commercial establishments. Except for a gas station - general store located on SR20, the few commercial businesses are within the community and oriented more to the old highway. Rockport State Park, a 500-acre facility, is located just west of the community on the slopes of Sauk Mountain. This facility, along with the Sauk River County Park in Rockport, strongly affect the summer character of the area.

SR20 and the Darrington Road intersect just north of the main body of Rockport. As the North Cascade area becomes more familiar to many visitors, this intersection will help to make Rockport a "more natural stopping place."

Table 3 , the demand/need analysis for Rockport, indicates that the potential exists at the most for only one additional multi-functional business along with expansion of existing facilities. It is expected that proper utilization of existing facilities could meet all the anticipated demand.

Along with the 50 new camping units at Rockport State Park, a consideration is also being given to the establishment of an interpretive center and view point at the top of Sauk Mountain. This development would further strengthen commercial ventures in Rockport.

Table 3

DEMAND/NEED SUMMARY

ROCKPORT

Expenditure Category	Allocated Expenditures (000) 1973	1975	1980	1990
Gasoline	$ 34.6	$ 44.4	$ 57.2	$ 83.0
Groceries	28.8	34.7	43.3	69.2
General	24.3	28.2	33.3	51.4
Gifts & Curios	15.4	18.4	22.7	36.2
Restaurant & Drive-in	55.3	61.2	71.4	118.9
Sub-total	$148.4	$186.9	$228.9	$358.7
Direct jobs*	1.5	1.9	2.3	5.6
Hotel-Motel	$ 13.1	$ 15.7	$ 18.8	$ 26.0
Campgrounds	17.5	20.4	24.3	35.8
Sub-total	$ 30.6	$ 36.1	$ 43.1	$ 61.8
Direct jobs	.3	.4	.4	.6
Total Expenditures				
Low	$189.0	$223.0	$271.0	$420.0
High	212.6	250.9	304.9	472.5
Total Direct Jobs				
Low	1.8	2.3	2.7	6.2
High	2.0	2.6	3.0	7.0

*Full time, year-round job equivalents

The proximity of Rockport to the river offers a great potential and incentive for development. The community, for the most part, has not maximized the potential of this natural resource. For example, a good restaurant located in a manner to provide a view of the river and the valley itself could command a greater share of the demand than allocated in Table 3. In conjunction with the restaurant facilities, motel accommodations might be developed. The demand/need analysis indicates (Table 3) that 13 to 16 motel units will be needed by 1980. The combination of a restaurant-motel complex located with a view of the river would help to re-identify Rockport to the North Cascade traveler.

The demand/need analysis also indicates that about 100 to 110 additional camp sites are needed in addition to the 50 under construction at Rockport State Park. Visitors to the State Park would have a greater enjoyment of the area if the Park had an orientation to the Skagit River. The expansion would also permit the Sauk River County Park, a camping park, and the Rockport State Park to be physically and visually connected. This interaction would not only benefit the park user by increasing his selection of camping sites and his enjoyment of the Skagit River, but is would help to fuse the relationship between the camping areas and the business community. Public access to and enjoyment of the riverfront is another positive consideration.

4C. Marblemount - Zone 4

Marblemount, like Rockport, is an unincorporated community. The history of Marblemount goes back to the 1880's when this area was a center of logging and mining. Some of the original town structures are still in use.

The Marblemount area is the last large bench of relatively flat land before reaching the rugged terrain of the North Cascades. This bench was apparently formed by the joining of the Skagit and Cascade Rivers at Marblemount.

The Marblemount community is located back from the river. The business section is clustered around the intersection of SR20 and the Cascade River Road. Scattered residential development exists both north and west of the business area along the highway. In addition to the commercial activity clustered in Marblemount, the small settlement of Corkindale, about two miles to the west, also has several retail establishments.

Presently, SR20 is routed through Marblemount which makes a 90^{o} angle turn at the Cascade River Road and continues northward. The State Highway Department is presently studying alternatives to rerouting the highway to by-pass the Marblemount commercial area. The rerouting of SR20 past Marblemount will effect the future land development pattern for the community. At present, the future route is unknown. Its ultimate location is critical to planning decisions. However, a new routing should permit a better relationship between the river and the expansion of retail businesses in Marblemount.

Table 4 presents the allocated demand/need for various types of retail activities. As noted by the Table, a very optimistic level of business activity is indicated for Marblemount. Envisioned is substantial expansion of the existing general-grocery store, restaurant, gas station and gift store. The expected 1980 visitor demand could also support the construction of an additional gas station, restaurant and three or four 10-12 unit motels.

The Marblemount area, being a large bench of land in the Skagit River Valley, has many possible developable sites for commercial activities. However, based on the premise of clustering, it is recommended that any new commercial developments be generally within the existing Marblemount business area.

