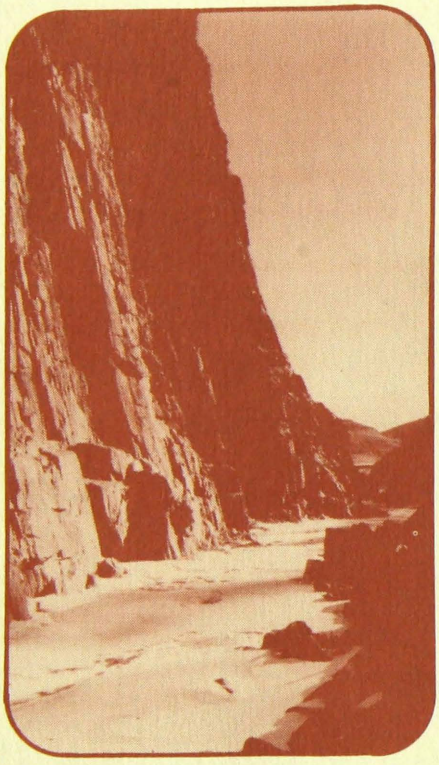
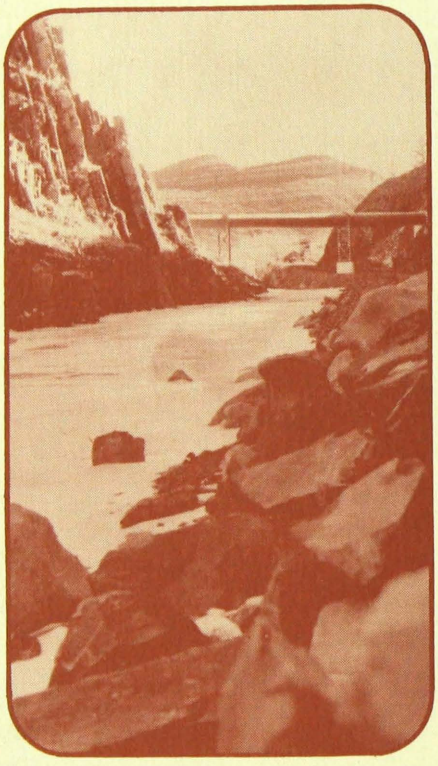
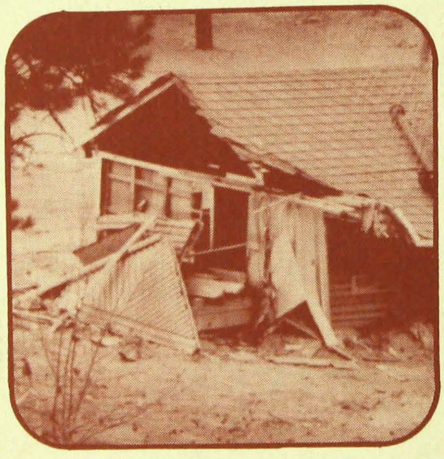
big thompson disaster recovery planning report







toups corporation

VOLUME 3

BIG THOMPSON DISASTER
RECOVERY PLANNING REPORT
(PHASE B)

September, 1977

Prepared For: Larimer-Weld Regional Council of Governments
201 East Fourth Street
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(303) 667-3288

and

Big Thompson Recovery Planning Office
201 East Fourth Street
Loveland, Colorado 80537
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Prepared By: Toups Corporation
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The preparation of this report was financed in part through an urban planning grant from the Department of Housing and Urban Development, under provisions of Section 701 of the Housing Act of 1954, as amended.

toups corporation

September 7, 1977

Big Thompson Recovery Planning Office
201 East 4th Street
Loveland, Colorado 80537

ATTN: Mr. Willard Quirk
Flood Recovery Coordinator

Dear Willard:

Toups Corporation is pleased to submit the report entitled "Big Thompson Disaster Recovery Planning Report - Phase B" in accordance with our contract with the Larimer-Weld Regional Council of Governments. This report presents the data analysis and alternatives developed during the second phase of the Big Thompson Disaster Recovery Planning Program.

Volume 3 of this report is divided into the following chapters designed to supplement the material presented in Volumes 1 and 2:

Chapter VI	- Land Use Opportunities and Constraints
Chapter VII	- Land Use Alternatives
Chapter VIII	- Water Quality Management
Chapter IX	- Police and Fire Protection
Chapter X	- Land Use Alternative Evaluation

Volume 4 includes the maps supporting the documentation presented in Volume 3.

This report documents the methodology used to develop the land use alternatives and describes each alternative. Water quality management techniques are also summarized including water supply and wastewater treatment options. These options will be presented in detail in a subsequent document. The existing and required levels of police and fire protection are identified and then compared with the land use alternatives.

toups corporation

We wish to acknowledge the assistance and consideration demonstrated by all persons and organizations who contributed to the preparation of this report. Special thanks goes to the residents of the study area who provided us with their ideas and concerns which are hopefully reflected in the alternatives.

Should any questions arise regarding the content of this report, we would be pleased to discuss them at your convenience.

Very truly yours,

TOUPS CORPORATION

Curt Smith

Curt Smith
Project Manager

CS/bt

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

[a] These tables are included in Volume 4.

LIST OF FIGURES AND MAPS

LIST OF FIGURES AND MAPS (Cont.)

*These Maps and Figures are included in Volume 4.

EXECUTIVE SUMMARY

The purpose of this report is to document the land use alternatives for the Big Thompson Disaster Recovery Planning Program and to describe the methodology used to develop the alternatives. In addition, this report summarizes the water supply and wastewater management alternatives for the study area which will be documented in detail in Volume 5. The existing and required levels of police and fire protection are identified and then compared with the land use alternatives in a detailed evaluation of the alternatives.

LAND USE OPPORTUNITIES AND CONSTRAINTS

As a basis for the land use alternatives the physical characteristics evident in the study area (see Volumes 1 and 2) were analyzed to identify the opportunities for and constraints on development or redevelopment. The factors considered in this analysis were flood hazards, geologic hazards, slope, and accessibility. This evaluation was used to develop a series of maps portraying land that could easily accommodate development, land that could be developed pursuant to implementation of measures to reduce or eliminate hazards, and land that should not be developed due to location in extremely hazardous areas. Chapter VI describes the land use opportunity and constraint analysis in detail and presents the development potential maps mentioned above.

LAND USE ALTERNATIVES

Various alternatives exist for the ultimate redevelopment and/or new development of the study area. These alternatives are conditioned by the land use opportunities for and constraints on development, existing land use and ownership patterns, wildlife distribution and activity, and the desires of local residents. Rather than attempting to construct the infinite variety of alternatives possible, three alternatives have been developed which encompass the full spectrum of potential development patterns in the study area. The first alternative constitutes continuation of existing land uses but no expansion of development, either commercial or residential. The second alternative assumes full residential development of those areas deemed suitable for development based on the above mentioned factors. The final alternative assumes full development of those areas deemed suitable for residential and/or commercial use. In those areas demonstrating potential for either residential or commercial development, commercial use was designated. It is foreseen that the final plan will constitute a composite of these alternatives resulting from the interchange of ideas in the public arena. A detailed description of each of the land use alternatives and the assumptions used to derive them is presented in Chapter VII.

WATER SUPPLY AND WASTEWATER MANAGEMENT ALTERNATIVES

A review of the existing water supply and wastewater management practices in the study area indicated that wastes from septic tanks were more than likely polluting the river

and most of the shallow water wells. This situation suggests that the health and safety of the residents and tourists is in jeopardy and that safer water supplies and more effective wastewater management programs must be developed especially if any additional development is to be allowed as suggested by two of the land use alternatives. Alternatives were developed for improving the water supply and the wastewater management programs. Those alternatives are summarized in Chapter VIII of this report and will be presented in detail in Volume 5.

The following tables summarize the costs associated with the water supply and wastewater management options. These costs assume a project life of 20 years and including capital and operating and maintenance costs, and generally assuming that the entire study area will be served. In certain cases options exist to only rebuild the systems that were damaged by the flood. The costs of these options will be included in Volume 5. Although these options represent the least cost solution, they do not solve the potential health problems in the area.

SUMMARY OF WATER SUPPLY ALTERNATIVE COSTS

SYSTEM	TOTAL COSTS ($1000)
Individual Wells	2685
Cluster Wells	1951
Community Surface Water	1931
Canyonwide Surface Water	3614

SUMMARY OF WASTEWATER
MANAGEMENT ALTERNATIVE COSTS

SYSTEM	TOTAL COSTS ($1000)
Lagoons	1520
Extended Aeration	2946
Clarifier/Filter	1090
Rotating Biological Contactor	4540
Vault and Haul	2977

The selection of the best option for the study area depends on the desires of the residents, the selected land use plan, and the willingness of Larimer County to pursue these options further. Therefore, no recommendations are made at this time; the water supply and wastewater management alternatives are presented simply to suggest the options available to Larimer County.

There is a general rather than specific relationship between the land use alternatives and the water supply and wastewater management alternatives. Any development beyond existing levels would intensify the present water quality and health problems in the study area. Therefore, implementation of a water supply and wastewater management program is increasingly necessary if the ultimate development pattern involves additional residential and/or commercial development.

To be eligible for Federal or state financial assistance, an agency responsible for managing, operating and maintaining the water supply and wastewater collection and treatment facilities must be established. Volume 5 will include a discussion of the types of agencies that would be eligible to receive grants.

CONCLUSION

The Big Thompson Disaster Recovery Planning Program has reached the decision making point. Alternative land use plans have been developed based on technical evaluation of the characteristics of the study area and on input from the local residents. Development suggested by two of the alternatives would necessitate implementation of a water supply and wastewater management program if existing water supply and health problems are to be addressed. The residents of Larimer County and their elected and appointed decision makers must now determine the most appropriate pattern of development and pursue steps toward its implementation.

CHAPTER VI

LAND USE OPPORTUNITIES AND CONSTRAINTS

The purpose of this chapter is to document the opportunities for and constraints on development and/or redevelopment in the study area. The section describing the general determinants of land use patterns includes discussions of the social and regulatory opportunities and constraints and identifies the importance of conducting a detailed analysis of the physical opportunities and constraints. This section is followed by an overview of the type of analysis done to identify the physical opportunities and constraints evident in the study area. The remainder of this chapter describes this analysis in detail and presents the results of the analysis conducted for the entire study area and for each of the communities designated for detailed planning.

GENERAL DETERMINANTS OF LAND USE PATTERNS

The interaction of physical, social, and regulatory factors within an area determine to a great extent its land use patterns. These factors are the land use determinants for that area and through their interaction create either opportunities or constraints for various land uses to develop.

PHYSICAL FACTORS

The physical factors that influence land use patterns are those geographically disposed resources that affect the ability of a particular parcel of land to accommodate various

land uses. A geographically disposed resource is one that can be directly tied to a particular geographic area. Economic and environmental resources act as physical determinants of land use patterns. Economic factors reflect the availability of certain resources, such as water or sewer facilities, for which there is a demand or which can be utilized to create a demand. When the demand exists, the development potential for that land will usually increase because the availability of the resource acts as an economic attractor of growth.

