



Department of Health and Environmental Sciences
STATE OF MONTANA HELENA, MONTANA 59601

John S. Anderson M.D.
DIRECTOR

October 9, 1974

Honorable Thomas Judge, Governor, State of Montana, Helena
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City-County Planning Board, Courthouse, Bozeman
City-County Health Department, Box 639, Bozeman
Gallatin County Attorney, Courthouse, Bozeman
Jim DeWolfe, Bozeman Chronicle, Bozeman
Morrison-Maierle, Inc., 910 Helena Avenue, Helena
Department of Intergovernmental Relations, Division of
Planning, Helena
Department of State Lands, Helena
Department of Natural Resources and Conservation, Helena
Department of Highways, Helena
Rick Graetz, Box 894, Helena
Perry Nelson, Gallatin Sportsmen's Association, 526 North
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Louis Moos, Sacajawea Audubon Society, 712 South 13 Avenue,
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Mary Lee Reese, 29 South Alta, Helena
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James Posewitz, Department of Fish and Game, Helena
Gallatin National Forest, Federal Building, Bozeman
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Northern Rockies Action Group, #9 Placer Street, Helena
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Center, University of Montana, Missoula
Montana State Library, Helena
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Ed Mohler, Gallatin County Tribune, 201 Mendenhall,
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Bozeman Public Library, Bozeman
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of Montana, Missoula
Gallatin Canyon Study Team, Montana State University, Bozeman
Beaver Creek South, Inc., 24 South Willson, Bozeman
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Morrison-Maierle, Inc., Box 1113, Bozeman

Dorothy Bradley, Box 931, Bozeman
Elizabeth Smith, 2311 Highland Court, Bozeman
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Joe Sabol, 27 North Tracy, Bozeman
County Assessor, Courthouse, Bozeman
County Sheriff, Courthouse, Bozeman
County School Superintendent, Courthouse, Bozeman
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Layton Thompson, 918 South Tracy, Bozeman
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Mrs. Vel Jansen, 430 South Sixth, Livingston

This revised final environmental impact statement for Beaver Creek South, a proposed subdivision in Gallatin County, was prepared at the request of the Montana Environmental Quality Council. It is submitted for your consideration. Comments and questions will be accepted for 30 days following issuance of this statement. All correspondence should be directed to the undersigned.

Sincerely yours,



D. G. Willems, P.E., Chief
Water Quality Bureau
Environmental Sciences Division

DGW:APK:sh

Enclosure

cc: Ben Wake

Terry Carmody

MONTANA STATE DEPARTMENT OF HEALTH
AND
ENVIRONMENTAL SCIENCES

E.S. 74/85

A Revised Final Environmental Impact Statement
for
BEAVER CREEK SOUTH,
a proposed subdivision in Gallatin County, Montana

Pursuant to the Montana Environmental Policy Act, Section 69-6504 (b) (3); the act controlling both public and private water supply and sewage disposal for subdivisions, Section 69-5001 through 69-5005; and the act to control water pollution, Section 69-4801 through 69-4827; and at the request of the Montana Environmental Quality Council, a revised final environmental impact statement was prepared by the Department of Health and Environmental Sciences, Environmental Sciences Division, Water Quality Bureau, concerning the proposed Beaver Creek South subdivision in Gallatin Canyon, for which a submittal has been received requesting subdivision plat approval.

Response to the draft environmental impact statement was received from the state's Environmental Quality Council, Department of Highways, Gallatin Sportsmen's Association, U. S. Forest Service, Department of Natural Resources and Conservation, the Northern Rockies Action Group, Inc., and Dorothy Bradley. An attempt will be made to satisfactorily answer all questions raised in the correspondence.

Location

This project is located approximately seven miles south of the Big Sky of Montana Meadow Village in the canyon of the West Gallatin River. It is situated in the SE 1/4 of Section 17, Township 7 South, Range 4 East, MPM. Beaver Creek crosses a portion of the property for about one-fourth mile along the north side. The right-of-way of U. S. Highway 191 forms the eastern boundary.

Description of the proposed project

The owner, Beaver Creek South, Inc., a Montana corporation, intends to divide approximately 95 acres into 75 lots for single-family and multi-family residences and a maximum

of 7 1/2 acres along U. S. Highway 191 for a neighborhood commercial area. Following is a table of land use and areas:

Phase I	
Lots	60.899 acres
Roads	12.468 acres
Open space and parks	<u>21.281</u> acres
	88.456 acres

Phase II	
Lots	4.560 acres
Roads	0.701 acres
Park	<u>0.931</u> acres
	6.192 acres

DENSITY AND USE ASSIGNMENT

Single-Family	<u>Lots</u>	<u>Acreage</u>	<u>Dwelling Units</u>
Phase I			
Block 2	15	8.7	15
Block 3	17	11.6	17
Phase II			
Block 9	<u>7</u>	<u>4.6</u>	<u>7</u>
	39	24.9	39
Multi-Family-Condominium Apartment Dwellings			
Phase I			
Block 1	6	5.5	44
Block 4	7	3.8	23
Block 6	4	2.1	8
Block 7	7	6.0	48
Block 8	<u>4</u>	<u>12.0</u>	<u>12</u>
	28	29.4	135
Neighborhood Commercial			
Phase I			
Block 5	<u>5</u>	<u>7.5</u>	<u>0</u>
TOTAL	72	61.8	174

The developer proposes an initial housing start on Phase I that would serve approximately 150 persons. Water supply systems and an initial phase of the sewage collection and treatment system would be installed to serve this initial development, which would be concentrated in Block 7. Expansion of these facilities to enable development of the remainder of the subdivision would be contingent upon successful operation of the sewage treatment system.

It has been estimated by the Soil Conservation Service (U. S. Department of Agriculture) in 1972 that the annual discharge of Beaver Creek is about 9,000 acre feet. This stream supports a salmonoid fishery with individuals ranging up to 12 to 14 inches in size.

Stream-side willows and other brush provide stream bank protection and afford browse and cover for undulates and other wildlife.

The land use plan for Beaver Creek South calls for a natural open space parkway dedication of 300 feet in width along the creek. No buildings will be permitted within this parkway nor will any of it be plotted into lots. This parkway, as well as the other natural open space and recreation areas, will be owned in common and maintained by the property owners' association, Beaver Creek South Association. The overall open space and recreation areas for Beaver Creek South will make up over 22 percent of the development.

Physical features of the land include the Beaver Creek alluvial fan, which covers the northern one-quarter of the property. The vegetative cover is dominantly by wheatgrass, fescue, and sagebrush, except along Beaver Creek. The eastern third of the property borders U. S. Highway 191 and has a gentle slope to the south. It is covered with similar vegetation as the alluvial fan. The remaining part of the property occupying the southwest corner is dominated by a hill that looms about 350 feet above lower, gently sloping land to the north and east. Lodgepole pine and douglas fir are the primary tree species, although several aspen groves of up to three acres in size are in evidence in addition to several small meadows. The hill area is generally not included within the external boundaries of the Beaver Creek South subdivision.

Because Section 69-5005, R.C.M. 1947, states that *adequate evidence that a water supply that is sufficient in terms*

adequacy
of quality, quantity and dependability will be available to ensure an adequate supply of water for the type of subdivision proposed, a report on potential water sources was prepared by Donald Alford, Geophysical Consultant, and is submitted as part of this adequate evidence.

The report concerned itself primarily with a discussion of the potential for development of sufficient water supplies from the surficial geological materials to supply the domestic needs of the development and was not considered to be a complete hydrologic evaluation of the development. The discussion was based primarily on an examination of the near surface characteristics of the geologic materials in the area and their relationships to the surface drainage pattern of this portion of the Gallatin Canyon.

Geology

This discussion of the geology of Beaver Creek South was taken largely from Hall (1961), modified to some extent by observations of Donald Alford.

The area occupied by Beaver Creek South is presumably completely underlain by the Thermopolis Shale, which is Cretaceous in age. Hall (1961) states that:

Overlying the upper sandstone member of the Kootenai (lower Cretaceous) with apparent conformity are some 150 feet of medium to dark gray, very fissile carbonaceous shales and unevenly bedded siltstones, possibly of non-marine origin. This shale has previously been included by others as the lowest member of the "Colorado shale", which includes rocks of both Early and Late Cretaceous age. This shale may be terrestrial or brackish-water equivalent of the marine Thermopolis shale of Wyoming and is tentatively so considered on the basis of stratigraphic position and lithologic similarity."

The Kootenai formation, which underlies the Thermopolis shale in the area, is some 400 feet thick (Hall), and consists of interbedded non-marine conglomerates, claystones, fresh-water limestones and sandstones.

The dip of these formations in the study area is gently (approximately 5 degrees) northward to northeastward.

Locally overlying the Thermopolish shale within the study area are a variety of Quaternary surficial deposits, including those produced by gravity movements and the alluvium deposited by Beaver Creek and the Gallatin River. The Gallatin River alluvium and the Beaver Creek alluvium have been differentiated on the basis of a series of test pits excavated to a depth of 8 to 12 feet at 12 sites in the study area. The Gallatin River alluvium, which composes the surficial deposits in the southeastern corner of the development, consists of interbedded, well-sorted gravel and sand with thin, intermittent clay lenses. No evidence of clay was found within the gravel and sand layers. The Beaver Creek alluvium on the other hand was found to consist of very poorly sorted detritus, ranging in size from boulders greater than 25 cm in diameter to a fairly spatially uniform clay matrix. It is felt that, while the permeability of the Gallatin River alluvium will be uniformly high throughout the study area, that of the Beaver Creek alluvium will have a high local variability, depending primarily on the percentage content of the clay fraction. There was some indication from the test pits that the clay content of the Beaver Creek alluvium decreased from east to west, but no tests were conducted to quantify this impression.

No attempts were made to determine the lithologic character of the landslide deposits since it is not felt that they would contribute significantly to the water supplies of the area, although their hydrologic characteristics may be of some significance in determining their present stability.