A water-oriented county park on the Skagit River in Marblemount is presently being considered. This park would provide the terminus to the proposed riverfront trail running downstream to Rock Creek, a distance of 5.5 miles. This trail will help insure a continued open space and river access for the area. The proposed County Park at

Marblemount and the existing Sauk River County Park at Rockport together will form a system of public open spaces and access on the Skagit. In order to link these two facilities together in a recreational system, it is recommended that the proposed riverfront trail extend beyond Rocky Creek an additional four miles to the County Park at Rockport.

This extended recreational system could help meet the projected camping demand for the Marblemount area. As Table 4 indicates, by 1980 there will be a demand for 420 to 450 additional campsites. This is an increase of nearly 10 times of the existing number in the area. Because of limited developable public land, only about 50 to 100 of the 450 campsite demand will be met by the U. S. Forest Service and Skagit County. The remaining demand will be unmet if it cannot be accommodated by private development of campgrounds. It may become necessary for the State Parks and Recreation Commission to meet the potential deficit.

Several potential campsite areas exist around Marblemount. One of the most desirable would be near the intersection of the Skagit and Cascade Rivers. This site, near the proposed County Park and the Marblemount business community, could be developed in a multi-recreational manner. Along with camp and trailer sites, provisions for equestrians could be made. In addition to general area riding, trail packing over the Cascade Pass to Lake Chelan would be an easy and beautiful trip. The facility could take on a "Duke Ranch" air offering urban residents a taste of the old west.

Much of the potential for development lies beyond the traveler to the North Cascades. Marblemount is one of the unique communities along the route that, with careful planning, can become an important recreational community for development. The community already has developable land, the river and its assets, the proposed County Park and a built-in tourist demand from visitors crossing over the North Cascades. Two problems necessitate further analysis and planning:

Table 4

DEMAND/NEED SUMMARY

MARBLEMOUNT

Expenditure Category	Allocated Expenditures (000) 1973	1975	1980	1990
Gasoline	$119.5	$149.0	$193.6	$ 268.4
Groceries	55.5	115.5	171.5	258.6
General	46.9	79.9	149.6	211.2
Gifts & Curios	29.6	36.7	60.8	100.9
Restaurant & Drive-in	156.5	171.3	204.6	339.1
Sub-total	$408.0	$552.4	$780.1	$1,278.2
Direct jobs*	5.1	8.0	14.8	24.0
Hotel-Motel	$ 20.0	$ 35.4	$ 50.9	$ 75.4
Campgrounds	17.7	38.9	51.6	77.0
Sub-total	$ 37.7	$ 74.3	$102.5	$ 152.4
Direct jobs	.9	1.2	2.0	3.0
Total Expenditures				
Low	$445.7	$626.7	$882.6	$1,330.6
High	501.4	705.0	992.9	1,496.9
Total Direct Jobs				
Low	6.0	9.2	16.8	27.0
High	6.8	10.4	18.9	30.4

*Full time, year-round job equivalents

Total Job Increase Upriver by 1990 ---- 46.0

1) the non-clustered commercial development away from the existing business community, and 2) the magnitude of potential non-compatible commercial activities in Newhalem and Diablo.

Prepared for: Washington State Parks and Recreation Commission, by Community Development Services, Inc.

IMPLEMENTATION

1. ORDINANCES

To effectively implement the land-use planning alternatives recommended by this report, it will be necessary to amend several of the existing land-use development/control ordinances presently in use in the Skagit Regional Planning area.

The Zoning Ordinances, the Subdivision Ordinances, and Short Plat Provisions of the county and of the cities should be amended. Of particular importance is the formulation of a completely revised zoning ordinance for the county, due to the inadequacies, age, and status of the present Interim Zoning Ordinance. Additionally, the floodplain management ordinance will need to be revised to include the recommendations of this report. As explained in the introduction of this report and as mentioned in the summary, it is not anticipated that a final Comprehensive Plan will be approved and adopted for one year.

Due to this lack of a final Comprehensive Plan, any specific recommendations regarding the revisions of the ordinances would be premature.

Amendments to existing zoning ordinances will be recommended when the decision is reached concerning which of the alternative land use plans will be adopted as a Regional Comprehensive Plan.

The Open Space Taxation Law is presently assisting the implementation of the recommendations of this report with regard to preservation of agricultural lands for flood safe uses. It is a recommendation of this report that this legislation not be amended at this time.

2. UPRIVER PLANNING

It has been recommended that the County Board of Commissioners appoint a special study group in the upriver area that will reflect the attitudes of the upriver area residents. A special study group, assisted by the Skagit County Planning Department, should be able to reach a decision on a Comprehensive Plan for the upriver area within the one year period.

3. SHORELINE MASTER PLAN PROGRAM

During the one year review period, it is anticipated that the Comprehensive Plan affecting the Fidalgo and other islands, and all the tidelands areas will be reviewed under the Shoreline Master Plan Program.

4. RIVER BASINS PROGRAM

The River Basins Program, which is directly related to water quality, will be completed by July 1, 1974. This program will refine and detail the existing Skagit County Water, Sewerage and Drainage Facilities Plan. Additionally, the River Basins Program will greatly expand the data available with regard to cost of water, sewer, and drainage facilities throughout the entire Skagit Regional Planning area.