The environmental quality of an area can also serve as an attractor of growth due to amenity of the resource. On the other hand, certain environmental resources can impose physical constraints on or be extremely sensitive to certain land uses. The environmental resources evident in the Big Thompson study area are excellent examples of both types of environmental factors. The scenic nature of the canyon has historically attracted growth and development; while specific areas subject to flooding, landslides, rockfalls or unstable slope conditions impose constraints on development.

Economic and environmental resources are ameniable to spatial land use analysis because these factors can generally be directly related to particular land areas. Such an analysis was conducted for the study area and is described in detail below.

The social and regulatory determinants of land use are not included in this analysis because these factors are subject to change and frequently cannot be directly related to particular land areas. The factors influencing social and

regulatory land use determinants of the study area are discussed in the following sections, since they do play an important role in determining appropriate land use alternatives and patterns for areas under consideration in the recovery planning effort.

SOCIAL FACTORS

Through public forums residents are afforded the opportunity to voice their opinion concerning preferred land use types and density. Their expression of interest in support of or in opposition to specific land use issues occasionally will conflict with economic and environmental realities. However, if the residents' opinions are strong enough they can influence the decision making process and act as a land use determinant.

To facilitate the expression of the concerns and preferred land use patterns of the residents, two series of public meetings were held. At the first series of meetings the residents of each planning community were given the opportunity to review the baseline data collected for the Recovery Planning Program and to express their initial feelings as to how new development and/or redevelopment of their particular community or the entire study area should occur. The majority of the discussion at these meetings revolved around three issues:

1. The provision of a flood warning system;
2. Development of the floodway for recreational uses;
3. Provision of low cost housing in the study area as suggested in the preliminary goals and objections for the recovery planning program (see Volume 1, Chapter 2).

Since the recent flood, the residents of the study area have been harshly reminded of the devastating potential of the normally placid Big Thompson River. In recognition of this potential, the residents consistently expressed concern over the need to develop a flood warning system. This concern was relayed to the Big Thompson Recovery Council which is presently investigating potential courses of action to provide such a system for all canyons in Larimer County.

A great deal of discussion revolved around the suggested objective of acquiring the land in the canyon designated as a floodway for public recreational uses. The residents were extremely concerned over maintaining the character of those residential areas that were not destroyed by the flood and felt that recreational uses of the floodway would be incompatible with residential uses. Through further discussion, the residents were not opposed to public acquisition of those properties destroyed by the flood as long as future use of their lands was compatible with the surrounding community characteristics. One use that was generally considered to be compatible was open space.

The objective to provide low cost housing opportunities in the study area was suggested to identify the demand for such housing opportunities created by the flood. The residents attending the meetings were asked to contact the consultant if they or their friends could benefit from a program that would provide low cost housing in the study area. Based on the responses from the residents, it appears that such a program is not required.

During the second series of meetings the residents were asked to review the results of the analysis of the physical opportunities and constraints, explained in the following sections of this chapter, and express their opinion on specific land use patterns or alternatives for their community and the study area. The input provided at these meetings has been incorporated in the land use alternatives which are discussed in the following chapters of this report.

This form of cooperation through "give and take" informal planning work sessions with each community should go a long way in narrowing the gap on important planning issues and concerns.

REGULATORY FACTORS

The other major factors influencing land use patterns are those involving regulatory issues. The two most important issues involving land use patterns and the regulatory constraints on the development of particular land areas within the study area are Larimer County's Flood Plain and Geologic Hazard Regulations. These regulations were developed to protect the health, safety and welfare of the residents of the county by identifying allowable uses and means to reduce loss of life and property in the hazard areas in the event of a disaster. The conditions under which allowable uses can exist are also identified in those regulations. The reader is referred to the existing regulations included in the appendix of this report for specific information relating to these regulations. The defined flood and geologic hazard areas referred to in flood plain and geologic hazard regulations are two of the major physical constraints incorporated in the analysis of physical opportunities and constraints conducted for the study area.

Other major regulatory factors which were considered include the realignment and reconstruction of U.S. Highway 34 being carried out by the Colorado Department of Highways and the Emergency Watershed Protection Program authorized by Section 216 of the Flood Control Act of 1950, being conducted as a joint program by the U.S. Forest Service and the Soil Conservation Service. The highway realignment was considered not to pose any major constraint on the development throughout the study area, since the road was generally being replaced where it was located prior to the flood. The only realignments were in areas where the old road has not been accurately located along the right of way. In these areas the road was realigned to accurately fall within the right of way.

The 216 Emergency Watershed Protection Program encompasses work done to safeguard lives and property during flood emergency situations. It involves efforts in the Big Thompson River and its tributaries to prevent flooding, erosion and sedimentation through rechannelization; bank stabilization; construction of protective diversions and earth berms; and other water and land control measures. This work should not significantly affect the developmental potential of land areas within the study area because the majority of the work is being done in the areas designated as floodways. Although neither the reconstruction of U.S. Highway 34 or the 216 program directly affects the developmental potential of the study area, both programs will have similar indirect effects. When completed, both programs will alter the flood plain characteristics of the Big Thompson River and its tributaries. The reconstruction of U.S. 34 includes removing the roadway from the 100 year flood plain or protecting it from a 100 year flood. In certain areas, the flood plain as presently delineated

extends beyond the previous roadway. Upon completion of the reconstruction programs, these areas would no longer be located in the 100 year flood plain. In a similar fashion, certain aspects of the 216 Program could alter the 100 year flood plain areas as presently defined. In both cases the result should be a reduction of the designated flood plain areas. In order to account for these anticipated changes, the 100 year flood plain should be redefined subsequent to completion of these programs and the new flood plain compared with the presently defined flood plain to identify those areas removed from flood hazard areas and associated regulations.

It is apparent that the general land use determinants described above will affect the future land use patterns of the study area and should be considered in decisions made concerning the locaion of new development and/or redevelopment. To facilitate such decisions a detailed evaluation of the physical land use determinants has been conducted. This process is described in the following sections of this chapter. When related to the social and regulatory factors discussed above, decision makers will better understand the trade-offs that must be made when determining future land use patterns.

BIG THOMPSON DEVELOPMENT POTENTIAL EVALUATION

The purpose of the developmental potential evaluation process conducted for the study area is to identify land that can accommodate new development or safely be redeveloped. Figure VI-1 suggests the steps involved in this process.

DEVELOPMENT POTENTIAL ANALYSIS

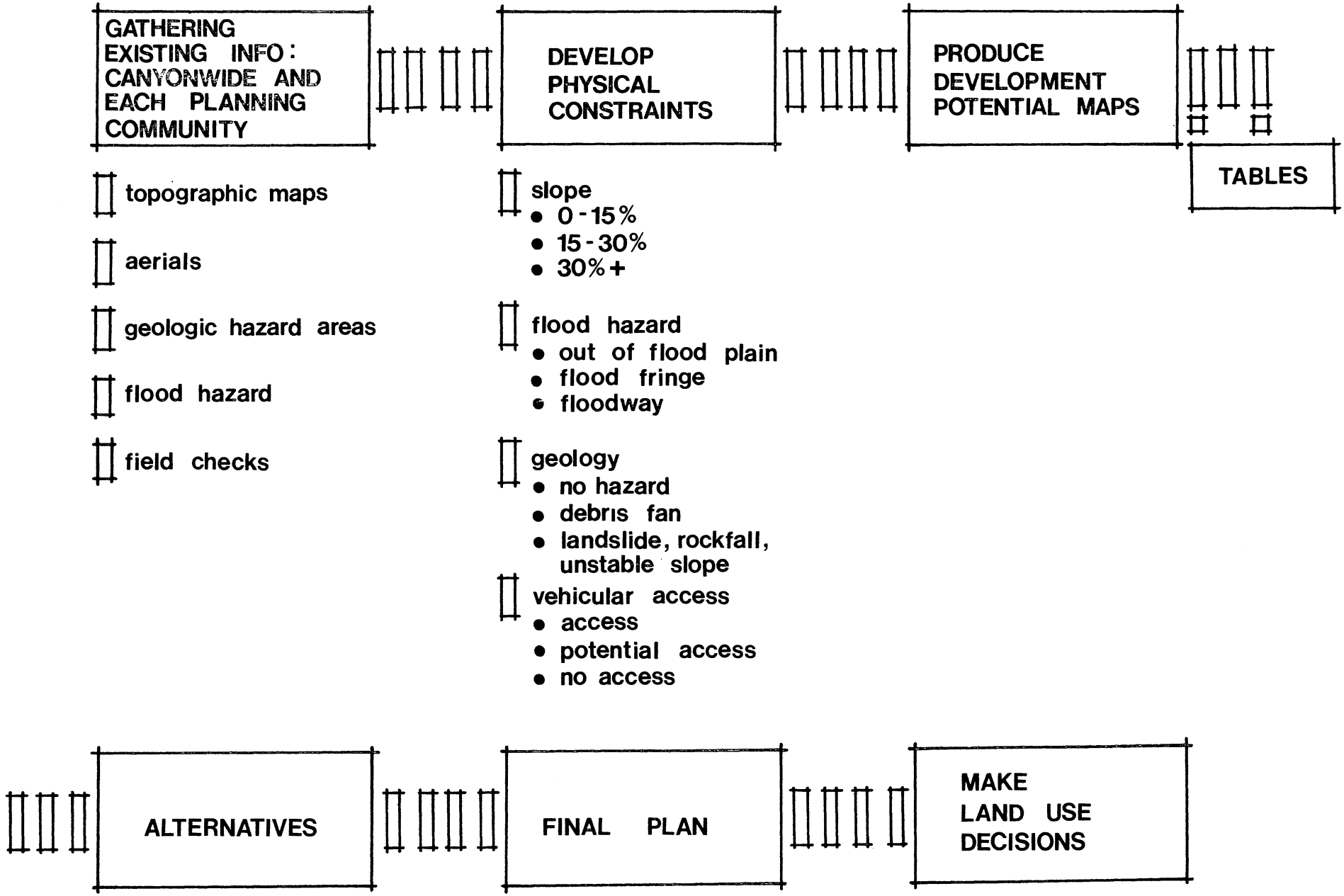

figure VI-1

OVERVIEW

The process is one of spatial analysis whereby the physical characteristics of a particular area are identified to determine the attractiveness of such areas for various land uses, thus indicating an incentive for its utilization. The process also identifies the hazards or sensitivity of a unit of land for various land uses, thus indicating a disincentive for its utilization.

The process consists of identifying the land use classifications for which the potential will be evaluated, the specific resources that will influence the selected land uses, evaluation of the resources identified, and generation of maps graphically portraying the results of the resource evaluation. The process provides easily identifiable information which serves as a basis for land use planning and facilitates land use decisions thereby providing for sound management of the land and resources of the study area.

It should be pointed out that the maps, reflecting the results of this process, are important tools in the land use planning process; but, in and of themselves do not constitute a plan or plans for the study area and planning communities. The maps display those areas that can best accommodate development and those areas that should remain undeveloped. It also identifies the resources present that influence the development potential.