Hydrology

The primary water resources of the area are represented by surface flows in Beaver Creek and the Gallatin River, together with an unknown quantity of groundwater, which is presumably contained in the Kootenai formation. It has been estimated by the Soil Conservation Service, Department of Agriculture (1972) that some 350,000 acre feet of water represent the total mean annual flow of the Gallatin River at the mouth of the West Fork, a few miles downstream from the confluence of Beaver Creek with the Gallatin River. This same source gives 9,000 acre feet as the annual discharge of Beaver Creek. It is presumed that the near-surface

(i.e., those contained in the Quaternary alluvium) ground-water resources of the study area are intimately connected to the surface stream flow past the site. Because of the apparent high permeability of the Gallatin River alluvium and the large volume of annual surface flow, it is suggested that this unit represents the most probable source of developable water supplies of the quantity required by Beaver Creek South. The only qualification given to this statement is that the total depth of the gravels is not known at this time, and they must extend to below the elevation of the Gallatin River to be productive. A minimum thickness of 30 inches is felt to be required. Locally, the Beaver Creek alluvium should yield water but the quantities will be much smaller due to lower transmissibility of the unit in general and the greater local variability of this characteristic.

The second potential source of water for the development is an upper sand member of the Kootenai formation, which, while it is nowhere exposed in the study area, is presumably present at depths of 100 to 150 feet. This member of the Kootenai formation is a productive aquifer almost everywhere it is encountered in the state of Montana and very large sections of the state are dependent upon it for water supplies. Water derived from the Kootenai formation may have a high dissolved mineral content which may include iron, calcium, etc. The entire 400-foot thickness of the Kootenai formation is a potential water source, depending upon local condition of permeability.

References Cited

- Hall, W. B., (1961) - Geology of Part of the Upper Gallatin Valley of Southwestern Montana, Unpub. Ph.D. dissertation, Department of Geology, University of Wyoming, 239 pp. with maps and illustrations.
- Farnes, P.E., and Shafer, B. A. (1972) - Hydrology of Gallatin River Drainage, Soil Conservation Service, U. S. Department of Agriculture, Box 970, Bozeman, Montana, 28 pp. with maps.

Two wells have been drilled on the property. One is at a depth of 52 feet and has been rated at 98 gallons per minute. The other is 43 feet and rated at 60 gallons per minute. The well logs read as follows:

<u>Depth (feet)</u>			<u>Depth (feet)</u>		
<u>From</u>	<u>To</u>	<u>Formation</u>	<u>From</u>	<u>To</u>	<u>Formation</u>
0	9	Clay	0	2	Topsoil
9	20	Very dirty gravels with large rocks	2	26	Loose clay- bound sand- gravel to rocks
20	28	Dirty gravels - rocks			
28	52	Red Shale	26	40	Sands
			40	43	Porous Rock

The master plan for Beaver Creek South calls for the developer to supply water to each living unit. It is anticipated that no single well will serve more than eight living units nor more than 24 persons, thereby avoiding the creation of a public water system. The property owners' association would be responsible for maintenance of the systems. However, it would be impossible to state that such common water systems would never become public as the developer has no control over the number of people that may occupy a living unit. It would be in the best interest of future residents to have one community water system. Since the many common water systems can adequately supply domestic water, no statutes are applicable that would force the developer into such a venture.

The Department of Natural Resources made the following comments in regards to the water supply:

In reference to the water supply, there is no mention of water rights. On page 7 it is stated that, ". . . it is anticipated (emphasis added) that no single well will serve more than eight dwellings or more than 24 persons . . ." This statement does not place a limitation on the withdrawal from each well. In accordance with the Water Use Act, if the yield is 100 gallons per minute or more per well than an application for a beneficial water use permit must be made to the Department of Natural Resources and Conservation, and a permit to appropriate water issued before construction may begin. It should be further noted that the Water Use Act also requires that regardless of the yield from each well, the driller must file a well log report. Within 60 days of completion the appropriator must file a notice of completion of water development with the Department.

As noted above, the two test wells had yields of 98 and 60 gallons per minute after four hours of pumping. There is no intention of pumping 100 or more gallons per minute from wells at Beaver Creek South. The driller has filed a well log report for the two test wells with the Department of Natural Resources and Conservation.

Comments on the draft environmental impact statement concerning water supply that were submitted by Dorothy Bradley indicated that the . . . *fairly complete discussion on the geology of the area . . .* and test wells were not adequate information as to the long-term water need of the proposed subdivision. This becomes a question of interpretation of the language of Section 69-5005, R.C.M. 1947, which states that . . . *adequate evidence that a water supply that is sufficient in terms of quality, quantity and dependability will be available to ensure an adequate supply of water for the type of subdivision proposed.* It has been deemed by this department that a favorable hydrogeologic report and two drilled wells that produce 60 and 98 gallons per minute is adequate evidence.

Regarding the potability of groundwater in the West Gallatin River area, the following data has been compiled by the Gallatin Canyon Study Team.

NUTRIENT CONTENT OF WELLS AND SPRINGS (mg/l)*

<u>Well</u>	<u># Samples</u>	<u>Total PO₄-B</u>	<u>Ortho PO₄-P</u>	<u>NO₃-N</u>	<u>NH₃-N</u>
B.S.	4	0.057	0.000	0.053	0.002
Ch.	3	0.008	0.000	0.064	0.002
C.W.	2	0.019	0.003	0.1021	0.007
M.W.	3	0.018	0.000	0.225	0.049
NTS ⁴	1	0.018	0.000	0.410	0.032
Po	4	0.015	0.000	0.025	0.030
OP	3	0.017	0.000	0.121	0.016
BT4	3	0.042	0.016	0.000	0.283
NTS6	1	0.004	0.000	0.177	0.000
NTS7	1	0.027	0.000	0.340	0.000
Ro	2	0.018	0.000	0.012	0.002
Sm	1	0.008	0.000	0.013	0.005
Cr	1	0.000	0.000	0.080	0.000
NTS-5	1	0.043	0.025	0.090	0.000
NTS-8	1	0.017	0.003	0.014	0.000

*Ground and Surface Water Quality of the West Gallatin Canyon Area, Progress Report, 1970).

<u>Well</u>	<u># Samples</u>	<u>Total PO₄-B</u>	<u>Ortho PO₄-P</u>	<u>NO₃-N</u>	<u>NH₃-N</u>
Average		0.035	0.003	0.104	0.019
Springs					
C.S.	4	0.071	0.044	0.103	0.001
M.S.	4	0.223	0.106	0.072	0.011
V.S.	1	0.020	0.000	0.006	0.025
LMR	2	0.045	0.000	0.017	0.003
Average		0.105	0.050	0.060	0.012

As can be seen, the groundwaters have not been contaminated by the chemical pollutants most commonly associated with human activity and water quality degradation. Biological contamination has not been a factor in the West Gallatin area due to its semi-wilderness character.

Sewage disposal at Beaver Creek South or any other subdivision is the most important variable with respect to maintenance of ground and surface water quality.

Can-Tex Industries' diffused air type sewage treatment units are proposed. BOD* and suspended solids should be reduced 80 to 90 percent, and fecal coliforms reduced to 200 per 100 milliliters, thus affording the equivalent of secondary treatment. Plans and specifications for these sewage treatment units are available for inspection in the Helena office of the Water Quality Bureau. Wastewater disposal would be through the use of rapid infiltration ponds. Morrison-Maierle, Inc., consulting engineers, provided the following concerning the proposed disposal system:

Two percolation ponds are proposed, each containing 20,000 square feet of bottom area. The percolation area will be topsoiled and planted to Reed Canary grass. Maximum dosing rate of secondary treated effluent would amount to approximately 0.10 ft/day (0.75 gal/sq.ft./day) under initial development to 0.466 ft/day (3.50 gal/sq.ft./day) with ultimate development. The average rate would be 1/2 these values.

*Biochemical Oxygen Demand - a measure of the organic content of the sewage.

	<u>INITIAL</u>		<u>ULTIMATE</u>	
Population	150		700	
Plant Flows				
Average daily flow	15,000 gpd		70,000 gpd	
Peak flow	40 gpm		125 gpm	
	<u>mg/l</u>	<u>lbs/day</u>	<u>mg/l</u>	<u>lbs/day</u>
Sewage Quality				
Raw sewage BOD	200	26	200	120
Raw sewage SS	250	31	250	145
Design Efficiency - Treatment Plant				
Effluent BOD to percolation ponds	15-25	3	15-25	14
Effluent SS to percolation ponds	20-30	4	20-30	17
Extended Aeration Plant Components				
Design flow	15,000 gpd		70,000 gpd	
Aeration tank	15,012 gal.		70,000 gal.	
Aeration tank de- tention time	24 hrs.		24 hrs.	
Air capacity	52.2 CFM		270 CFM	
Blower	3 HP		one at 3 HP one at 5 HP	
Clarifier volume	2,872 gal.		11,700 gal.	
Clarifier detention time	4.6 hrs.		4 hrs.	
Clarifier surface loading rate	237 gal/ft ²		256 gal/ft ²	
Clarifier weir overflow rate	1,579 gal/L.F.		2,080 gal/L.F.	
Aerobic digester	3,393 gal.		16,000 gal.	
Aerobic digester - cu. ft./capita	3.05		3.05	
Chlorine tank	392 gal.		2,000 gal.	
Chlorine tank de- tention time	37.7 min.		40 min.	
Gas chlorinator capacity	100 lb/day max.		100 lb/day max.	
Percolation Ponds				
Number of ponds	2		2	
Bottom area, each pond	20,000 sq. ft.		20,000 sq. ft.	
Dosing rate (avg.)	0.375 gal/ft ² /day		1.75 gal/ft ² /day	

In order to evaluate the suitability of the land at Beaver Creek South for this type of sewage disposal system, geologic, hydrogeologic, and soils information must be analyzed. Geologic and hydrogeologic information were presented previously in this revised final environmental impact statement. In addition, Donald Alford, consulting geologist, prepared a report on factors influencing slope stability that was submitted by the developers. His general conclusions stated that:

The Gallatin Canyon area of Montana is characterized by virtually every type of mass-movement which is known to occur. These include rockfalls, rock-slides, talus deposits, rapid and slow slumpage, earthflows and mudflows. It is apparent that if all development were proscribed in and near areas of mass-gravity movements, not even a road would now exist in the Canyon.