5. FLOODPLAIN MANAGEMENT

The Floodplain Management regulations adopted as an amendment to the Interim Zoning Ordinance #4081 by the Board of County Commissioners in December of 1971, outlines certain precautions to be taken when considering construction in areas subject to flooding. It specifies conditions for construction on all lands within the floodplain (based on the fifty (50) year frequency flood level established by the Army Corps of Engineers).

It is felt that in order for any of the alternative plans presented in this report to be a significant guide for development in the region, regulations for management of the floodplain areas should be followed by county government and by the various municipalities and special districts within the floodplain.

The following is the Floodplain Management Amendment as adopted by the Board of County Commissioners:

1. All construction or structures on land situated within the floodways that are or will be established by the Corps of Engineers shall be permitted by conditional use permit only. Such permits shall only be issued when:
   a. The structures, works, or obstructions are designed so as not to be appreciably damaged by flood waters.
   b. The structures, works, or obstructions shall be placed or affixed upon the property so as to offer the minimum obstruction to and effect upon the flow of flood water.
   c. The structures, works, or obstructions shall be firmly anchored or affixed to the property in order to prevent dislocation by flood water and damage to life, health, and property.
   d. The structures, works, or improvements will not adversely influence the regimen of any body of water by restricting, altering or hindering, or increasing flow of the flood waters in the floodway or flood channel expected for a maximum flood of up to a fifty (50) year frequency.
   e. The structures, works, or improvements meet all other zoning requirements and State regulations W.A.C. 508.60 and R.C.W. 86.16.
2. All lands situated below the fifty (50) year frequency flood level[(1)] except for properties included in above noted paragraph shall be classified as floodplain and as such the following conditions shall be required:
   a. The floor level of structures for residential, commercial, or industrial use shall be located above the fifty (50) year frequency flood level.[(1 & 2)]

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(1) As established by Army Corps of Engineers.
(2) Limitations shall apply only to those structures used for human occupancy, or the principal buildings housing commercial, or industrial operations. Limitations shall not apply to barns, garages, or other accessory structures and their contents which are not susceptible to major flood damage.

b. All furnace fire pots and electrical distribution panels shall be placed above the fifty (50) year frequency flood level[1].

c. A certified benchmark[3] shall be located within 200 feet of all proposed structures in the floodplain area prior to issuance of a building permit.

3. All structures located on tract 20 acres or larger in an agricultural zoned area are exempt from the standards[4].

6. FLOOD CONTROL METHODS

If at all possible, through means of stratigically located levees, elevated highways, etc., the existing urban areas within the floodplain should be protected from flooding to at least the 50 year frequency level (see Flood Characteristics Section for details). Efforts should begin immediately to solve this problem. The Army Corps of Engineers should be requested to give assistance in developing an acceptable solution. The Planning Department will continue working closely with both the Army Corps of Engineers and with various municipalities with respect to urban flood control. A step toward providing an even distribution of flood protection for all cities would be the consolidation of the many diking districts into a regional organization.

7. COMMUNITY FACILITIES

When one of the alternative land use plans is adopted, it will be necessary to develop a concise, well documented, community facilities element to accompany the Skagit Regional Comprehensive Plan. The scenario which describes and evaluates each of the alternative land use plans is a rudimentary beginning of a community facilities element. The community facilities plan should precisely describe the needed public services of a cultural, recreational and personal service nature. The one year review period, and regular discussion with the Cultural and Personal Services Technical Advisory Committee will produce an effective and useful

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(3) Benchmark as established by a registered land surveyor or registered civil engineer.
(4) Structures constructed not in conformance with these standards are not eligible for flood insurance.

community facilities element to accompany the Skagit Regional Comprehensive Plan.

8. TRANSPORTATION

As suggested in the scenarios which describe and evaluate the alternative land use plans, the Skagit Regional Planning area is well served with existing, fully documented Urban Arterial Plans. Skagit County and the cities will continue to have an adequate and satisfactory arterial road network.

The combined road configurations for alternative land use plans should be examined for possible inclusion in the future proposals to the Urban Arterials Board. As the Skagit Region develops, additional collectors and arterial roads will be needed to serve the present and future residents of the Skagit Regional Planning area.

9. PUBLIC OPINION SURVEY

It has already been mentioned that the opinion survey developed for the citizen input element of this report should become a regular occurrence in the Skagit area. It may be possible to use this method to obtain public opinion as to which alternative land use plan should be adopted as the Skagit Regional Comprehensive Plan. A question calling for a choice among the alternative land use plans could be easily added to an opinion survey format. It might also be worthwhile to add a question pertaining to these choices on the next election ballot, or to treat the question as a special referendum issue at some other point in time.

10. LAND USE SIMULATION EXERCISE

It is suggested that the land use simulation exercise discussed in the Community Goals and Objecitves portion of this report be used to follow through as a method to keeping the public informed about the planning process and to facilitate the choice of which alternative land-use plan should be adopted and implemented for the Skagit River Floodplain and Related Upland areas.