Designation of a particular unit of land as undevelopable does not imply that it should not be utilized; rather, it serves as an indicator or "red flag" that there is present a particular factor or group of factors which make that site

very sensitive to development. Knowledge of these factors assist planning agencies in designating the best development and conservation areas. It enables the decision making body to specify expenditures which must be incurred to lessen the areas' sensitivity and judge as to whether the benefit to be derived from such an expenditure is sufficient relative to the cost.

SCOPE AND LIMITATIONS

The development potential evaluation produced a total of 9 maps portraying areas that can accommodate development and those areas that should not be developed. One map was produced for each of the following seven communities selected for detailed planning: Glen Haven, Loveland Heights/Glen Comfort, Waltonia, Drake/Midway, Cedar Cove, Sylvan Dale and Big Thompson Valley East. In addition to the seven maps illustrating development potential for the planning communities, two maps of a more general nature were prepared covering the entire study area: Canyonwide East and Canyonwide West.

Through review with the Larimer County Planning Department and the BTRPO, two composite land use categories were selected for evaluation. All uses requiring major structural improvements (commercial, residential, public facilities, etc.) were lumped into a development category. All other uses (recreation, open space, etc.) were categorized as undevelopable. The Canyonwide maps follow this classification by defining areas of potential development and areas that are undevelopable. For the community maps the development category was divided into two subcategories: Prime Development and Secondary Development. The undevelopable category was also divided into two subcategories to differentiate between land undevelopable due to its designation as a floodway and due to other hazards or constraints.

Subsequent to the selection of the land use categories, the specific resources that would influence physical development potential were identified. Four determinant resources were selected from the planning data base (see Volumes I and II) as having the most influence on the physical development potential. The four resources selected were:

1. Flood Hazards;
2. Geologic Hazards;
3. Slope;
4. Accessibility.

Existing land use and ownership patterns also influce future land use patterns, but were not included in the physical development potential evaluation because they are factors that are flexible and therefore not directly tied to specific parcels of land. Due to the overlay mapping technique used to develop the planning data base, this existing land use and ownership information can be readily compared with the development potential maps and will be so used during the generation of land use alternatives.

Various combinations of the four selected resource categories determine whether an area within a community is classified as prime development (PD), secondary development (SD), or undevelopable (UD). Each resource category has been broken down into three subcategories to facilitate this classification. The first subcategory of each resource reflects the absence of any hazard or constraint for development. The second subcategory reflects the presence of constraints or hazards that can be minimized through construction practices, engineering, or locational decisions. The third subcategory reflects the presence of a constraint or hazard that is severe enough to preclude development. Figure VI-2 indicates the subcategories of each resource.

FIGURE VI-2

PHYSICAL/DEVELOPMENT POTENTIAL RESOURCE CRITERIA

RESOURCE	#1 NO CONSTRAINTS OR HAZARDS	#2 MITIGATABLE CONSTRAINTS OR HAZARDS	#3 NONMITIGATABLE CONSTRAINTS OR HAZARDS
Flood Hazard	Out of Flood Plain	In Flood Fringe	In Floodway
Geologic Hazard	Non-Hazard Areas	In Debris Fan	Rockfall, Landslide or Unstable Slope Areas
Slope	0-15%	15-30%	30%+
Accessibility	Existing Access	Potential Access	No Potential Access

PD areas are those which have a number one rating for each of the resource subcategories. SD areas have one or more number 2 ratings, but no number 3 ratings for any of the resource subcategories. UD areas are those areas with one or more number 3 ratings for any of the resource subcategories.

COMMUNITY EVALUATION METHODOLOGY

Flood hazards, geologic hazards and slope subcategories were all mapped as overlays. These were overlayed onto the base map to determine PD, SD, and UD areas. The base map supplied information as to existing vehicular access and to the availability of such access.

Through the analysis, 8 distinct area types were identified. These designations remain consistent throughout the community maps. Each of the community maps include most of those designations. All areas were field checked to verify their

accuracy. These designations are PD, SD1, SD2, SD3, SD4, SD5, and UD[1] and UD[2]. Each of these areas may or may not have vehicular access. Where access is available, a small "a" follows the designation (SD1a).

As mentioned above, PD areas are those areas with 0-15% slope and not exhibiting flood or geologic hazards. SD1 includes areas out of the flood plain and out of geologic hazard areas, but with a 15-30% slope. SD2 are areas having 0-15% slopes out of the flood plain, but are in debris fan locations. SD3 indicates areas not of the flood plain but in debris fan locations and experiencing 15-30% slopes. SD4 indicates areas experiencing 0-15% slope, but are within the flood fringe and debris fan locations. SD5 indicates areas located in 0-15% slope out of geologic hazard areas, but are within the flood fringe. UD[1] includes areas within the designated floodway and UD[2] areas are all other areas experiencing slopes in excess of 30%, or are in a rockfall, landslide, or unstable slope hazard area. Below the area designation on the maps there is a number in brackets. This number is a reference number which cross-references the specific area to a table. Each table contains resource information which is represented graphically on the maps. By locating areas in the table by reference number from the map, one can determine specifically what hazards or constraints are found within that particular area.

The following is an example of how the area designations would appear on the community maps.

EXAMPLE: SD5a
[154]

SD - Secondary Development
5 - Flood fringe; 0-15%
a - access
[154] - Reference number

In all areas designated other than PD, site specific studies should be done to determine exact locations and magnitudes of specific hazards or constraints.

The following is a description of each community's physical development potential map. The development potential maps and their associated reference tables are included in Volume 4 of this report.

Big Thompson Valley East

The Big Thompson Valley East (VTVE) community contains a considerable amount of land designated PD. There are two very large PD areas roughly paralleling U.S. Highway 34 including a large parcel of land south of U.S. 34. This parcel extends across the complete length of the community map. In addition, there are seven smaller PD areas scattered throughout the community. Approximately 50 percent of BTVE is designated as PD area.

There are 26 SD1 areas fairly small in size and are scattered throughout the community. There are six large SD5 areas and twenty-six smaller areas also scattered throughout the length of the community. These areas are all located along the Big Thompson River as they are in the designated flood fringe areas. About 30 percent of the community is designated UD[1] due to the flood plain hazard. This area follows the course of the Big Thompson River. Although the majority of undevelopable land in BTVE is due to the flood hazard, there are three very small strips that are classified as UD[2] due to a slope of greater than 30 percent. One area is located at the extreme eastern

end of the community. The two remaining areas are to the extreme west. There are no designations dealing with geologic hazards on this map because there are no significant geologic hazards in BTVE.

A good portion of the Glade Road area is presently developed as low density residential. This area is in the northwest quadrant of the BTVE map, which is mostly in areas designated as PD. A good deal of the existing development, both commercial and residential, occurs in the UD areas located in the floodways. For more specific information consult the development potential map (Map VI-3) and the reference table (Table VI-1).

Sylvan Dale

The majority (55 percent) of land in this community is of prime development potential. There are eleven sizeable areas designated PD and nine smaller areas. The major PD areas are the lands surrounding the Loveland Filtration Plant north of the Water Dale Road, land east of the Hansen Feeder Canal on both the north and south side of the river, and large areas along the eastern section of the community map. These eastern areas are in the Fawn Hollow vicinity, the Riverview Campground area, and an area north of U.S. 34 and east of County Road 27.

There are twenty-four small areas designated SD1 scattered throughout the length of the map. There are fourteen minor SD5 areas and two larger ones in the Sylvan Dale Community. The minor areas are scattered along the entire length of the floodway, while the two larger areas are found at the

extreme eastern portion of the map. Approximately 25 percent of the community is designated as UD[1] due to the location of the floodway, which follows the Big Thompson River throughout the community. Another 10 percent of the community is designated as UD[2] due to the slopes greater than 30 percent including a small strip of undevelopable land located at the western portion of the community known as "The Narrows". There are no designations dealing with geologic hazards in the Sylvan Dale Community since there are no significant geologic hazards in this community.

Most of the existing development in Sylvan Dale is residential and is located in the floodway UD[1] area mainly around the Sylvan Dale Ranch. For more detailed information, refer to the Development Potential Map (Map VI-4) and Reference Table (Table VI-2).

Cedar Cove

The Cedar Cove planning community has thirty-seven designated PD areas, constituting approximately 25 percent of the planning area. Of these thirty-seven areas, seven are fairly large. The largest of these areas is on the south side of the Big Thompson River, southeast of Cedar Cove. Two other large areas are located at the head of the Narrows.

There are also thirty-seven SD1 areas in the community accounting for approximately 25 percent of the land. The largest areas are around the head of the Narrows, a strip east of Cedar Cove and the Cedar Cove area itself. There are twelve SD2 areas found in almost every draw in the area.

Thirteen SD3 areas are found in close proximity to the SD2 areas. There are only three SD4 areas which are found on the eastern portion of the map. SD5 areas are found along the floodway east of Cedar Cove.

Approximately 20 percent of the map is designated as UD[1] due to the floodway. Since the topography of the community is fairly steep with many slopes over 30 percent, approximately 30 percent of the land is classified UD[2].

Several of the PD and SD areas are partially developed in the Cedar Cove area and east of it. However, the greatest portion of development exists in UD lands in the floodway. There is also an occasional structure in UD areas with slopes greater than 30 percent.

The areas west of the Cedar Cove Community remain mostly undeveloped, because the land is within the boundaries of Viestenz-Smith Mountain Park, which presently serves as an active recreation area.

For more specific information refer to the Development Potential Map (Map VI-5) and the following Reference Table (Table VI-3).

Drake/Midway

The Drake/Midway planning areas contain twenty-seven PD areas. These areas, representing only 5 percent of the community, occur around the communities of Drake and Midway and approximately 1/2 mile east of Midway.

There are fifteen SD1 areas encompassing approximately 30 percent of the community occurring in larger parcels around Drake and Midway with the majority in the extreme eastern portion of the community study area. Ten SD2 areas are scattered throughout the area along with ten SD3 areas. There is one SD4 up the North Fork, just northwest of Drake. There are thirteen SD5 areas following the floodway throughout the community.

Approximately 20 percent of the study area is designated UD[1] due to the floodway. At least 40 percent of the area is designated UD[2] due to the presence of slopes greater than 30 percent. These areas occur on both sides of the Big Thompson River.

The major portion of existing development occurs in areas designated UD[1] due to the floodway, especially in the Drake area. Most other development occurs within the PD and SD areas scattered throughout, although there is an occasional structure on slopes greater than 30 percent.

Map VI-6 and Table VI-4 provide specific information concerning the development potential of the Drake/Midway Community.

Waltonia

The Waltonia study area contains eleven small PD areas which occur mainly as strips along U.S. 34, although there are two very small areas found within the Waltonia Community proper.

There are twenty-three small SD1 areas scattered throughout, occurring both north and south of U.S. 34, along with four areas found within the Waltonia Community. The seven SD2 areas, the four SD3, and the seven SD4 areas occur mainly in Quillan Gulch where Waltonia has developed. There are four SD5 areas which follow the course of the floodway.

Approximately 20 percent of the area is classified UD[1] due to the floodway and at least 50 percent of the area is classified UD[2] because of the presence of slopes greater than 30 percent.

The main portion of the existing residential development is located on the south side of the Big Thompson up the steep sided Quillan Gulch. However, there is very little PD area in this area.

For more specific information, refer to Map VI-7 and Table VI-5.