It appears that a majority of the geomorphic features recognizable as mass-gravity phenomena are quasi-stable under present environmental conditions which exist in the Gallatin Canyon. Most of them are presumably remnants of past periods of increased water availability at the surface, either from glacier melt or periods of increased precipitation. Some are undoubtedly the results of the 1959 Hebgen Lake earthquake. Certainly, there is no uniform state of conditional instability which would allow the development of regionally valid criteria for the determination of the type of construction which is possible on any given slope.

The effects of human activities is equally indeterminate. While the construction of roads and buildings may constitute a sufficient cause for the initiation of slope instability, this is by no means a foregone conclusion. Under certain conditions, primarily when these activities result in a decrease in soil moisture, construction may even contribute to slope stabilization. It is quite likely that the construction of roads across convex slopes will probably invariably result in some slumping but, given a certain amount of care, this type of surface morphology can be avoided. This is primarily an engineering problem except in areas where some type of movement is occurring under natural, unmodified conditions.

None of the area to be served by sewer systems or the proposed sewage treatment plant and percolation ponds is on land characterized by mass land movement, although ground of this type is in evidence in the SE 1/4 of Section 17. The potentially developed area at Beaver Creek South has been tentatively located so as to avoid these types of land forms and the problems Donald Alford enumerates that are associated with them.

From the GENERAL SOILS MAPS AND SOILS INTERPRETATION by J. A. Olsen, et. al. of the Montana Agricultural Experiment Station in Bozeman, the subject Beaver Creek South property contains three basic types of soil associations:

1. Bigel-Hobacker on the relatively flat lands on the north and east sides of the property.
2. Leavitt-Hanson on the near hilltop slopes of grades 20 percent and less.
3. Leavitt-Loberg on the lower steep slopes of the hill facing north and east with grades from 20 to 40 percent.

The Bigel-Hobacker Association is well drained, gravelly and cobbly soils and shallow gravelly soils. These soils are found on the nearly level terraces of the Gallatin River and the fan of Beaver Creek, a main tributary. These soils are suitable, with only slight possible limitations, for foundations for low buildings, with or without basements and show only slight possible limitations for roads, parking, lawns and landscaping. It is upon this soils association that the planned multi-family residences will be built. Also, the development sewage treatment plant and filter ponds will be located on these soils where possible limitations for this use are judged to be slight to moderate in the above-referenced GENERAL SOILS MAP OF GALLATIN CANYON.

The Leavitt-Hanson association is deep, well drained, stony loam soils. These soils are found on the 0 to 30 percent slopes at or near the top of the hill and on its upper north facing slopes. Moderate limitations are possible for foundations of low buildings on this soil association, particularly where the slope is excessive grade. There is no part of this planned subdivision that has been or will be laid out on the Leavitt-Hanson association of soil type.

The Leavitt-Lobert association is well drained, strong loam and clay soils. At Beaver Creek South, this soils association is found on the middle, steeper slopes of the hill on the southwest of the property. Development limitations on this soil is very similar and moderately greater to those expected with the Leavitt-Hanson association. The Leavitt-Loberg association soils are located on the north and east facing slopes where the grade is from 30 to 50 percent. There is no part of this planned subdivision that has been or will be laid out on the Leavitt-Loberg association of soil type.

In May 1973, 12 ten-foot deep soil test pits were dug at various locations on the subject property. The primary purpose of these pits was to determine if the groundwater in the spring would be within ten feet of the surface. No groundwater was found at any of the pits. In general, the loamy topsoil was found to be 12 to 18 inches deep, and the various soils below were generally cobbly, gravelly, deep and well drained.

Numerous wastewater facilities across the country are successfully utilizing percolation ponds or other methods of surface disposal of treated wastewater. Following is a brief summary of data collected from some of these facilities as related to loading rates, nutrient removal efficiencies and other pertinent information.

Flushing Meadows Project - Phoenix, Arizona

Reference - "Water Quality Aspects of Intermittent Systems Using Secondary Sewage Effluent" by Herman Bouwer, U. S. Water Conservation Laboratory, Phoenix, Arizona.

- (a) Grassed percolation ponds (Bermuda Grass).
- (b) Soil profile - 3 feet fine loamy sand underlying by coarse sand and gravel.
- (c) Depth to water table - 10 feet.
- (d) Infiltration Rates - 1 to 3 feet per day (7.5 to 22.5 gallons per square foot per day).
- (e) Wastewater applied - secondary effluent.
- (f) With inundation periods of two to three weeks, the nitrogen was reduced between 1 and 3 milligrams per liter at 20-foot depth test wells located 100 feet from the percolation ponds. Phosphates average about 1.5 milligrams per liter at the same test wells.

Robert A. Taft Water Research Center - Cincinnati, Ohio
Reference - "Soil Systems for Liquid Waste Treatment and Disposal: Environmental Factors" by Warren A. Schwartz and Thomas W. Dendixen, WPCF Journal, April 1970.

- (a) Lysimeter studies with and without vegetation.
- (b) Vegetation used - Reed Canary Grass.
- (c) Soils - Ottawa silica sand and Downs silt loam.
- (d) Unsaturated depth of soil - 5 feet represents an adequate depth in most situations.
- (e) Wastewater applied - Secondary trickling filter effluent.
- (f) At loading rate of one gallon per square foot per day on bare soil, phosphorous removal was 98 percent, ammonia nitrogen 96 percent, and total nitrogen 48 percent.
- (g) At loading rate of one gallon per square foot per day on Reed Canary grass, phosphorous removal was 99 percent, ammonia nitrogen 96 percent, and total nitrogen 85 percent.
- (h) Vegetation on soil surface increases hydraulic longevity by a factor of two.
- (i) Biological treatment is the main victim of cold weather. The adverse effects of cold weather operations can be overcome by achieving biological maturity in the system prior to the onset of the cold season.
- (j) Over 99 percent of plant nitrates and 92 percent of the total plant nitrogen is lost to the atmosphere when the grass is burned.

San Francisco Bay, Chicago - South End Lake Michigan, Southeastern Michigan, Cleveland-Akron Metropolitan and Merrimack River Basin Areas

Reference - "Assessment of the Effectiveness and Effects of Land Disposal Methodologies of Wastewater Management," Wastewater Management Report 72-1, U. S. Army Corps of Engineers, January 1972.

- (a) Wastewater applied - secondary effluent.

- (b) Rapid Infiltration Ponds - Design loadings suggested up to 330 feet per year (6.8 gallons per square foot per day average).
- (c) Removal of BOD and SS in rapid infiltration ponds is very effective - over 99 percent.
- (d) Rapid Infiltration Ponds with Grass - field results: Case 1 - Application 3 feet per day (22.5 gallons per square foot per day) 14-day infiltration, 14-day rest, silty sand soil with 2 percent clay, total nitrogen removal is 80 percent, phosphate removal is 62 percent. Case 2 - Application 4.5 feet per day (34.5 gallons per square foot per day) 6-month infiltration, 6-month rest, sandy soil with 0 percent clay, total nitrogen removal is 92.4 percent, phosphate removal is 92.5 percent.
- (e) Estimated Effectiveness of Rapid Infiltration Ponds - Application 330 feet per year (6.8 gallons per square foot per day) 10 days infiltration, 4 days rest, sandy gravel soil with continuous vegetation, nitrogen removal is 80 percent, phosphate removal is 90 percent.
- (f) Volatilization of nitrogen gases through biological nitrification - denitrification remains the major mechanism of nitrogen removal in rapid infiltration ponds.
- (g) An increasing clay content in the soil will increase denitrification and nitrogen and phosphate removal by adsorption.
- (h) The nitrogen removal in rapid infiltration ponds is mainly governed by the period the basin is inundated. A longer period gives a better balance between aerobic and anaerobic conditions necessary for nitrification-denitrification. However, prolonged inundation periods, which create permanent aerobic conditions, should be avoided.

Miscellaneous Projects

Reference - "EPA Studies on Applying Sludge and Effluent to the Land," by Curtis C. Harlin, Jr., Chief, National Water Quality Research Program; Robert S. Kerr, Environmental Research Laboratory, EPA, Ada, Oklahoma, Compost Science, July-August, 1973.

Infiltration-Percolation Studies

- (a) Four projects studied in the southwestern states and two projects in the north central states.
- (b) Denitrification in the soil plays a major role in obtaining nitrogen removal.
- (c) Results of the colder north central states projects were similar to those observed in the southwest although climatic and soil differences necessitate different rates of loadings.
- (d) Short flooding and drying cycles resulted in high nitrate concentrations in the groundwater immediately under the percolation site.
- (e) Longer flooding periods resulted in total nitrogen removal at one north central site of 70 percent and 90 percent near Phoenix.
- (f) Quote - *Our experiences from these projects indicate the infiltration-percolation approach can be utilized effectively to achieve specified levels of tertiary treatment at selected sites.*

Overview

Reference - "Wastewater Treatment and Reuse by Land Application" - EPA - 660/2-73-006a, August, 1973.

Infiltration-Percolation Ponds

- (a) Infiltration Rates - Moderate - Four inches to 60 inches per week (0.35 to 5.5 gallons per square foot per day). High rate - Five feet to 10 feet per week (5.5 to 11 gallons per square foot per day).
- (b) Soils with infiltration rates of four inches per day to two feet per day or more are desirable for percolation ponds.
- (c) Phosphorous removals generally range from 70 to 90 percent depending on physical and chemical characteristics of the soil that influence retention of phosphorous.
- (d) Nitrogen removals are generally poor unless specific operating procedures are established to maximize denitrification.

- (e) Increased nitrogen and phosphorous can be removed with vegetation through plant uptake with harvest.
- (f) At Lake George, New York, phosphorous retention in some percolation ponds appears to have been exhausted through ten feet of soil. The system has been operating about 35 years at moderate rates of 7 to 15 inches per week.
- (g) At Lake George, the snow and ice do not present serious problems. As the basins are flooded, the ice floats seven to eight inches and serves to insulate the soil surface from further lowering of temperature.
- (h) Infiltration-Percolation - Use in cold climates - excellent.

Penn State Project

Reference - "Crop Selection and Management Alternatives - Perennials," by William E. Sopper, Penn State University, Proceedings of the Joint Conference on Recycling Municipal Sludges and Effluents on Land, July, 1973.