Loveland Heights/Glen Comfort

Within the Loveland Heights/Glen Comfort planning area there are fifty-one PD areas located north of U.S. 34 which are generally found throughout the area with the exception of one large area south of U.S. 34 near Estes Park.

There are sixty-three SD1 areas primarily located north of U.S. 34. These areas are scattered throughout the Loveland Heights/Glen Comfort region with the exception of the western portion where SD1 areas are found on both sides of U.S. 34. Major areas are found northeast of

Loveland Heights, southwest of Glen Comfort and northeast of Drake Gulch. There are thirteen small SD2 areas found throughout the area. There are fourteen SD3 and four SD4 areas found in the same vicinities as the SD2 areas. The twenty-three SD5 areas are found next to the floodway throughout this study area.

Approximately 25 percent of the entire study area is classified UD[1] due to the floodway. At least 30 percent of the area is classified UD[2] due to slopes greater than 30 percent along the steep canyon walls.

There is a great deal of existing development within the UD[1] area in the floodway. There is light development within several PD and SD areas in the Glen Comfort and Loveland Heights area. However, most of the PD and SD areas are not developed.

For more specific information, refer to Map VI-8 and Table VI-6.

Glen Haven

Within the Glen Haven area there are forty-five PD designations located at random throughout the study area representing approximately 15 percent of the total land area.

There are forty-eight SD1 designations comprising approximately 40 percent of the study area. These SD1 areas are found along West Creek, Devil's Gulch and Fox Creek. Six SD2 and fifteen SD3 areas are found in the same vicinities in major gulches and draws. The two SD4 areas are located beside the floodway on Devil's Gulch. The twenty-one SD5 areas follow the floodway.

Approximately 25 percent of the area is designated UD[1] due to the floodway. Around 35 percent is designated UD[2] due to slopes greater than 30 percent.

Most of the existing development has occurred along the three tributaries in the area, especially along Devil's Gulch and where West Creek converges with Devil's Gulch. Most of this development is not in PD areas, but falls within SD categories with a great deal occurring within UD[1] areas. Most of the development in Glen Haven is residential.

For more specific information, refer to Map VI-9 and Table VI-7.

CANYONWIDE MAP EVALUATION

The canyonwide maps cover approximately 105 square miles. Of this total, approximately 35 percent is considered to be developable and 65 percent is considered undevelopable from the aspects of slope and accessibility. These maps provide a broad overview of the entire canyon area and indicate broad development areas only. Specific information can be found by referring to each particular community.

Within the study area boundaries, the 35 percent developable land is identified by 31 different areas, as designated on Maps VI-10 and VI-11. By referring to Table VI-8 entitled "Canyonwide Development Potential", each area can be identified in terms of physical description, acreage, ownership, distance from through road, and accessibility.

The eastern portion of the study area east of the mouth of the Big Thompson Canyon contains the majority of the developable land. The change in topography in this area serves as the main dividing line between land that is considered undevelopable and developable. Most land west of the Charles Hansen Feeder Canal is undevelopable due to steepness of slope. Only small parcels of developable land can be found west of the canal. East of the canal, most of the land is developable. The undevelopable land in this area includes: Green Ridge, East of Green Ridge Glade, Devil's Backbone Area, an area north of Marianna Butte, Boedecker and Buckingham Lakes, and a small area in the west portions of Sections 14 and 23.

Approximately 80 percent of the land in the western portion of the canyon is undevelopable due to the rugged topography. An exception to this would be the Drake/Midway area, an area due north of Drake/Midway, Glen Comfort and Loveland Heights areas, and the Glen Haven areas north and south of the North Fork of the Big Thompson. Other than these, there are only small patches of developable land in the study area west of the mouth of the Big Thompson Canyon.

West of the head of the canyon, the largest section of developable land is within the corporate boundaries of Estes Park and north along Devil's Gulch to Glen Haven.

Existing development occurs fairly heavily around each community. There are, however, large parcels of developable land yet to be developed.

Refer to Maps VI-10 and VI-11 and Table VI-8 for specific canyonwide information.

CHAPTER VII

LAND USE ALTERNATIVES

Three land use alternatives have been developed for the study area. This chapter presents the methodology used to derive these alternatives, the land use classifications portrayed on each alternative, and a description of each alternative.

ALTERNATIVE DERIVATION

Various alternative plans may exist for the ultimate redevelopment and/or new development of the study area. These alternatives are conditioned by the severity of constraints and the extent of opportunities existing for redevelopment and/or new development of the area. The alternatives formulated herein have been conceived principally as a function of the physical opportunities and constraints analyzed by the development potential maps presented in Chapter VI.

Other opportunities and constraints which have been considered are property ownership, accessibility, existing land use patterns, and wildlife distribution and activity. To determine the specific nature and locality of wildlife-imposed limitations, the reader may consult Figures 8 and 9, Volume 1. The alternatives are further conditioned by citizen and agency input and acceptance and by the tradeoffs between alternatives.

Rather than attempting to construct the infinite variety of alternatives that may be conceived at a detailed level, three alternatives have been developed which encompass the full spectrum of potential development patterns in the study area. These span the conceptual range from no additional development to maximum residential/commercial development within the constraints just discussed. It is foreseen that the final plan will constitute a composite of all these plans resulting from the interchange of plan ideas, one with another.

Incorporated into the land use alternatives is the land acquisition program proposed by the BTRPO. Each land use alternative portrays acquisition areas based upon availability of funds. One alternative designates those parcels that could be acquired with available funding. Another alternative reflects additional parcels of land that are proposed for acquisition assuming recipience of some funding beyond existing levels. The final alternative indicates all land parcels that are proposed for acquisition if all funding presently requested becomes available. Areas suggested for acquisition by the U.S. Forest Service are not shown on the land use alternatives. These areas should be incorporated into the final land use plan.

ASSUMPTIONS OF LAND USE ALTERNATIVES

Various assumptions and conditional priorities are embodied in the methodology utilized to formulate each land use alternative. The specific application of these assumptions will be noted in the individual descriptions of each alternative. A description of certain broadly applied conditions and assumptions is appropriate beforehand.

Whereas land use plans are normally based upon population projections, the study area presents a particular problem due to its unique population profile. Although population projections have been developed for purposes of sewer and water studies, it is difficult to calculate development requirements due to the high tourist influx and part-time residential status. In consequence, it has proven impractical to incorporate population considerations into the formulation of the land use alternatives presented herein.

Another condition inherent to each alternative concerns structures or other development presently situated in the floodway. These developments are accepted as existing uses; however, no further development is proposed in the floodway. In addition, some areas determined not amenable to development on the development potential maps (Figures VI-3 to VI-11) presently embrace some development. These areas are also accepted as existing uses, but no further development is proposed.

Preclusion of development in sensitive wildlife areas is considered of major importance in each alternative. Although some development presently exists in these areas, no further development is proposed.

As noted earlier, acquisition parcels for each alternative indicate various levels of funding which will or could become available and may be incorporated into any of the land use schemes. Public open space remains the same in each alternative, as no development areas within public lands were considered.

Assumptions of Alternative A - Status Quo

Alternative A, "Status Quo", constitutes continuation of existing land uses but no expansion of development, either commercial or residential. The alternative does not allow for redevelopment to pre-flood densities or conditions. Acquisition parcels shown indicate those parcels for which funding is available at this time. These comprise 79 parcels at an estimated cumulative value of $698,900.

Large areas of private open space appear in Alternative A, indicating the presence of much privately owned land which has not been developed. This alternative does not consider whether the land has not been developed due to physical constraints or whether the landowner simply has chosen not to develop it.

Assumptions of Alternative B - Intensified Residential Development

Alternative B, "Intensified Residential Development", assumes full residential development of those areas deemed suitable for development. Acquisition parcels for Alternative B assume the full requested level of funding. There are 169 acquisition parcels at an estimated cumulative value of $1,863,700.

Private open space designated in Alternative B reflects only privately owned land that is not amenable to development due to physical or wildlife sensitivity constraints.

Assumptions of Alternative C - Intensified Commercial and Residential Development

Alternative C, "Intensified Residential and Commercial Development", assumes full development of those areas deemed suitable for residential and/or commercial use. In those areas demonstrating potential for either residential or commercial development, commercial use has been assigned priority. Alternative C incorporates a funding level intermediate between that of Alternative A and Alternative B. There are 136 acquisition parcels at a cumulative value of $1,484,100.

Areas designated as private open space represent privately owned land which is not amenable to development due to physical or wildlife constraints.

LAND USE CLASSIFICATIONS

Land use classifications portrayed on the alternative land use maps are as follows:

- Existing Residential;
- Proposed Residential (Alternatives B and C only);
- Existing Commercial;
- Proposed Commercial (Alternative C only);
- Historic Sites;
- Public Facilities;
- Private Open Space;
- Public Open Space.

EXISTING RESIDENTIAL

The existing residential category describes those areas which are presently developed as residential. As explained earlier,

some of the structures in existing residential areas do not fall within areas designated as amenable to development on the development potential maps. These particular structures are usually situated in the floodway or on slopes of greater than 30 percent.

PROPOSED RESIDENTIAL

The proposed residential category comprises those areas where expanded residential development is dictated by the conditional priorities and assumptions of the alternative in question. These areas have been determined by extending residential areas to include those areas designated developable by the development potential maps (Figures VI-3 through VI-11). As explained in Chapter VI, developable lands have been further categorized according to their physical amenability to development into prime and secondary development areas.

Existing land use and accessability has also been incorporated into the determination of areas of proposed residential.

EXISTING COMMERCIAL

The existing commercial category indicates those areas now under commercial usage. Again, several of the presently existing structures do not fall within developable lands as designated by the development potential maps. These lands are considered undevelopable due to location in the floodway or on slopes of greater than 30 percent.

PROPOSED COMMERCIAL

The proposed commercial category indicates those areas that could best accommodate further commercial development. These areas have been determined through analysis of the development potential maps, in addition to existing land use compatibility, ownership information, accessibility, and proximity to U.S. Highway 34.

HISTORIC SITES

Historic sites as designed by Larimer County have been located on each of the alternative maps. These sites are the Idle Wild Inn in Drake, the Modena Family Graves in Namaqua Park, and the Forks Hotel/Drake Stage Stop in Drake.

PUBLIC FACILITIES

Public facilities are located throughout the study area and are portrayed on all the alternative maps. These include post offices, community buildings, fire stations, the State of Colorado highway buildings, schools, the State of Colorado Fish Hatchery, the Loveland Water Treatment Plant, and the Loveland hydro-electric plant.

PRIVATE OPEN SPACE

Private open space is privately-owned land that is not developed in any manner. On Alternative A the private open space designation indicates any privately owned land that is not developed regardless whether due to physical constraints or owner discretion. On Alternatives B and C (alternatives with proposed development), private open space indicates privately owned land that is not considered desirable to develop due to physical or wildlife intensity constraints.

PUBLIC OPEN SPACE

Public open space indicates those undeveloped areas that are publicly owned. Included are city, county, and Federal undeveloped lands.