- (a) Perennial grasses appear to be the most suitable for wastewater disposal.
- (b) Secondary effluent applied to Reed Canary grass, all seasons.
- (c) Average application - two inches per week, 1965 - 1970.
- (d) During six-year period, 2,127 pounds of nitrogen were applied to Reed Canary Grass. A total of 2,071 pounds were removed in the harvested crops, resulting in a renovation efficiency of 97.3 percent.
- (e) Annual renovation efficiencies on phosphorous varied from 24 to 63 percent.
- (f) Quote - *In summary, it appears that there is sufficient evidence to indicate that perennial grass management systems are adaptable to municipal wastewater, . . . and that the wastewater can be satisfactorily renovated.*

Overview

Reference - "Treatment Processes and Environmental Impacts of Liquid Waste Disposal on Soil," by Eugene B. Welch and Demetrios E. Spyridakis, Fourth Annual Environmental Engineers' Conference, Montana State University, February, 1973.

- (a) Plant uptake of phosphorous and nitrogen combined with biological and chemical immobilization of phosphorous and volatilization of nitrogen through biological and/or chemical denitrification, and escape of ammonia from alkaline soils, and nitrate leaching provide the main mechanisms for nitrogen and phosphorous removals from soil solution.
- (b) Eighty to 90 percent nitrogen removals by soil systems are indicated by values obtained the last 15 to 20 years in comparable experimental systems under a variety of environmental conditions.
- (c) Efficiencies of nitrogen removal may be increased (greater than 90 percent) and maintained for many years by additions of organic carbon.
- (d) A high carbon-nitrogen ratio will accumulate nitrogen in the soil minimizing loss through leaching. Increased soil organic matter will also maintain or improve soil structure, increase the potential for plant uptake and aid aeration and water flow processes.

Summary Report

Reference - "Project Report of Pilot Studies on the Use of Soils as Waste Treatment Media" (1962-1967), by Warren A. Schwartz, Thomas W. Dendixen and Richard E. Thomas, FWPCA, July, 1967.

- (a) Vegetation on soil - Reed Canary grass and soil removed 85 percent of the total nitrogen dosed versus 48 percent for bare soil.
- (b) Burning of the grass resulted in 91.7 percent of the total nitrogen lost to the atmosphere.
- (c) Cold temperatures tend to suppress biological activity in the winter but also produce several other effects. Snow or ice can serve as insulation for the surface for ice frequently forms a bridge over the surface with the pond liquid infiltrating out from under it.

- (d) Nitrification is suppressed with cold weather startup of infiltration systems. Summer startups provide a more mature biological system resulting in better overall seasonal removals of total nitrogen.

The U. S. Forest Service alleged that Brelsford and Associates have made most favorable interpretations of J. A. Olsen, et. al. GENERAL SOILS MAPS AND SOILS INTERPRETATION and questioned whether the single-family residences and neighborhood commercial area would be confined to the Bigel-Hobacker soils. The sewage treatment plant and percolation ponds would be located on Bigel soils. The neighborhood and commercial area and some of the single-family residences will be located on the Bigel-Hobacker Association soils. Part of the single-family residences would be constructed on Leavitt-Loeberg and Leavitt-Hanson associations.

With respect to the matter of sewage disposal, Dorothy Bradley made the following comments concerning the draft environmental impact statement:

Information was definitely insufficient on the matter of sewage disposal. P. 11 of the EIS states that "the proposed method of wastewater disposal is still under review by the Water Quality Bureau." How is the public supposed to evaluate something on which the agency has made no determination? The EIS would have it appear as a relatively simple matter, saying on P. 14, "when it is determined what pond area and dosing rates of wastewater from the sewage treatment would insure the quality of ground and surface waters, then the proposed development would appear to meet the concept criteria required . . ." This conflicts with another agency which states on P. 12 that "unless at least tertiary sewage treatment is planned, it is my feeling that in time water quality degradation will occur in the watercourse in the area even though the seepage ponds are located quite far away from either stream."

Part of the purpose of the EIS is to present to the public information and agency evaluations regarding decisions that are to be made. Information on waste treatment should not be skimped. Agency conflicts should be cleared up or, at least analyzed.

It would appear that Ms. Bradley's primary objection to the discussion of sewage disposal in the draft environmental impact statement was not a matter of insufficient information but the fact that the Water Quality Bureau had not made an irrevocable decision concerning the future course of action. If a decision had been reached, an environmental impact statement would have been a means of justification and not in compliance with the Montana Environmental Policy Act. If an irrevocable decision had been reached, no environmental impact statement would have been prepared, for the environmental impact statement process should be a predecision methodology to assure a reasoned and balanced judgment about the effects of a project before it is begun.

The Montana Department of Fish and Game, the Northern Rockies Action Group and Dorothy Bradley have expressed interest in a tertiary treatment system in their responses to the draft environmental impact statement. There is much public misunderstanding concerning tertiary treatment as many consider this to be a magic cure-all for complex problems.

In reality, tertiary treatment is partial removal of pollutants not removed by conventional biological secondary treatment processes. Here, removal implies a reduction in concentration of pollutants--not complete removal. These pollutants would include suspended solids, biochemical oxygen demand, refractory organics, nutrients (nitrogen and phosphorus) and inorganic salts. Depending on the tertiary treatment needs, the unit operation(s) could consist of something simple like filtration or complex like chemical coagulation, reverse osmosis or electro dialysis. In the case of percolation ponds, the soil system and vegetation is a tertiary treatment system.

Reed Canary grass is a hearty plant that can withstand large quantities of water. The grass is being used primarily for nutrient removal; however, improved percolation is a secondary benefit. Tests have shown that the infiltration rate can be 25 percent higher in a grass-covered basin than in a bare soil basin.

Miller found
no difference
on Highway and
Bench

High percentages of phosphate removal are expected through plant uptake and adsorption by soil particles. The depth of soil column to the groundwater is more than generous for this purpose.

Nitrogen removal is probably the item of most concern and will require some care in operation and management to accomplish desired results. The direct uptake of nitrogen

humus

by the grass roots for Reed Canary grass is estimated to be about 200 pounds per acre per year. (U. S. COE Special Report 171, May 1972 states 226 pounds per acre per year for Reed Canary grass). Possibly more significant than plant uptake is nitrogen removal by bionitrification, an anaerobic process where nitrates are reduced mainly to nitrogen gas which escapes to the atmosphere. Studies conducted by Herman Bouwer at the Flushing Meadows Project in Arizona determined that this nitrogen removal process contributed to the largest portion of nitrogen removed. However, they were loading the percolation ponds at extreme rates, averaging about seven and one-half gallons per square foot per day, which contributed for more nitrogen than the grass roots could possibly take up.

High percentages of nitrogen removal do not take place with frequent, short inundation periods when complete aerobic conditions prevail. However, there is significant nitrogen removal for longer inundation periods when oxygen is limited allowing denitrification of the nitrates present. Since the loading rates at Beaver Creek South will be considerably less than the regular high rate percolation ponds, it is expected that a higher percentage of the nitrogen removal will be by plant uptake. However, during the winter months, the denitrification process, along with adsorption by the clay fraction, would play a more important role.

Careful scheduling of inundation and dry-up periods of the percolation ponds is important to achieve the highest degree of nitrogen removal. Longer inundation periods are desirable for nitrogen removal in grassed basins where nitrogen loadings exceed uptake capacities of the grass. Dry-up periods, however, are necessary to allow oxygen to enter the soil for the aerobic bacteria that decompose the organic waste matter and to obtain a recovery in the infiltration rate.

Assuming a total nitrogen concentration in the secondary effluent at Beaver Creek South of 20 milligrams per liter, the total annual nitrogen applied would amount to about 910 pounds at the initial development (design flow is 15,000 gallons per day) and about 4,250 pounds at ultimate development (design flow is 70,000 gallons per day). Plant uptake for Reed Canary grass would remove perhaps 200 pounds per acre. To provide the necessary area for complete plant uptake of the nitrogen would require in excess of 20 acres at design flows, which is beyond the limits of a percolation pond. Biological nitrification-denitrification and adsorption must then be relied on to remove the larger portion of the nitrogen.

It is proposed that the percolation ponds be inundated and dried on 14-day cycles. The rise or mounding of the groundwater table as a result of this disposal system is expected to be minor.

In addition to improving nutrient removal and providing better percolation capabilities, the Reed Canary grass will provide additional benefits in reducing water content through evapotranspiration. The grass vegetation will also offer some protection against freezing.

Two percolation ponds of 20,000 square feet each are planned for both initial and ultimate development. Dosing rates at ultimate development would still be low compared to rates commonly used. However, additional percolation pond area can be added after gaining operating experience, if it is determined that the additional area will benefit treatment.

Since percolation ponds have not been used to a great extent in this part of the country, any such system would require monitoring wells to ascertain any effect on groundwater. Two to the east of the ponds and one north of the ponds would be necessary.

These wells would be tested every three months, and the BOD, suspended solids, nitrogen, phosphorus, and fecal coliform count would be reported to the department along with data on the total weekly flow from the treatment plant. The sewage treatment plant and wastewater disposal system would be adjusted pending the data obtained from the test wells.

Any sewage disposal system that requires maintenance needs careful management. The Beaver Creek South Association, which would comprise the lot owners, would be responsible for operation of the sewage treatment plant. A qualified operator would have to be hired to maintain the plant. Since this sewage plant would serve ten or more families, the operator would have to pass an examination and be licensed by the Montana Board of Certification of Water and Wastewater Operators.

The vegetation would have to be harvested from any type of surface disposal system, whether it be an infiltration pond or irrigation system.

Probable Impacts of the Project on the Environment

Impacts from development of this property would undoubtedly fall within the range associated with the residential use

of a mountain valley. A visual impact would certainly result from the proposed development. The severity of this visual impact is purely speculation, and the desirability is a matter of personal aesthetic values.

The Department of Natural Resources and Conservation had the following comments concerning the visual impact of the proposed development:

We agree that the visual impact of the proposed development is, to a degree, open to speculation and a matter of personal values. However, the Final EIS should acknowledge the fact that the Gallatin Canyon is widely renowned for its scenic, natural beauty, unmarred by extensive development. The placement of subdivisions within the scenic canyon setting, therefore, has a far more serious visual impact relative to similar developments within or near urbanized areas.

The department will acknowledge the fact that the Gallatin Canyon is a widely renowned area noted for its scenic beauty that has not, until the last several years, been subject to extensive development. Any development, including the proposed Beaver Creek South, placed within this scenic canyon setting would be considered aesthetically offensive by a majority of people.

The U. S. Forest Service stated:

The Beaver Creek development is not adjacent to National Forest land. Effects on National Forest land will be secondary in such forms as increased pressure for the 161 KV power-line, highway 191 improvement, use of National Forest lands for various recreation purposes, etc.

The Northern Rockies Action Group made the following comments with respect to probable environmental impacts on the environment of the proposed subdivision:

. . . where the Department does engage in its own analysis, the language used is primarily canned. For example, it is reasonable to assume without knowing anything besides the location of this development that the impacts would "undoubtedly fall within the range associated with the residential use of a mountain valley." However, this kind of

statement does not come close to satisfying the requirements of the Montana Environmental Policy Act and the guidelines prepared thereunder. A rather rigorous balancing analysis of costs and benefits of residential use of a mountain valley should be undertaken. Absent this kind of analysis, the statement is not in compliance.

Admittedly, some language used in the preparation of an environmental impact statement for a subdivision sounds "canned" as the impacts of one subdivision may be similar in some respects to impacts of others.

Economists have not developed an acceptable process to place on economic evaluation on such intangibles as aesthetics. The severity of a visual impact is still the "canned" speculation and the desirability a matter of personal aesthetic values.

The SE 1/4 of Section 17 has been recently grazed by livestock. Although no range survey has been completed on this site, other areas with similar climate, soils and vegetation require four to seven acres per animal unit month, depending upon range conditions and trends. This land would not be usable as pasture should the subdivision proceed as planned.

The Montana Department of Fish and Game reports that the proposed subdivision and the immediate area currently winters in the vicinity of ten elk plus deer and moose. Game birds are also present. The Montana Department of Fish and Game offered the following comments before the draft environmental impact statement was released.

One of our greatest concerns with development within the Gallatin Canyon is the destruction of wildlife range. Any development in this area destroys the potential of maintaining wildlife in their existing numbers. The Beaver Creek South subdivision is no exception and will reduce the carrying capacity of the area for wildlife.

The other factor related to wildlife when establishing a subdivision is the fact that people concentrations tend to change the use of much more area than just where they physically live. For example, at the present time people living on

the south end of the Gallatin Game Range plus the trustees of the Ophir Grade School complain about hunting on the Game Range. The Gallatin Game Range was purchased by Montana Sportsmen for raising elk and other wildlife and hunting. This purchase was made before any extensive development occurred in the area and people who later built in the area knew it was a Game Range. Yet, now they are complaining about hunting. This reminds me of people who build close to an airport and then complain about the airplane noise. The Beaver Creek South subdivision is also located adjacent (The Montana Fish and Game owns the rest of Section 17) to the Gallatin Game Range and in the future people will no doubt attempt to change the long established hunting use of a large part of the general area. A few people may have an effect on the entire Montana hunting public. This same problem can be further pointed out by a proposal by The Big Sky Corporation to make a large portion of the West Fork of the Gallatin River a game refuge and allow no hunting.

The report you furnished indicated there would be a central sewage treatment facility but no real details were available. I cannot really accept or reject this method of sewage treatment until more details are available. Unless at least tertiary sewage treatment is planned, it is my feeling that in time water quality degradation will occur in the watercourse in the area even though the seepage ponds are located quite far away from either stream.

The question of sewage disposal was considered earlier in this statement. It should be noted the Montana Department of Fish and Game did not offer additional comments in response to the final environmental impact statement. The Gallatin Sportsmen's Association did respond stating their concern for the adverse environmental impacts the proposed subdivision would have on wildlife.

We appreciate the opportunity to comment on the draft environmental impact statement for the proposed Beaver Creek South subdivision in Gallatin County. Our main concern is for wildlife, mainly elk, in the area of the subdivision and adjacent to the subdivision.

Wildlife provide a major source of recreation in the Gallatin. Recreation hunting has been a traditional and necessary form of wildlife management for years. For 75 years, Montana Sportsmen have invested their money in management programs for the benefit of wildlife, people and recreation. The Beaver Creek South subdivision is adjacent to the Gallatin Game Range which was acquired for wildlife winter range and hunting in 1951 with sportsmen's money generated by hunting license fees and excise taxes on sporting arms and ammunition.

Since 1951 more extensive development has occurred in the area and the newcomers are already complaining about the hunting on the game range and adjoining public land. While we share their concern we must remind them that hunting has been an established use of wildlife on public lands since Montana became a state. We suggest it be mandatory that subdivision developers inform prospective buyers of the fact that hunting on public lands is an established right!

Environmental impact statements often convey the feeling that wildlife is not disturbed by development and merely move to another part of the forest and live happily ever after. Such a feeling has no basis in fact and demonstrates a lack of appreciation for wildlife ecology. Most Montana wildlife, especially the big game species, require habitat with wilderness type characteristics. Development in one form or another and the year long people activities associated with development can effectively stop wildlife production in the impacted area. The area of impact is always a much larger area than that occupied by the development alone. Eventually, development will stop the production of the wildlife dependent upon the area and their contribution to the wildlife population will be lost forever.

The development of land in wildlife winter range areas, such as Beaver Creek South subdivision, may also result in considerable economic loss to Montana. A recent publication indicates that wildlife in the area of the proposed subdivision would yield between \$50 and \$100 million in benefits over the next 35 years¹.

¹ 1974 The Gallatin Area, Bulletin 344, Gallatin Canyon Study Team, National Science Foundation, Cooperative Extension Service, Montana State University, Bozeman, Montana

To realize the benefits we will need to protect the wildlife habitat, especially the winter range in the Gallatin. Also, a basic problem must be recognized--wildlife habitat cannot simultaneously be used for both wildlife under natural conditions and for development of subdivisions in or near the wildlife habitat.

If Big Sky of Montana, Inc. feels that this subdivision is necessary to their operation, we suggest it be moved into the West Fork area closer to Big Sky where wildlife is already relegated to a minor land use.

Montana citizens and sportsmen are concerned about land use control in relation to wildlife range. Unfortunately, concern has not been enough and the legislature "dropped the ball" when it came to seriously considering wildlife in laws dealing with planning and approving subdivisions. However, we hope the State of Montana will show concern, pursuant to the Montana Environmental Policy Act, for wildlife, for recreation and for our investment in wildlife that was made for the benefit of all people.

Our Association is not in favor of approving this subdivision because of the adverse impact on wildlife and on public recreation associated with wildlife.

The U. S. Forest Service echoed the Department of Fish and Game's concern for the adverse impact the proposed subdivision would have on wildlife and added that the development would further restrict game movement, particularly elk. The Northern Rockies Action Group also lent support to the Gallatin Sportsmen's position on wildlife and the proposed subdivision.

It is true, as the Gallatin Sportsmen's Association comments indicate that the legislature did not pass legislation which would authorize consideration of wildlife habitat in the planning and approval of subdivisions. The subdivision review authority vested with the Department of Health and Environmental Sciences is given in Section 69-5001 through 69-5005, R.C.M. 1947, as revised by Chapter No. 509, Montana Session Laws 1973, House Bill No. 465. This review authority encompasses water supply, sewage disposal and solid waste disposal. In addition, there are the sections of the codes that concern water quality that may be directed toward subdivision review.

However, the state of Montana did not show a complete disregard for wildlife or any other environmental or land use concern. Chapter No. 500, Montana Session Laws 1973, Senate Bill 208 as amended in 1974 by House Bill 1017 is an act requiring local governing bodies to adopt subdivision regulations and in default thereof providing for the promulgation of departmental assessments; providing for the administrative establishment of procedures and requirements for preparation of subdivision plats; setting forth requirements for surveying and platting divisions of real property and for recording surveys and plats; providing for surveying, platting, and subdividing generally.

Under this legislation, public hearings are to be advertised and held at a convenient location. The concerned public and governmental agencies are afforded an opportunity to voice their concern relating to a proposed subdivision and bring environmental facts to the attention of the planning boards and county commissioners. A notice of hearing was published concerning a public hearing for Beaver Creek South, which was held on October 11, 1973. The planning board granted preliminary plat approval subject to staff recommendations. One of these recommendations was that final approval be subject to Department of Health and Environmental Sciences approval of water and sewer systems. Don Bianchi, regional information and education officer for the Montana Department of Fish and Game, submitted a letter on possible infringement of wildlife habitat and asked for more details on sewage disposal systems. No other comments were received. On January 10, 1974, an advertised public hearing was held concerning the seven-lot Phase II of Beaver Creek South. Apparently, no comments were received.

Therefore, there is an opportunity to effect rejection or revision of a subdivision for environmental reasons at the county level. This would appear to satisfy the spirit in which the Montana Environmental Policy Act was enacted.

Previous to the preparation of the draft environmental impact statement, Mr. Paul R. Devine, Chief of the Planning and Research Bureau, Montana Department of Highways, was consulted concerning the effect the proposed development would have on U. S. Highway 191. Following is his analysis:

If this subdivision is developed to its full potential of 174 dwelling units, it is estimated that these dwellings will create approximately one thousand additional trips on U. S. 191. It is assumed that approximately 90 percent of these trips or 900 vehicles per day would use our highway to the north. The present traffic volume on U. S. 191 near this development is 1,065 vehicles per day. The average daily traffic on U. S. 191 just north of the Big Sky resort amounts to 1,240 vehicles per day. It is estimated that due to the recreational characteristics

of this highway, traffic will increase at the rate of approximately four percent per year for the next twenty years. Assuming this increase and adding in the additional traffic generated by this proposed development, the 1993 traffic volumes would be 3,200 south of Big Sky and approximately 3,600 to the north. These volumes will not warrant the construction of a four lane facility in this vicinity.