ALTERNATIVE DESCRIPTIONS

As indicated earlier, three basic land use planning alternatives have been formulated for the study area. These alternatives are depicted in a generalized fashion on canyonwide alternative maps (Figures VII-1, 2, 10, 11, 19, and 20). Due to the small scale of these maps, a few very small development areas (existing and proposed) are not distinguishable thereon. For detailed portrayal of each of the three alternatives at the community level, community alternative maps may be consulted (Figures VII-3-9, 12-18, and 21-26).

ALTERNATIVE A - STATUS QUO

Alternative A, "Status Quo", depicts existing land uses as defined earlier in this chapter. As shown (Figures VII-1-9), the majority of existing residential development occurs along U.S. Highway 34, the North Fork Road, and prominent gulches. In certain locations, development extends some distance off these roads. Among the larger residential developments off these major roads are six areas east of the Estes Park city limits. Another large residential development lies above the Drake/Midway area. Three fairly heavily populated developments occur to the south, southeast, and northeast of the Big Thompson School. Two developments are located around Boedecker Lake.

Existing commercial developments are scattered randomly along U.S. Highway 34 and the North Fork Road. The only concentrated commercial area is located east of the Narrows.

Most of the area west of the Narrows is public open space interspersed with private open space. The majority of the latter is adjacent to U.S. Highway 34 and the North Fork Road.

Public facilities specified on this and the other alternative maps are listed below:

- Glen Haven Post Office;
- Glen Haven Community Building;
- Glen Haven Fire Station;
- State Fish Hatchery north of Drake;
- State Highway Building in Drake;
- Drake Post Office;
- Big Thompson Community Building;
- Drake Fire Station;
- Cedar Cove Fire Station;
- Loveland Water Treatment Plant;
- Loveland Hydro-Electric Plant;
- Big Thompson School;
- Loveland Water Tanks.

As discussed earlier, some of the existing residential and commercial developments are located in areas where certain hazards and/or limitations occur. These hazards and limitations include the floodway, geologic hazards, severe slopes, the elk migration corridor and raptor nesting areas. To determine exact locations of these hazards and limitations, the reader may refer to Volume 1.

ALTERNATIVE B - INTENSIFIED RESIDENTIAL DEVELOPMENT

Alternative B, "Intensified Residential Development", indicates both existing residential and commercial developments and areas proposed for further residential development based upon the constraints detailed earlier in the "Land Use Classifications" section. As reflected on Figures VII-12-18, proposed residential areas are in most cases extensions from existing residential areas into those areas determined suitable for development by the development potential maps. Throughout the study area small areas suitable for development are extended from existing residential areas along U.S. Highway 34 and the North Fork. Larger areas are located in the North Fork area, Loveland Heights/Glen Comfort area, Cedar Cove area, and the area east of the Narrows. To the east of the Narrows there are several very large areas of proposed residential development extending considerable distances from U.S. Highway 34. In addition, four fairly large areas are located off U.S. Highway 34 south of Cedar Cove, and one large area is located quite a distance from U.S. Highway 34 north of Cedar Cove.

The amount of private open space on Alternative B contrasts markedly with that of Alternative A. As all land suitable for development has been designated for proposed residential, private open space has been reduced to land that is not amenable to development due to physical or wildlife sensitivity constraints.

ALTERNATIVE C - INTENSIFIED RESIDENTIAL AND COMMERCIAL DEVELOPMENT

Figures VII-21-26 reflect Alternative C, "Intensified Residential and Commercial Development", which indicates

existing residential and commercial, and proposed residential and commercial development. Proposed development is determined according to the constraints detailed earlier in the "Land Use Classification" section.

Whereas areas proposed for development on Alternative C are identical to those proposed for development on Alternative B, commercial development has been given consideration in this alternative, while proposed residential development has been decreased correspondingly. Areas designated for residential development on Alternative B have been reclassified for commercial development where determined amenable to such development.

Major areas designated proposed commercial occur in the Loveland Heights/Glen Comfort, Drake and Cedar Cove areas. In addition, there is proposed commercial development at the mouth of the Narrows and there are several extensions of existing commercial along U.S. Highway 34 to the east of the Narrows. The community of Waltonia has no Alternative C due to the absence of land amenable to commercial development.

Private open space designation on Alternative C is identical to that on Alternative B.

CHAPTER VIII

WATER QUALITY MANAGEMENT

Existing development and associated water supply and wastewater management practices in the study area have resulted in jeopardizing the health and safety of residents and tourists. Safer water supplies and more effective wastewater management programs must be developed to alleviate these problems, especially if any additional development is allowed as suggested by two of the land use alternatives which would compound the existing problems. For these reasons, water quality management techniques have been investigated as part of the Big Thompson Disaster Recovery Planning Program.

Volume 5 of the Big Thompson Disaster Recovery Planning Report will present detailed water and wastewater information. This chapter will present the highlights of that report.

BIG THOMPSON WATER QUALITY

Existing data regarding the water quality of the Big Thompson River and water wells within the study area was obtained from the Colorado Department of Health, Colorado State University, and from the Larimer County Health Department. Although there was not a great deal of data available, the information was analyzed in an attempt to distinguish sources of pollution. An analysis of the data will be presented.

STATE OF COLORADO

The Colorado Department of Health (CDH) began a water quality survey of the Big Thompson River approximately one month before the flood of 1976. This study was discontinued as a result of the flood, but the data is the most recent pre-flood data available.

One of the reasons that this study was begun was that diseased and dead fish had been found in the Big Thompson River. The problem was brought to the attention of the Colorado Department of Health by some of the Big Thompson Canyon residents. The Division of Wildlife was only able to determine that the disease killing the fish was a result of a weakened condition among the fish. The primary cause which had weakened the fish was never determined.

Colorado State University (CSU) also conducted a water quality sampling program designed to determine the effect of the Upper Thompson Sanitation District discharge.

These independent studies showed that although the water quality standards were not violated, there was definitely man-caused pollution of the river. The increased levels of ammonia and fecal coliform bacteria in the river downstream of some of the populated areas is indicative of contamination by septic tank systems.

LARIMER COUNTY

The Larimer County Health Department (LCHD) will sample private wells upon request and test for bacteria. This data is difficult to assimilate due to the fact that the LCHD

files the information by the name of the property owner rather than by geographic location. This means that the results of all the wells tested in Larimer County are interspersed.

Nevertheless, some records of well samples from within the study area were obtained. This information indicates that many of the shallow water wells are contaminated by domestic wastewater.

FLOOD DAMAGE TO WATER AND WASTEWATER SYSTEMS

Following the flood, the LCHD conducted a survey in the portion of the study area west of the Narrows to determine the extent of damage to water and wastewater systems. Notices were served residents with unsafe wells and/or septic tanks. Almost 100 notices were served due to unsafe water supplies; over 100 were served notices due to obviously damaged and inadequate wastewater systems.

SUMMARY OF WATER QUALITY INFORMATION

Due to the sketchy test data available, it cannot be conclusively stated that a health problem exists in the canyon. However, with the limited test data and the survey conducted by the LCHD combined, the only prudent conclusion that can be reached is that the health and safety of canyon residents and tourists to the area is in jeopardy. Further testing should be conducted.

WATER AND WASTEWATER PLANS

An analysis of water and wastewater alternatives which would protect the integrity of the quality of surface and groundwaters was conducted. Cost estimates of various treatment and transportation alternatives were developed. Annual operation and maintenance cost estimates were also prepared, and presented as present worth so that all alternatives could be equally evaluated. Present worth is the amount of money needed today to secure payment of all obligations over the life of the project.

All potable water alternatives evaluated would comply with the Safe Drinking Water Act. This is a Federal law which requires that all public water supplies comply with certain standards. Limitations on chemical and biological parameters are imposed by the Act, along with certain monitoring and reporting requirements.

Wastewater alternatives evaluated would comply with all applicable Federal and state discharge standards and/or generally accepted engineering and public health standards. A water quality model was run to determine if any wasteload allocations are more stringent than basic state standards for wastewater discharges.

The most promising alternatives which were evaluated will be reviewed herein and canyonwide costs will be presented. Again, for more detailed information the reader is directed to Volume 5.

DEVELOPMENT OF WATER ALTERNATIVES

Several water supply alternatives were evaluated. Some of the alternatives would supply water only to commercial or residential structures which had water supplies damaged

by the flood. Other alternatives would be sufficient to serve everyone in the canyon with safe drinking water.

The Big Thompson Valley East area is not included in this analysis. The residents of this area are currently served by the City of Loveland. They have no need for additional water service.

Four general categories of water systems were analyzed. These include:

- Individual wells for each study area residential and commercial establishment;
- Installation of wells that supply water to a group of households - a cluster alternative;
- Design and development of a community water system for each study area community;
- Design and development of a canyonwide water supply system extending from Loveland Heights to Cedar Cove. The other communities would be served by one of the three alternatives listed above.

Two cost estimates were developed for each of these alternatives. As mentioned above, one would supply water only to those with damaged systems; the other would supply all establishments in the canyon.

Individual Wells

The possibility of using shallow well systems was investigated but rejected because quality requirements of the Safe Drinking Water Act could not be met. However, deep drilled and cased wells can supply a sufficient quantity

of safe water. Although this is not the least expensive system analyzed, it would be the easiest to implement. This is because no institutional (i.e., water district) arrangements must be made.

Cluster Alternative

This alternative is similar to the method discussed above, except that a well would serve more than one dwelling. Distribution lines from the wells to homes would be installed, but fewer wells would be required. The net effect is that costs would be reduced. It is visualized that one management structure would operate and maintain all of the wells and distribution lines.

Community Water System

This concept is a surface water supply alternative with a treatment plant for each community. Water would be drawn from the Big Thompson River and distribution lines would be installed. Shares of Colorado-Big Thompson (C-BT) water would be purchased.

Canyonwide System

This concept is very similar to the community water system described above except that only one water treatment plant would be built. A pipeline would be constructed down the entire canyon. Glen Haven cannot be economically served with a canyonwide system due to the high cost of the line and pumping facilities. One of the three alternatives previously discussed would have to be utilized for the community of Glen Haven.

ALTERNATIVE WATER SUPPLY COSTS

Cost estimates were prepared for each of the alternatives discussed. Table VIII-1 presents the canyonwide costs and the number of connections assumed to be served by each alternative. The number of damaged systems indicated in Table VIII-1 is a combination of the survey conducted by the LCHD and an estimate of the number of damaged systems in areas not covered by the survey. The present worth of operation and maintenance costs is included in the table.

TABLE VIII-1. PRESENT WORTH OF ALTERNATIVE WATER SUPPLIES

SYSTEM	PROPERTY SERVED	NUMBER OF HOOK-UPS[1]	CANYONWIDE COST ($1000's)
Individual Wells	Damaged	158	1032
	Entire Community	393	2685
Cluster Wells	Damaged	158	846
	Entire Community	393	1951
Community Surface Water	Damaged	158	1310
	Entire Community	393	1931
Canyonwide Surface Water	Damaged	158	2671
	Entire Community	393	3694

[1] A commercial establishment is included as only one tap, not as equivalent residential taps.

DEVELOPMENT OF WASTEWATER ALTERNATIVES

Several wastewater collection and treatment alternatives were investigated. The treatment alternatives included individual on-site disposal methods and community-wide (or canyonwide) systems. As with potable water systems, cost estimates were prepared and presented as present worth.