In response to the draft environmental impact statement, the Montana Department of Highways sent the following comments:

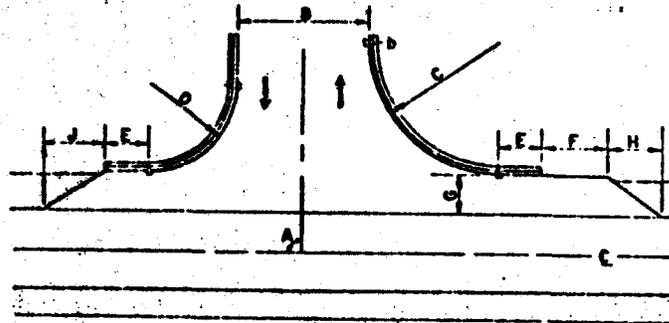
Reference is made to your draft environmental impact statement dated April 8, 1974 on the subject subdivision. As pointed out in the statement, this subdivision will generate a large amount of traffic that will utilize U. S. 191.

After reviewing the subdivision plat in your office we have the following comments.

- 1. Access to U. S. 191 should be limited to one approach at highway station 894+51 ± (Twin Antler Drive).*
- 2. The approach at this point should be in accordance with the Montana Department of Highways Approach Standards for Montana Highways. The attached page 26 from this manual illustrates what would be an acceptable approach in this particular situation. It is recommended that 55 MPH speed be used for determining "F".*
- 3. With the approach at Twin Antler Drive, there are adequate interior roads to serve the subdivision without allowing any other access to U. S. 191. The commercial area should be served from the proposed frontage road adjacent to U. S. 191.*
- 4. It is requested that future statements include a general location map and a copy of the proposed subdivision plat.*

**PUBLIC ACCESS APPROACH
RIGHT TURN LANE & TAPERS**

The applicant shall provide right-turn lanes or tapers as part of an approach or driveway system if the department determines that such right-turn lanes or tapers are required to minimize congestion or hazard on the highway caused by vehicles entering the applicant's approach. A right-turn lane shall be preceded by a taper. The design feature dimensions of a right-turn lane and taper shall conform to those shown below.



RIGHT-TURN LANE AND TAPERS					
Design Features		Curbed Highway		Uncurbed Highway	
		Standard	Range	Standard	Range
	E	10 ft	no range	10 ft	no range
Right-turn Lane Length	F	* *		* *	
Right-turn Lane Width	G	12 ft	10 to 15 ft	12 ft	10 to 15 ft
Entering Taper	H	150 ft *	50 to 150 ft	150 ft	50 to 150 ft
Exiting Taper	J	not applicable		50 ft	50 to 150 ft

* If a right-turn lane is used, the Entering Taper standard shall be 50 ft.
Without a right-turn lane, the Entering Taper standard shall be 150 ft.

The standard shall be used unless engineering judgment determines that another dimension within the range is more suitable for a particular site or special condition and is approved by the department.

* * TO DETERMINE F		
HIGHWAY SPEED M.P.H.	RIGHT TURN LANE F (FT.)	TAPER (FT.)
25	75	50
	0	150
30	100	50
	0	150
35	125	50
40	175	50
45	225	50
50	275	50
55	325	50
60	400	50
65	475	50
70	550	50

It is anticipated that Beaver Creek South Association will comply with the recommendations of the Montana Department of Highways. A permit is necessary for access to this primary road. It would undoubtedly not be issued if the approach at Antler Drive did not meet specifications.

Objection to the Department of Highways analysis of the proposed subdivision's impact on the U. S. Highway 191 was voiced by the U. S. Forest Service.

The treatment of the effect on traffic is very incomplete. No date is placed on the ADT's given. I would assume these figures are current. In 1971 the State of Montana Highway Department estimated the present highway will carry 4,500 ADT. At that time they said that in 1969 an average increase of 43 cars per day each year without Big Sky or an ADT in 1980 of 3,181 cars. Big Sky traffic by 1980 was estimated at 600 additional cars per day or 3,781 ADT. Today we have Beaver Creek South with an estimated 900 ADT for a total of 4,681 ADT. An additional figure should be added to this total for subdivisions proposed or approved since 1971 such as proposed Karst #1 and the approved Ken McBride subdivision in the West Fork.

The State of Montana Highway Department should reevaluate their projections for this proposal and total use of this Highway taking into consideration peak periods of use. They appear to have used yearly average figures rather than peak figures and have not adequately considered the effect of other developments when they estimate a 4% increase per year to 1993; nor are they consistent with past projections.

Use of Highway 191 in the Gallatin Canyon may be approaching capacity during peak periods of the day now. Motor vehicle accident figures and deaths have increased many fold in the last five years. Beaver Creek South will intensify the problems. The report should accurately quantify these additional traffic problems and weigh their consequences including the consequences of a 4 lane highway.

Comments on the effect the proposed subdivision would have on U. S. Highway 191 were also received from the Department of Natural Resources and Conservation.

Page 13, Vehicle Impact. The Department of Highways' comments give the full development level for the subdivision as 174 dwelling units; elsewhere in the Draft the developer affirms that 200 dwelling units will be possible if the subdivision is fully developed. Therefore, the Department of Highways traffic figures may be somewhat understated if based upon 174 units.

It would be useful information if the threshold level were given for that average daily traffic (ADT) which would warrant road widening or the construction of a four-lane highway in the canyon. The Department of Highways projects future traffic in the canyon for 1993 as 3,600 vehicles per day. This figure assumes a 4 percent annual growth in the present traffic volume of 1,240 vehicles per day for an increase to 2,717 vehicles by 1993. The 900 additional trips generated from Beaver Creek South are added to 2,717 giving a total of 3,617. If the 900 figure is added at the beginning of the 4th year rather than at the end of the 20th year, a traffic volume for 1993 is 4,470 rather than 3,600. Using either a figure of 3,600 or 4,470, the carrying capacity estimated by the Department of Highways for the present canyon highway of 4,500 vehicles per day is being approached.¹

The estimates for 1980 summer ADT prior to the advent of the Beaver Creek South subdivision is 3,781². If the additional traffic volume from Beaver Creek South of 900 is added to this assumed traffic flow it appears that within 10 years, summer traffic could exceed the present capacity of the highway!

Although we are unskilled in estimating future traffic flows, it would seem that some discussion should be given to the adequacy of using a 4 percent annual increase in traffic when it seems possible to estimate the load more exactly from subdivision activity underway or planned such as was done for Beaver Creek South. For example, the Draft EIS for the Cascade Subdivision at Big Sky, September, 1973, states that this one

¹The Murray-McCormick Environmental Group, Gallatin Canyon Final Report, (1972). p. 180

²Ibid. p. 132.

subdivision will accommodate 363 single family homes, multiple homesites for 420 families; and that between 950 and 1,000 condominium units would eventually be included.³ If Beaver Creek South will increase ADT by 900, it should be possible to estimate the increased ADT from this subdivision as well as provide a seemingly better estimate of future traffic loads.

³*Montana Department of Health and Environmental Sciences Draft Environmental Impact Statement, Cascade Subdivision in Madison County, Sept. 20, 1973, p.1.*

The Northern Rockies Action Group adds:

A Department of Highways official is quoted saying that the projected volume from the Beaver Creek South and the Big Sky developments would not warrant construction of a 4-lane facility from the area. What volumes of traffic would warrant construction of a 4-lane facility? How many more subdivision units could the Department of Health approve in the Gallatin Canyon without warranting the construction of such a 4-lane road?

The Department of Highways reaffirms their statement on the effects of the proposed subdivision on U. S. Highway 191. Paul R. DeVine, Chief of the Planning and Research Bureau, states that highways are designed to handle the 30th peak traffic flow and not the greatest peak traffic period.

It is the consensus of opinion that the ultimate factor that will control the amount of development in the Gallatin Canyon will be the capacity of the highway to handle the traffic load that would be generated. Beaver Creek South would add to the traffic load on the highway, but as the Department of Highways indicates, Beaver Creek South would not be the development that would make reconstruction necessary.

Again, the legislature has provided the public an opportunity to voice their concern and alter the course of events through the aforementioned S. B. 208 as amended by H. B. 1017.

On September 19, 1973, Robert Sewall, engineer for the Mountain Telephone Company in Big Timber, Montana, which serves the Big Sky area with telephone service, was contacted to confirm the company's ability to supply adequate and necessary telephone service to the proposed 200 living units at Beaver Creek South. The Mountain Telephone Company affirmed their ability to supply such service.

Montana Power Company (Mr. Dick Johnson) was also contacted to confirm the availability of electric power for lights, heating and 3/60/440 power for the sewage treatment plant. Mr. Johnson said there would be "no problem" in supplying the needs of the anticipated numbers of residents of Beaver Creek South.

Public criticism was received concerning the Montana Power Company statement such as this from the Northern Rockies Action Group.

A Montana Power Company official was quoted as stating that it would be no problem in supplying the needs of the anticipated number of residents of the Beaver Creek South subdivision. Does this "no problem" mean that the existing transmission lines are adequate to supply the needs of this development, or does it mean that the power company and thereby the Department of Health are banking on the construction of the proposed 161-kv line from Ennis?

The U. S. Forest Service adds:

Forest Service contact with Montana Power Company does not support the quote of "no problem" in supplying the power needs of Beaver Creek South. John Cromer - Vice President for Electrical Operations in Montana Power at a 12/18/73 meeting with Forest Supervisor Hawkes told us that additional power service for the upper Gallatin Canyon, particularly Big Sky of Montana, would be needed by the fall of 1975. We have since received application for a 161 KV line from Clyde Park to Dillon to meet this and other needs. The developers of Beaver Creek South should be aware that this proposed powerline has not and may not be approved. Development of Beaver Creek should not be carried beyond the present power capacity in the Gallatin Canyon. If in fact all present power capacity is allocated, they

should not proceed with their development until additional power is assured.

The Department of Natural Resources and Conservation continues:

The proposed 200 homes, if of average size, with normal electrical use and heat, could contribute approximately 2.0 to 2.5 megawatts to peak energy demands. Additional energy demand will result from the commercial development and the sewage treatment plant.

Montana Power Company's long-range plans indicate that in the near future, the Company wishes to apply to the DNR&C to construct an additional powerline of 161 kilovolts (KV) near the area of this proposed development. If an application is received, the Department has 600 days thereafter to study the proposal and make its recommendation to the Board of Natural Resources, who, has final authority to deny or approve the application. To date, no application has been received by the Department for this project.

A statement is made in the Draft EIS that there would be "no problem" in supplying the power needs of development, however, it is not clear if there is presently no problem or if there would be "no problem" assuming the proposed 161 KV transmission line were approved and constructed.

Dorothy Bradley concludes:

For example, a Montana Power Company representative is quoted saying that supplying energy for Beaver Creek South residents will be "no problem." No problem for whom? Will that source of energy depend on the proposed 161 kv line from Ennis to Big Sky? If so, it is a problem for those of us who are supporting inclusion of Jack Creek in the Spanish Peaks Wilderness proposal. No problem for MPC? I heard this past winter from a MPC lawyer in his presentation to the Environmental Quality Council, that an energy emergency would occur in the summer of '75 if plans for power plants in eastern Montana did not take place rapidly.

He was requesting a waiver of the legally required time periods for public review of energy facilities.

The development of Beaver Creek South would add to the total power needs of the area. Subsequent conversation with Dick Johnson of Montana Power Company reaffirms the fact that the proposed subdivision could be served without additional power lines but would be a contributing factor toward any future necessity for additional service.

Again, S. B. 208 as amended by H. B. 1017 is the avenue for public objection to a subdivision based on such things as availability of electrical service, that has not been utilized.

Mr. Jerry Beagley, State Forester for the Bozeman area, was contacted to determine the availability of fire-fighting assistance in the Big Sky area. There is a forest fire district in that area for fighting wild fires in the Gallatin Forest Fire Protection District, which does not include the SE 1/4 of Section 17, Township 7 South, Range 4 East. For structural fires of commercial and residential buildings, a rural volunteer fire district has been organized in the Big Sky area. They have operated for about two years and have a fire truck that was donated by Big Sky of Montana, Inc. Other equipment and supplies are provided for by donations and fund-raising activities.

The U. S. Forest Service reaffirmed this in their comments:

The Gallatin Forest Fire Protection District does not include the land on this proposed subdivision and thus the U. S. Forest Service would not be responsible for wildland fire suppression on this property. Adjacent forested land is, however, within the fire protection district. The proposed subdivision would therefore have to depend on the volunteer fire district for both structural and wildland fire protection.

For all practical purposes, there would be little in the way of fire protection at the proposed Beaver Creek South subdivision. The proposed method of supplying water does not include the installation of fire hydrants and the Big Sky fire truck is about six or seven miles distant.

Police protection for the residents of the development will be provided by the Gallatin County sheriff and the Montana Highway Patrol. However, the association may decide to hire its own security agent for added

protection, such as was done at Big Sky of Montana. The Department of Natural Resources and Conservation had the following comments concerning police protection:

The final statement should clarify the comment that "the Association may decide to hire its own security agent for added protection, in a similar manner to Big Sky of Montana." A recent news article pointed out that the salary of a deputy sheriff to be stationed at Big Sky will be paid by the public (Gallatin and Madison Counties). From what funding will the salary of Beaver Creek South's security agent be drawn?

If Beaver Creek South were to hire a security agent, his salary would be paid by the property owners' association through annual assessments.

The Gallatin County sheriff said no additional staff would be hired to extend law enforcement to these developments or any others. He said that his staff is already "short-handed and run to death," and that subdivisions add to the over-extension of his responsibilities. Sheriff's deputies spend an increasing amount of time responding to "lost horse reports" and other problems in subdivisions, as stated by the sheriff.

Thus, the subdivision of this land apparently would not cost the county any more for law enforcement, but would result in generally poorer law enforcement elsewhere in the county. Eventually, increased population and redistribution of existing population by subdivisions probably would cause expansion of the sheriff's staff.

Solid waste disposal for Beaver Creek South would be handled by a private operator out of Bozeman. Presently, Suhr Hauling Company is making garbage and solid waste pick-ups in the Gallatin Canyon three times a week. Solid wastes would be hauled to the Bozeman landfill disposal area by the firm.

The roads, parks, and sewage treatment system of Beaver Creek South will be privately owned and maintained by the property owners' association, Beaver Creek South Association. Funds for operating and maintaining the common elements and facilities of the development will be obtained by assessment of the property by the lot owners as provided for in the by-laws of the association.

The Department of Natural Resources and Conservation had this to say concerning covenants and the property owners' association:

The developers assert that development planning and architectural control are to be maintained by a landowners' association and that land-use covenants will reduce the disruptive influence of the proposed subdivision upon the natural environment.

A full discussion of the effectiveness of these control methods should be presented in the Final EIS. Such discussion should center on such questions as:

- (a) How is the landowners' association created and can it be dissolved?
- (b) What enforcement power does the association have?
- (c) Can the association modify or absolve the development plan or the restrictive covenants and, if so, by what means or procedures can this happen? and
- (d) Generally, are these restrictive covenants adequate to protect the natural environment? If not, where are they weak?

The landowners' association would be comprised of the lot owners and is financed by an annual assessment. Enforcement of covenants or restrictions is the responsibility of the association. They may bring an action at law against a lot owner for violations. The restrictive covenants can be modified by an instrument signed by 70 percent of the lot owners.

As with most covenants, enforcement is most difficult. A neighbor is reluctant to take another neighbor into court. Therefore, compliance is usually voluntary. These covenants address such problems as architectural control, hunting prohibition, building size, open space and the like. These could reduce the visual impacts to this widely renowned scenic area, but they would not eliminate the impact.

The Department of Natural Resources and Conservation and Dorothy Bradley suggested an in-depth study into the effect the proposed 200 living units at Beaver Creek South would have on the Ophir School.

this is supposed to save wildlife

The assessed value of property or improvements need to be estimated in order to make some calculations. Other data that would be needed would be the area of the subdivision, number of lots, number of parcels with improvements, number of in-state and out-of-state owners, number of lots occupied year-round, number enrolled in school, number of registered voters, tax rates, school district tax levy, number of children in the district, and the number of taxed lots in the school district. Some of this information is not readily available. However, it can be stated that the same benefit-cost relationship does not continue with increased development of a subdivision. A subdivision may generate more revenue than its service cost at one stage of development but may generate less revenue than its service costs (without a tax increase) at another stage of development.

Some rough estimates can be made, however. The Ophir School had 59 students at the beginning of this school year with a total budget in excess of \$68,000. The total cost per student is \$1,163.67. This includes instruction costs, transportation, special education, bonded indebtedness, retirement and the like. If each living unit at Beaver Creek South were valued at \$40,000, property tax revenue generated would be approximately \$768 per living unit or approximately \$153,600.

The office of the Superintendent of Public Instruction estimates that the average family has 8/10 student-age children. This means that approximately 160 school-aged youngsters, 110 of grade school age, could be expected to reside at the proposed subdivision. At current education expenses, it would cost \$128,000+ to educate these youngsters.

The Environmental Quality Council questioned the location of the commercial area.

If the proposed commercial area is intended to cater to neighborhood residents, i.e., residents of the proposed subdivision, why will it not be centrally located rather than along the edge of the subdivision on U. S. 191? Although the highway location may attract more customers, it would be less convenient to residents of the subdivision and would sacrifice some of the aesthetic qualities of U. S. 191 as a scenic highway.

The proposed commercial area is intended to cater to residents of the subdivision, and the highway location

access control does not mitigate aesthetic impact to any degree

is designed to attract other customers. However, there would be only one access approach to U. S. Highway 191, and the commercial area would be served from a proposed frontage road.

An analysis of the impact of the proposed subdivision would not be complete without consideration of the necessity for the development.

A statement from Big Sky of Montana, Inc. asserts their support of the proposed development and is hereby included as part of the environmental impact statement.

Big Sky at the present time has considerable difficulty arranging for employee housing of its employees. This does not take into account the additional housing problems faced by other persons employed in the Big Sky area by contractors, sub-contractors and commercial lessees doing business at the Big Sky project.

At the present time there is in excess of 600 people employed in the Big Sky area including the Big Sky personnel and those employed by others. At total build-out, Big Sky is expected to carry approximately 1000 full time employees in its payroll which will be augmented by construction personnel and other individuals employed by third parties. Big Sky presently has plans to complete in two phases, housing accommodations for approximately 176 employees in the Mountain Village and has already completed an employee housing facility for 50 people in the Meadow Village. Additionally, Big Sky has just completed a 42-pad mobil home park. If an estimate of three persons per trailer is made, we therefore will have a total of 342 accommodations for people in the Big Sky project. We are, therefore, seriously short of housing accommodations for employees and workers at Big Sky even at the present time. This, of course, does not include those persons who buy condominiums and/or lots within Big Sky--this number is expected to be relatively small in comparison with the total number of people for whom accommodations will be needed.

Because of the unavailability of housing facilities in the future for a rather significant number of people, we certainly do welcome plans for the same to be provided by others with proximity to the

Big Sky project--so long as they are compatible with the existing quality and architecture in the area. From what you have told me of your project, this certainly will be the case and we can only say that we wish to encourage you with your program and the sooner you can offer this type of residential--apartment housing, the sooner we will receive some relief from our employee housing problems.

The Department of Natural Resources did not completely agree with the statement of Big Sky of Montana, Inc.

This statement supports the proposed development on the assumption it will help provide housing for employees of Big Sky and other individuals employed by third parties at Big Sky. Yet, the draft lacks an analysis of this statement and thereby leaves the reader to accept the conclusions as presented. If this statement remains in the final, then the Water Quality Bureau should address its validity.

We have reservations whether the majority of employees at Big Sky and other associated workers could afford the lots or housing in this subdivision. And, if so, what will encourage them to purchase in Beaver Creek South rather than in Big Sky's subdivisions or condominiums? Obviously, Beaver Creek South would have to sell or rent real estate more cheaply, if Big Sky's employees are to prefer Beaver Creek South.

Dorothy Bradley had the following comments with respect to the need for this subdivision:

I am concerned that part of the justification for Beaver Creek South is the housing needs of its neighbor, Big Sky. Will such reasoning not lead to a proposal for a new housing development to take care of the employees of Beaver Creek?