Collection Methods

The collection methods evaluated include gravity sewers, vacuum sewers, pressure sewers, and a corridor system. The possibility

of hauling wastewater with a tank truck was compared with treatment alternatives rather than collection alternatives. In some instances, a combination of these alternatives was investigated. Estimates of capital costs and operation and maintenance expenses were prepared.

The present worth cost of the gravity sewer ($1,600,000) was comparable with the present worth of the vacuum sewer ($1,615,000). These two alternatives were much less expensive than the other methods.

Individual Wastewater Treatment Systems

Several methods of on-site treatment and disposal alternatives were presented. The most common of these are septic tank/leachfields and vaults. Soil association maps developed by the U.S. Soil Conservation Service (SCS) were reviewed to determine suitability for leachfields. Most of the soils in the canyon are rated as unacceptable for septic tank/leachfields. This helps substantiate the conclusions reached regarding the poor water quality previously discussed.

The State Geologist was also notified. He verified that the Big Thompson Canyon area was not well suited for leachfields [Rold, 1977].

The only major area where soils are adequate for septic tank/leachfield systems is the Big Thompson Valley East area. The soils here are fair. The best long-term solution for the residents of this area is to be served by Loveland. For now, the septic tanks currently being used are adequate.

Community-Wide Wastewater Treatment Systems

Eleven separate treatment and discharge alternatives have been investigated. Some of these were impractical for use in the Big Thompson Canyon because they require a great deal of operator skill and attention.

The most promising treatment processes include lagoons, extended aeration, clarifier/filter, rotating biological contactor, and hauling by truck. Each of these systems will be very briefly described.

Lagoon Systems

Three types of lagoon systems (also called wastewater stabilization ponds) were investigated. The aerated stabilization pond was deemed to be the only system with merit for use in the canyon.

Extended Aeration

Extended aeration is an activated sludge process suitable for use by small communities. It can be installed as a package system, which reduces construction costs.

Clarifier/Filter

This system utilizes two settling tanks followed by a slow sand filter. It is capable of providing a high degree of treatment while operation and maintenance (O&M) costs remain relatively low.

Rotating Biological Contactor

This is a type of treatment plant which can be installed as a package system. Biological growth on a rotating drum provides the predominant treatment.

Alternative Wastewater Treatment Costs

The estimated capital and operation and maintenance (O&M) costs for each of the previously described systems are presented in Table VIII-2. A 20-year project life is used as a basis for all costs. The least expensive of the alternatives presented is the clarifier/sand filter scheme. The costs presented in this table assume a treatment plant is constructed at six separate sites in the canyon. The hauling alternative presented assumes wastewater is hauled to the county lagoons.

INSTITUTIONAL/FINANCIAL

In order to construct any community-wide facilities in the canyon, some type of institutional structure must be established. In line with this, several types of management agencies were presented. The organization should be qualified to be a grant recipient and must have taxing authority to cover expenses.

Although most of the institutional alternatives presented can be established for a single community, this is not the optimum organization. The cost estimate prepared assumed that economies of scale would be realized.

The sources of government grants and low interest loans were presented. The effect of various percentages of grants was analyzed so that the local share could be determined. The greater the percentage of government grants that can be obtained, the less the residents would have to pay. Of the water and wastewater systems discussed, all of the capital costs are grant eligible under one or more of the programs. However, there presently is no assistance for annual operating expenses. These costs must be entirely borne by the local residents.

TABLE VIII-2. CANYON-WIDE TREATMENT SYSTEMS COST

	TYPE OF SYSTEM				
PRESENT WORTH ($)	LAGOON	EXTENDED AERATION	CLARIFIER/ FILTER	ROTATING BIOLOGICAL CONTACTOR	HAUL BY TRUCK
Capital Cost ($)	973,000	1,817,000	316,000	3,230,000	-
O&M ($)	547,000	1,129,000	775,000	1,310,000	2,977,000
Total ($)	1,520,000	2,946,000	1,090,000	4,540,000	2,977,000

Implementation Program

For the canyon residents to proceed with construction of community-wide water and wastewater facilities, several events must take place before a final financial program can be developed. First, a management agency should be formed. A decision should be made as to what type of facilities are the most economical and desirable. A final determination of the number of hook-ups to each system should be made. Application for government grants should be made.

Once the total system costs, O&M costs, grant percentage, interest rate, and number of taps is known, the user charge can be accurately determined.

WATER CONSERVATION

Methods to reduce the volume of water consumed were explored. Most of these methods are devices or appliances which use less water than conventional devices. Water conservation reduces water and wastewater transportation and treatment costs. Unfortunately, the devices designed to force water conservation cannot be economically justified. Therefore, residents should be encouraged to voluntarily practice water conservation.

CHAPTER IX

POLICE AND FIRE PROTECTION

The purpose of this chapter is to define the existing police and fire protection service levels; to compare these service levels with service standards; and to suggest required service levels based on the land use alternatives.

POLICE PROTECTION

This section discusses the police protection service in the study area. As suggested, increased development would require the Larimer County Sheriff's Department to increase its service level.

EXISTING LEVELS OF SERVICE

As explained in Volume I, Larimer County exercises jurisdictional authority over the study area and administers police protection therein. Post-disaster funds obtained through the Law Enforcement Assistance Act (LEAA) enabled the county to temporarily increase police protection throughout the canyon following the flood. This increased protection was to remain in operation until July 31, 1977, and then the county was to return to its normal policing responsibilities in the study area. However, authorization from the LEAA has extended the use of the current policing personnel until the funds obtained through the LEAA are exhausted. According to the Larimer County Sheriff's Office, this is expected to occur in late September, 1977. At that time, Larimer County will return to its normal policing responsibilities.

Through the LEAA, there are six temporary officers patrolling the canyon. The Act has also provided for increased police equipment including vehicles, radios, a communications van, and various other types of equipment. According to the Larimer County Sheriff's Office, the LEAA has fostered a much quicker response time than before due partially to 24-hour patrolling.

Upon returning to normal policing responsibilities, the six temporary officers will be terminated. However, the county will be allowed to maintain usage of the vehicles and equipment. Since the study area did not receive 24-hour patrolling prior to the flood, it will not receive 24-hour patrolling after September 30. However, calls will be answered and investigated around the clock.

Currently, as in pre-flood conditions, there are four officers in the Estes Park sub-station. This station is responsible for the areas of Glen Haven and the North Fork, and for the area from Estes Park to Drake. There are one to two officers in the Loveland sub-station. This station is responsible for the area from Loveland to Drake.

SERVICE STANDARDS

Larimer County has no official police protection standards. However, according to the Larimer County Sheriff's Office, 1.5 officers are needed per 1,000 people as a general rule. Commercial areas require more patrolling and investigation than residential areas which generally require only services dealing with such problems as trespassers, family

disturbances, etc. The study area presents unique policing problems due to heavy tourism, compounded by the presence of commercial areas.

REQUIRED SERVICE LEVELS

As suggested in the previous section, if any extensive development beyond existing levels occurs within the study area, Larimer County should increase the level of police protection provided to the area. Residential development, as suggested by land use Alternative B, should be served with the recommended level of 1.5 officers per 1,000 people. Increased service should be tied directly to growth in the area. Residential and commercial development, as suggested by land use Alternative C, would require additional service beyond that required by Alternative B. The precise level of service required will depend on the nature of commercial development. The situation should be evaluated periodically to determine required service levels.

FIRE PROTECTION

This section discusses the existing fire protection service levels and required levels in the study area. It is generally believed that the existing service levels are adequate to accommodate future development.

EXISTING LEVELS OF SERVICE

As explained in Volume 1, the Larimer County Sheriff is the designated fire warden for the county. The fire warden deals primarily with brush fires and assists in combating

any fire which exceeds the capabilities of local volunteer fire fighting groups. Structural fire protection is provided to the study area by volunteer fire fighting groups. The Big Thompson Volunteer Fire Department, which operates within the Insurance Services Office (ISO)-approved Loveland Rural Fire Protection District, deals with structural and minor fires. Legal boundaries of this fire district are the mouth of the Narrows and Grandpa's Retreat in the main canyon, and Drake to approximately 2 miles up the North Fork.

The Big Thompson Volunteer Fire Department has twenty volunteers and two substations at Drake and Cedar Cove. There are two pumper trucks, one jeep and various auxiliary pieces of equipment along with the backup of the Loveland City Fire Department.

The Estes Park Volunteer Fire Department provides fire protection to the west of Grandpa's Retreat into Estes Park, as well as to the North Fork. However, the Estes Park Volunteer Fire Department is not legally bound to respond to alarms within this area since it is not within a legal fire district.

The Glen Haven Volunteer Fire Department provides protection for the community of Glen Haven and southeast along the North Fork. According to the Loveland and Estes Park fire departments, the present fire protection level is adequate for existing development.

SERVICE STANDARDS

No fire protection standards have been adopted for Larimer County. Therefore, it was determined that a safe standard for use as a planning guide is the ISO Specifications for Rural Fire Departments. The Specifications are a means of classifying and rating areas with reference to their physical conditions and fire defenses.

According to the Specifications, an approved Rural Fire Department must meet the following general requirements:

> "Rural fire protection to render satisfactory service must consist of the same fundamental facilities that go into the make-up of municipal fire service, namely:
>
> 1. An adequate number of well organized and properly trained men.
> 2. Adequate fire station facilities.
> 3. Proper operational records.
> 4. Reliable fire alarm facilities.
> 5. Reliable fire apparatus with proper equipment."

These specifications are used by the ISO and other insurance organizations to determine fire insurance rates for an area.

From a study of pertinent conditions and performance records extending over many years, certain standards have been developed by ISO which are set forth in the detailed specifications. The various features of fire defense in an area under consideration are compared with these standards in order to establish an approved fire department.

Every area is then rated on a scale of 1 to 10 reflecting the level of services. Level 1 is the highest service level. All approved rural fire departments are given a rating of 9. At this time, the City of Loveland is rated at 7, while the area from the Loveland city limits to Drake is rated at 9. The area served by the Big Thompson Volunteer Fire Department also is rated at 9. According to the Loveland Fire Department, there are no equipment problems.

The area from Grandpa's Retreat to Estes Park and the North Fork area (including Glen Haven) are assigned a rating of 10 because these areas are not within a legal or approved fire district. Even though these areas are served by the Estes Park Volunteer Fire Department, the ISO legally classifies them as having no fire protection.

REQUIRED SERVICE LEVELS

It would be very difficult for the area served by the Big Thompson Volunteer Fire Department to achieve a better rating due to its rural classification.

The area served by the Estes Park Volunteer Fire Department could improve its rating only by first joining an approved fire district such as the Loveland Rural Fire Protection District or Estes Park Fire Protection District. Although better ratings would be difficult to attain, increased development would present no major problems to the Loveland or Estes Park fire departments, according to both departments.

CHAPTER X

LAND USE ALTERNATIVE EVALUATION

To evaluate the differences between the land use alternatives and compare them with water supply and wastewater management alternatives and police and fire protection requirements, a series of evaluation criteria were developed. These criteria were designed to provide for evaluation of land use, economic, environmental, and social aspects of each land use alternative as well as to compare the land use alternatives with public service improvement programs and requirements. This chapter discusses the planning issues that were used to define the evaluation criteria and then presents an evaluation of each land use alternative based on the defined criteria. The evaluation is presented in a tabular format to enable rapid comparison of the differences between the alternatives. The primary purpose of this evaluation is to provide residents of the study area, residents of Larimer County, and Larimer County decision-makers with information necessary to define the most desirable strategy to guide redevelopment and future development of the study area.

PLANNING ISSUES

As the basis for the development of criteria to evaluate the land use alternatives, the following six general planning issues and related subissues were defined. These issues emerged from:

1. Residents' preferences for land use patterns;
2. Analysis of the potential for development in the study area;

3. Adopted policies of Larimer County;
4. Conflicts among residents' preferences, development potential, and adopted policies.

WHAT IS THE APPROPRIATE PATTERN AND LEVEL OF DEVELOPMENT WITHIN THE STUDY AREA?

The diversity of land use patterns reflected on the land use alternatives (Chapter VII) suggests the possibilities for development within the study area. It is apparent that much of the study area is undevelopable due to various constraints (Chapter VI), but there are significant undeveloped areas that could be developed. Alternative A portrays a development pattern that would leave all undeveloped land in its present state, while Alternatives B and C suggest full development of those presently undeveloped areas that could accommodate development. The most appropriate pattern and level of development is probably some combination of the land use alternatives and depends on a variety of factors as discussed below.

What Are the Implications of Flood Hazard Areas on Future Land Use Patterns?

Through Federal, state, and local legislation, flood hazard areas have been determined to be areas where human habitation should be avoided. The Larimer County Flood Plain Zoning Regulations limit development in designated floodways to low intensity, non-habitation uses such as agricultural production and place requirements on development in designated flood fringe areas to insure adequate floodproofing of any structure. Structures existing are allowed to remain in flood hazard areas; however, if such structures are more than

50 percent damaged by a flood they cannot be rebuilt. In light of these regulations, flood hazard areas have been treated in the same manner in each of the land use alternatives. All land located in the floodway that is presently undeveloped, which includes properties where structures were more than 50 percent damaged by the July 31, 1976, flood, were designated as open space or acquisition areas. All land located in the floodway that is presently developed, which includes properties where structures were less than 50 percent damaged, were designated either as existing residential or commercial uses. It should be recognized that even though presently developed parcels in the floodway are designated as existing residential or commercial uses, the flood plain zoning regulations would not allow these uses to continue if a future flood were to destroy or significantly damage, more than 50 percent, the present structures.

What are the Implications of Geologic Hazard Areas on Future Land Use Patterns?

State and local legislation has determined that concentration of human activities in geologic hazard areas should be minimized and avoided if possible. Geologic hazard areas pose a greater threat to public health, safety, and welfare than flood hazard areas since they are activated by unpredictable localized events such as a heavy thunderstorm which only affects small drainage areas. Geologic hazards cannot be assigned a predictability rating such as the 100 year flood plain.

Rockfall, landslide, and unstable slope areas identified by the Colorado Geological Survey [Soule, et. al., 1976] have been classified as open space on all the land use alternatives, unless these areas were already developed in

which case they were classified as existing residential or commercial. Alternatives B and C have indicated many of the designated debris fan areas as proposed residential or commercial since mitigation measures can be taken to minimize the debris fan hazard. Debris fans do pose a significant hazard to development and new development should only be allowed in debris fan areas if mitigation measures are incorporated into the development plans.

What is the Relationship of the Land Use Alternatives to the Provision of Adequate Water Supply and Wastewater Management?

As suggested in Chapter VIII, the existing water supply and wastewater treatment systems in the study area leave a lot to be desired. The primary forms of wastewater treatment are privies, septic tanks, and collection vaults. Many of the vaults were found to have holes in the bottom so that untreated sewage was seeping directly into the ground below the vault. The soil characteristics and lot sizes in much of the study area are such that septic tanks are not a suitable form of wastewater treatment. In many cases homes utilizing shallow water wells were receiving inadequately treated effluent from their neighbors privies, septic tanks or vaults. Frequently such occurrances went unchecked because there are no requirements to periodically check the water quality from individual private water wells. The flood further compounded the problem by washing away the top soils and leach fields along the flood impacted area. In light of this the existing water supply and wastewater treatment systems are considered inadequate for the existing level of development within all of the study area west of the Narrows and in portions of the community of Sylvan Dale.

Chapter VIII presents alternative means of providing a safe water supply to the homes whose wells were impacted by the flood and for the entire study area. From a review of this information it appears that privately owned individual or cluster deep wells could provide a safe water supply to those homes whose wells were destroyed or damaged by the flood. This would leave many homes on shallow wells and only remedy the present water supply problem for those homes whose wells were damaged. To provide an adequate and safe water supply for any development beyond existing levels or to remedy the water supply problem for all homes within the study area, community water supply systems should be developed. As suggested in the comparison of water supply alternatives, community systems are the most cost-effective method of providing safe drinking water to all homes and businesses in the study area that do not presently have deep drilled and cased wells. As indicated in Chapter VIII, community water systems are eligible for Federal financial assistance as long as an agency is established that is responsible for management, operation, and maintenance of water treatment and conveyance facilities.

Due to the inadequacy of the existing sewage treatment facilities in most of the study area, it appears that a more reliable method of sewage treatment would be required to solve existing problems and accommodate future growth. Chapter VIII presents alternative wastewater treatment programs for the study area. Analysis of those alternatives suggests that the cost-effective method of solving existing problems and accommodating future growth is to construct a small treatment plant in each community and provide sanitary sewers to the homes within the community. As with the community water supply systems, community wastewater collection

and treatment systems are eligible for Federal financial assistance if an agency is established with responsibility for management, operation, and maintenance of the facilities.

The above discussion suggests that the existing water supply and wastewater treatment systems within the study area pose significant problems to the health and safety of existing residents and users of this area. Such problems would be compounded if additional development occurs within the study area as portrayed on land use Alternatives B and C unless some form of community water supply and wastewater management program is undertaken. To implement such a program, an agency must be established to manage the program and insure proper operation and maintenance of the necessary facilities. The establishment of such an agency creates the opportunity of qualifying for Federal or state financial assistance in the detailed planning, design, and construction of the necessary facilities. Without such an agency, and the development of community water supply and wastewater management programs, further development in the study area following the patterns of historic development would simply compound the public health problem.

What is the Relationship of the Land Use Alternatives to the Adequate Provision of Police and Fire Protection?

The lack of service standards for police and fire protection in Larimer County makes it very difficult to assess the adequacy of police and fire protection in relation to the land use alternatives. The various fire departments and individuals responsible for fire protection in the study

area have concluded that they can provide adequate protection to existing and new development with the present manpower and facilities. To insure that such protection is available to all portions of the study area it will be necessary to have the areas west of Drake along the main body of the Big Thompson River and the North Fork join a fire protection district. At the present time the Estes Park Volunteer Fire Department provides service to these areas, but if major fires were to occur in Estes Park and in either of these areas, the fire department would legally have to give priority to the Estes Park fire. The areas west of Drake should be included in a fire protection district whether any additional development of the study area is allowed or not.

The Larimer County Sheriff has indicated that the existing level of police protection, after exhaustion of LEAA funds, is adequate for the existing level of development. However, intensified residential development, as suggested by Alternative B, would necessitate increasing the number of police officers on patrol and call to maintain existing protection to an increased population. Intensified residential and commercial development, as suggested by Alternative C, would require higher levels of protection than Alternative B. This is due to the fact that the increase in commercial activities would result in more tourists stopping as they drive through the study area, thereby increasing the population beyond that associated with increased residential development. Commercial activities also require more police protection than residential areas due to higher susceptibility to robberies and vandalism. Therefore, if any additional development is allowed within the study area, it should be coupled with expansion of police protection.

What is the Relationship of the Land Use Alternatives to the Circulation Network?

The reconstruction of U.S. Highway 34 and the construction of access bridges across the Big Thompson River and the North Fork have restored vehicular access to the study area. Review of the land use alternatives suggests that, with one exception in the community of Waltonia, the existing bridges and public road network provide sufficient accessibility to all proposed development areas on Alternatives B and C. One additional bridge would be required to provide access to two small parcels of proposed residential development west of the main community of Waltonia.

WHAT SHOULD BE THE TYPE AND CHARACTER OF DEVELOPMENT IN THE STUDY AREA?

The previous section raised several questions pertaining to the desirable level of development that should be allowed in the study area. Assuming that some new development is allowed to occur, the question must be asked: What type of development should occur? Alternatives B and C suggest two general development types: intensified residential (Alternative B) and intensified residential and commercial (Alternative C). However, within either of these general development types there are a lot of possible types of development. For example, residential development could result through the subdivision of large parcels into small lots as has been done in most of the existing residential areas or through the development of large lots.

To determine the most desirable type or character of development, two major factors must be considered. First, the existing character of the area, and second, the desires of the residents of the area. Although new development can change the character of a particular area, such changes should only be allowed subsequent to a conscious decision to do so, such as a decision to undertake an urban renewal project in a deteriorated downtown area.

The character of the study area is varied with a predominantly rural community located east of the Narrows and mixed rural and tourist-oriented community west of the Narrows. Through meetings with the residents of the study area there was a general consensus that the existing character of each community should be maintained as new development occurs. This generally does not present a problem in the communities east of the Narrows where existing development is consistent and compatible with the existing land use zoning regulations. However, with the exception of the Glen Haven area, the majority of the development west of the Narrows is not consistent with existing zoning regulations. The entire area west of the Narrows except the Glen Haven area, is zoned such that new residential development could only occur on 10 acre lots and extension of commercial development would only be allowed through a variance to the zoning regulations. Therefore, to implement land use Alternative B or C and maintain the existing community character, new zoning regulations will have to be developed. Such regulations should provide for residential development on small lots consistent with existing lot sizes and for commercial activities consistent with existing small scale tourist-oriented

commercial activities. New regulations would not have to be developed to implement land use Alternative A; however, most of the land uses west of the Narrows would remain as nonconforming uses and new uses would only be allowed if they were consistent with the above stated regulations.

TO WHAT EXTENT DO THE LAND USE ALTERNATIVES RESPECT THE SENSITIVITIES OF THE NATURAL ENVIRONMENTAL RESOURCES WITHIN THE STUDY AREA?

As discussed in Chapter VII, during the development of the land use alternatives land exhibiting sensitive environmental resources in the study area were considered undevelopable. The two most sensitive areas are the elk migration corridor running out of Rocky Mountain National Park between the main stream of the Big Thompson River and the North Fork, and the fresh water fisheries along both rivers. Although some development presently exists within the elk migration corridor, particularly along the Devil's Gulch Road at the western extremity of the study area, no new residential or commercial development is proposed within the corridor on land use Alternatives B or C. The existing residential development is designated as such on all the alternatives.

The fresh water fisheries in the Big Thompson River and the North Fork were severely damaged by the flood; in time, both of these rivers will again support fish populations. Although the intended purpose of the flood plain zoning regulation was not to enhance the fresh water fisheries within the study area, the restrictions placed on human habitation within the floodway will positively contribute

to the rehabilitation of the fisheries. Prior to the flood, the fisheries were experiencing stress due to pollution from the individual sewage treatment systems located along the rivers. The flood removed many of these inadequate facilities and the flood plain zoning regulations will not allow replacement unless the treatment facilities are floodproofed. In response to the flood plain zoning regulations and to enhance the recovery of the fresh water fisheries, no new residential or commercial development was proposed within the floodway of either the Big Thompson River or the North Fork on Alternatives B or C. Existing development in the floodway was designated as such on all the alternatives.

By precluding new residential or commercial development in the two major environmentally sensitive areas, all the land use alternatives can be considered to respect the sensitivity of the environmental resources of the study area.

HOW AND TO WHAT EXTENT CAN LIMITED RESOURCES BE CONSERVED AND TO WHAT EXTENT DOES THIS CONCERN IMPACT DEVELOPMENT WITHIN THE STUDY AREA?

Insuring the efficient use of limited resources such as energy and water is one of the best methods of conserving such resources. Over the past several years numerous devices and techniques have been developed that result in more efficient uses and therefore conservation of energy and water. Requirements that such devices be incorporated into new buildings is one method of reducing the demand on limited resources.

Conservation of energy resources would not have any effect on future development patterns within the study area because energy is generally available throughout the area. This is not to say that energy conservation measures should not be incorporated into proposed developments to reduce the demand on nonrenewable resources, but that development in the study area is not contingent on energy conservation.

On the other hand, water availability may have a significant effect on future development patterns within the study area. Although it appears that there is sufficient groundwater to accommodate new development, detailed groundwater studies have not been conducted and there may not be supplies adequate enough to accommodate all the development suggested by land use Alternatives B and C. The actual availability of water can only be determined through detailed groundwater supply studies. The incorporation of water conservation measures, as discussed in Chapter VIII, into proposed residential or commercial developments would be a means of reducing the demands on limited water resources. Such conservation measures would also reduce the amount of wastewater generated by new development.

WHAT ARE THE SOCIAL IMPLICATIONS OF THE LAND USE ALTERNATIVES?

The most significant social implication related to the Big Thompson Disaster Recovery Planning Effort are the families and businesses displaced by the flood and the subsequent flood plain zoning regulations. Those families and businesses that suffered structural damage in excess of 50 percent and are located in the designated floodway will be forced to

find another location for their houses or businesses. Alternative A would not provide these people with the opportunity to relocate within the study area unless they purchased an existing house or business. Alternative B provides areas for the displaced families to relocate within the study area and Alternative C provides opportunities for both businesses and families to relocate in the study area.

HOW CAN ADOPTED LAND USE POLICIES AND PROGRAMS EFFECTIVELY GUIDE FUTURE DEVELOPMENT IN THE STUDY AREA?

Once a land use strategy has been adopted by Larimer County officials, it must be implemented to effectively guide development in the study area. Lack of commitment to the adopted plan on the part of decision-makers will result in inconsistent and haphazard land use development. Wholesale granting of variances, conditional use permits, and plan changes in the name of "flexibility" often reflect an attitude of indifference or a fear of planning as an effective mechanism to guide future growth. When "flexibility" is used to encourage innovation or to accommodate more realistic assumptions, it can be a powerful tool in creating a "dynamic" rather than "static" plan. This kind of flexibility is crucial to a plan's success, since a plan is often "out-of-date" the day after publication. On the other hand, if a plan's flexibility reflects not innovation but indifference, as is often the case, the plan will not be an effective tool to guide growth. A "plan-as-you-go" attitude benefits only a limited element of the community, and in fact, it often results in detrimental effects for the community on a long-term basis. If planning is to be effective, a plan must have the support of those charged with its implementation.

If a plan is adopted only to satisfy legislative requirements from a higher level of government and is ignored on a continuing, practical basis, there is, in effect, no plan at all.

Of concern is the development of a viable and practical plan to guide orderly land use development and the commitment to its intent and specific policies from those responsible for its enforcement. If successful, a "plan for the future" will be more than a glossy document; it will be an active and vigorous instrument to remedy existing problems and accommodate future changes.

ALTERNATIVE EVALUATION

To provide for a full understanding of the differences between the land use alternatives, the planning issues discussed above have been used to develop specific criteria to compare the land use, economic, environmental, and social aspects of each alternative. In some cases the planning issues encompassed factors which lead to the selection of more than one criterion. The evaluation criteria are presented below. The table following each section relates the land use alternatives to the evaluation criteria.

LAND USE CRITERIA

The differences in the land use patterns suggested by the alternatives can be better understood by comparing them with the criteria listed below. These land use criteria were selected to help differentiate the physical consequences

of the land use alternatives. Each criterion is designed to ask the question "To what extent does the land use alternative result in or support..."

1. Alteration of existing physical community characteristics;
2. Increased commercial activities;
3. Existing planning and zoning designations.

Table X-1 indicates how the land use alternatives relate to the above criteria.

ECONOMIC CRITERIA

The economic criteria listed below were developed to compare the effects the land use alternatives would have on the economic or man-made resources in the study area. Each criterion is designed to ask the question "To what extent does the land use alternative require..."

1. Development of additional water supplies;
2. Development of additional wastewater treatment systems;
3. Additional police and fire protection;
4. Additional access bridges.

Table X-2 compares these criteria with the land use alternatives.

ENVIRONMENTAL CRITERIA

The environmental criteria identified below were developed to evaluate the effects the land use alternatives will have on the environmental resources in the study area. Each

TABLE X-1

EVALUATION OF LAND USE ALTERNATIVES
(LAND USE CRITERIA)

		A	B	C
1.	Alteration of Existing Physical Community Characteristics	Maintain existing characteristics due to maintenance of existing land use patterns.	Expanded residential development would result in the conversion of existing undeveloped land to residential uses. With proper control this development could be consistent with existing development. However, without proper controls the new development could significantly alter the characteristics of the existing communities.	Expanded residential and commercial development would have the greatest impact on the existing character of the communities. New commercial activities would draw additional tourists to the area and result in changes to the generally residential character of the area.
2.	Increased Commercial Activities	No increase will occur.	No increase will occur.	Expansion of existing commercial areas and development of several new areas would occur.
3.	Existing Planning and Zoning Designations	Existing uses would generally remain as non-conforming uses to O-Open zoning designation. Remainder of the study area would be consistent with O-Open classification as long as zoning variances were not approved.	Proposed residential development is inconsistent with existing zoning designations. New zoning regulations would be required to make proposed development consistent with zoning and to change existing development to conforming uses.	Proposed residential and commercial development would be inconsistent with existing zoning designations. New regulations would be required to alter these inconsistencies, and to change existing development to conforming uses.

TABLE X-2

EVALUATION OF LAND USE ALTERNATIVES
(ECONOMIC CRITERIA)

		A	B	C
1.	Development of Additional Water Supplies	Would require, at a minimum, expansion of water supplies for those areas whose systems were damaged by the flood.	Would require expansion of water supplies for new residential areas and for those areas whose systems were damaged by the flood.	Would require the largest expansion of water supplies to provide water for expanded residential and commercial activities.
2.	Development of Additional Wastewater Treatment Systems	Would require, at a minimum, development of additional wastewater treatment systems for those systems damaged by the flood.	Would require expanded wastewater treatment facilities to accommodate wasteloads from new residential development.	Would require largest expansion of wastewater treatment facilities to accommodate new residential and commercial development.
3.	Additional Police and Fire Protection	Existing protection levels are adequate for existing development patterns.	Existing fire protection is considered adequate to accommodate expanded residential development. Police protection should be expanded to maintain existing protection to all residents.	Although existing fire protection is considered adequate to accommodate expanded residential and commercial activities, expanded commercial activities could increase the demand for fire protection and require expanded services. Police protection would have to be expanded beyond the level required for Alternative B due to services related to commercial activities.
4.	Additional Access Bridges	None Required.	One additional bridge required in Waltonia.	Same as Alternative B.

criterion is designed to ask the question "To what extent does the land use alternative..."

1. Infringe on flood hazard areas;
2. Infringe on geologic hazard areas;
3. Infringe on environmentally sensitive areas;
4. Result in conservation of resources.

Table X-3 suggests how the land use alternatives compare with these environmental criteria.

SOCIAL CRITERIA

The effects of the land use alternatives on the residents of the study area are highlighted by comparing the alternatives with the following social criteria. Each criterion is designed to ask the question "To what extent does the land use alternative..."

1. Reflect the desires of the residents;
2. Require relocation of businesses and families.

Table X-4 compares these criteria with the land use alternatives.

TABLE X-3

EVALUATION OF LAND USE ALTERNATIVES
(ENVIRONMENTAL CRITERIA)

		A	B	C
1.	Infringe on Flood Hazard Areas	Existing development in flood hazard areas would be allowed to remain.	Existing development in flood hazard areas would be allowed to remain. No new development would be allowed in designated floodway areas. Development would be allowed in floodfringe areas.	Same as Alternative B
2.	Infringe on Geologic Hazard Areas	Existing development in geologic hazard areas would be allowed to remain.	Existing development in geologic hazard areas would be allowed to remain. No new development would be allowed in rockfall, landslide, or unstable slope areas. Development would be allowed in debris fan areas.	Same as Alternative B
3.	Infringe on Environmentally Sensitive Areas	Existing development in sensitive areas would be allowed to remain.	Existing development in sensitive areas would be allowed to remain. No new development would be allowed in elk migration corridor or along the rivers.	Same as Alternative B
4.	Result in Conservation of Resources	No new demands would be placed on water supplies.	New demands placed on water supplies. Conservation measures could be incorporated into development proposals to reduce the new demands.	Same as Alternative B

TABLE X-4

EVALUATION OF LAND USE ALTERNATIVES
(SOCIAL CRITERIA)

		A	B	C
1.	Reflect the Desires of Residents	Maintenance of existing uses in flood hazard areas is consistent with desires of residents. Some people felt no new growth should occur within the study area.	Maintenance of existing uses in flood hazard areas is consistent with desires of residents. Some people felt growth should be allowed, but only if it is compatible with existing uses.	Maintenance of existing uses in flood hazard areas is consistent with desires of residents. Some people felt there should be no limitations placed on type or level of growth.
2.	Require Relocation of Businesses and Families	Would result in displacement of families and businesses whose houses or structures were more than 50 percent damaged by the flood and are located in the designated floodway. These families and businesses would not have the opportunity of relocating in the canyon area.	Would result in displacement of families and businesses whose houses or structures were more than 50 percent damaged by the flood and are located in the designated floodway. The families would have the opportunity of relocating within the canyon area. The businesses would not have the same opportunity and would have to relocate outside the area.	Same businesses and families displaced by Alternatives A and B. Both businesses and families would have the opportunity to relocate in the canyon area.

APPENDIX 1

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APPENDIX 2

LARIMER COUNTY FLOOD PLAIN REGULATIONS

1977

(Available from Larimer County Planning Department)

APPENDIX 3

LARIMER COUNTY GEOLOGIC HAZARD REGULATIONS

1977

(Available from Larimer County Planning Department)

APPENDIX 4

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