The Environmental Quality Council offered the following comments on the subject of necessity of this proposed subdivision:

Compatibility "with the existing quality and architecture in the area", i.e., Big Sky, would probably put the price of a lot and structure in this subdivision beyond the reach of the average employee of Big Sky. A real question is whether this development will satisfy the housing shortage for Big Sky employees, or will cater to the same class of people that are attracted to Big Sky.

Many have suggested that the price of a lot and structure may be beyond the reach of most employees of Big Sky, that the development would not solve the housing problems at the resort complex but cater to the same class of people that are attracted to Big Sky. This may be a valid statement but has no bearing on the decision whether or not to approve the plat.

Regarding cumulative impacts, the Department of Natural Resources and Conservation made the following comments:

Although it requires more time and effort, some consideration of the cumulative impact of the increasing subdivision activity in the Gallatin Canyon is needed. Environmental assessments should not be restricted to the impact of a particular subdivision but rather should reflect consideration of those in existence and to the potential for new subdivisions. Limited reviews provide only incremental assessments which may not describe the total situation. Incremental impacts can add up to significant impacts and, therefore, some effort must be given to assessing their cumulative effect. For example, one subdivision might, in itself, remove only an insignificant amount of wildlife habitat; however, several subdivisions in concert may remove a substantial amount of such habitat resulting in a major negative impact on wildlife.

A helpful addition to readers of this statement would be a general location map together with a map showing the arrangement of development within the subdivision.

Similar to other impacts, one subdivision adds only an incremental amount of degradation of natural beauty which, taken alone, may be acceptable. Nevertheless, increments often accumulate with the addition of each new development until unacceptable levels or thresholds are reached or surpassed.

Public
need

The Final EIS should, therefore, consider not only the direct impacts of this one proposal, but also the cumulative impacts of existing and potential subdivisions in a relatively pristine canyon setting.

Although there would be adverse environmental effects on wildlife and, to many, a degradation of the aesthetic quality of the area, no legislative mandate is in effect which would give legal justification for refusing to grant subdivision plat approval on these grounds.

This comment articulates a problem common to a number of agencies which are often obligated by law to approve actions that may have a significant environmental impact. MEPA mandates a broad consideration of all impacts associated with certain actions. Yet, in that it is necessary to operate within legislative guidelines, it is not always possible to avert certain impacts by disallowing an action.

The regular occurrence of situations of this nature would suggest that new legislative guidance and direction is appropriate. A determination of the state's capacity to serve the long-term public interest can, in part, evolve from internal deliberations. Among these should be an assessment of the efficacy of given authorities and an examination of the need to propose certain statutory changes. Efforts of this nature on a continuing basis will hopefully enable the state to maintain its resource values and present quality of life.

The point is well taken that some consideration is needed of the cumulative impact of increasing subdivision activity in Gallatin Canyon as incremental impacts can add up to significant impacts. This is something that is necessary in all of Montana. The Gallatin Canyon Study Team from Montana State University is addressing this problem. With funds from the National Science Foundation, they are studying the impacts of development on Gallatin Canyon. Reports are available to the public.

One important cumulative impact of interest to the department is that of increasing nutrient load in the Gallatin River from domestic wastewater sources. Practically all aquatic plants may be desirable at one time or another, and in one habitat or another. However, when they become too dense or interfere with

water uses or aquatic habitat, they become nuisance growths. Under favorable environmental conditions, generally the more abundant the nutrient supply, the more dense the vegetation will be. With domestic wastewaters, the most common nutrients of concern are phosphorus and nitrogen.

There is very little reliable water quality information available on the Gallatin River. This makes it difficult to formulate final decisions; however, with the existing data, some general conclusions can be reached. For this evaluation, the following estimates and assumptions were made:

- (1) Population estimates (not including Big Sky)
 - 1974 canyon population 400
 - 158 lots available now for development
at three people per lot 474
 - Ultimate population of existing available
lots* 874
 - *lots either platted with restrictions
or with restrictions removed.
- (2) Parkview West ultimate population (if approved) 100
- (3) Beaver Creek South population (if approved)
 - Initial phase 150
 - Ultimate 700
- (4) Miscellaneous development in near future . . . 100
- (5) Sixty-five gallons per capita per day
sewage contribution
- (6) Annual sewage produced at Big Sky of Montana
at ultimate development 95 million
gallons
- (7) Average concentration of phosphorus in the
wastewater 10 mg/l-P
- (8) Average concentration of nitrogen in the
wastewater 20 mg/l-N

- (9) Low flow conditions in the Gallatin 120 cubic feet per second
- (10) Soil treatment systems will remove 98 percent of applied phosphorus.
- (11) Soil treatment systems will remove 50 percent of applied nitrogen.
- (12) Concentrations of total phosphorus and nitrogen in the Gallatin River at assumed low flow are both 0.02 milligrams per liter.

Under the above conditions at ultimate development of Big Sky of Montana and the lows now available, the phosphorus concentration could increase from 0.02 milligrams per liter (P) to 0.0206 milligrams per liter (P), and the total nitrogen would increase from 0.02 milligrams per liter (N) to 0.0650 milligrams per liter (N).

If the additional development discussed above is realized, the projected phosphorus and nitrogen levels would increase to 0.0209 milligrams per liter (P) and 0.069 milligrams per liter (N).

The exact numbers arrived at by this exercise are highly speculative to say the least. However, it is important to note the significance of the concentration changes. The phosphorus changes are increasing by ten-thousandths while the nitrogen concentrations change by hundredths. Such small changes should not result in significant changes in the quality of the Gallatin River, and it appears that nutrient enrichment will not be the controlling cumulative impact for development of the canyon.

On February 17, 1971, the first meeting of the Gallatin Canyon Planning Study Committee was called to order by Mr. Perry Roys of the Department of Planning. This committee was an official body appointed by the governor to work with the Murray-McCormick Company, who was hired to do the planning for the Gallatin Canyon. In March,

1973 ?
1971, a technical advisory panel was appointed to assist the study committee. The advisory panel consisted of representatives of the Fish and Game Department, Soil Conservation Division, Water Resources Board, Highway Department, Department of Health, City-County Planning Board, Gallatin County Commissioners, representatives of the U. S. Forest Service, representative of Burlington Northern, and Mr. Gus Raaum, representing the Big Sky Corporation. There were also representatives of the State Department of Planning who were ex officio advisors and liaison personnel between the committee and the environmental consultants. The state-sponsored study program met regularly for about one year, and on July 14, 1974, the final report prepared by Murray-McCormick Environmental Group was presented. The report contained a list of general goals developed to establish the intent and direction of planning activity within the Gallatin Canyon. Under the community design section of the report, the following is stated:

Keep all future development in character with the special natural environment of Gallatin Canyon.

Encourage site planning and building and landscape design to result in an attractive appearance from the highway, and a harmonious relationship among the various elements of the development and with the landscape.

Establish development guidelines and visual standards for new construction, including guides for signing, highway and development treatments, exterior motifs, utility distribution lines, and screening vegetation.

Take care not to obstruct important vistas and views within the Canyon. A variety of standards should be developed in order to achieve this purpose under different conditions.

Develop land use alternatives designed to enhance the compatibility of existing and new land uses in the Canyon.

Develop standards on signing and display advertising to establish certain size, color, and design limitations to blend with the natural environment.

Provide adequate facilities for community services to residents and visitors in the Canyon.

Visually screen mobile homes and recreational vehicles from major circulation routes.

The plan also designates those areas most desirable for residential development in terms of the identified land constraints and sensitivities. It is not the intention of the plan that residential development should occur only in the designated areas; however, they are designed as those areas most suitable for development under the identified parameters. They are meant to be used as a general guide in locating structures in the canyon. To reach the goals of maximizing attractiveness of the area and protecting the special scenic character, specific developments must be planned with care and imagination. Specific guidelines for residential development are set forth in the report. The report supports utilizing cluster-concept of site design and recommends that such developments be placed so as not to interfere with open meadows and be placed well away from wetland areas adjacent to stream channels.

The controlling element in terms of recommended residential density is expressed in the planning goals to keep Highway 191 a two-lane facility. Generally, the residential areas indicated in the plan are expected to accommodate one dwelling unit per ten acres. Here, the cluster-housing concept, which minimizes the impairment of scenic values is essential to accommodate potential growth. There is a recommendation in the plan that residential development adhere to the following general policies:

1. Cluster-concepts of design should be utilized for construction to reduce unnecessary visual impact upon the environment.
2. Future residential development should be limited to adhere to the expressed goal of keeping Highway 191 a two-lane facility.
3. Residential development should be located to avoid open meadows and keep away from riparian areas.
4. Development should closely adhere to the development planning and design guidelines suggested in the report.

Non-cluster developments should not be allowed to continue, especially along major highways. All development should be adequately screened from major roads and highways to protect the scenic visual qualities of the canyon. Any

proposed development should adhere in its purpose and design to the comprehensive plan or to the various elements included, or to the area plan of the particular location in which proposed development is to be constructed. Higher density developments are to be considered as particularly suitable to areas where there is direct access or proximity to community facilities and circulation and/or commercial services. Lower density development should utilize areas where there are steep slopes, canyons or mountainous terrain and where there is restrictive accessibility to service facilities.

The report on the Gallatin planning area also contains comments regarding commercial areas, which suggested that the commercial development should be restricted to nodes along Highway 191 to prevent unsightly linear development of service areas on major roads. Basically, the same criteria proposed for residential cluster development will apply to commercial facilities. These are namely the architecture and layouts should be compatible with the natural environment, they should be screened from view wherever possible and not be located along the line of site to scenic areas. As much of the natural environment should be retained, leaving native ground cover for buffer zones around the commercial areas. A comprehensive plan for the area provides for a main commercial area just north of Beaver Creek development along the highway primarily at the intersection between the West Fork of the Gallatin River and the main river channel. Just south of Beaver Creek South subdivision is an area provided for recreation, commercial use, with dispersed activity.

The comprehensive plan presents a statement that the major limiting factor on future land development in Gallatin Canyon is the strongly expressed desire of the residents to restrict construction activities on Highway 191 to normal maintenance and minor improvements. This objective means that the highway will be kept a two-lane facility with a maximum carrying capacity of 4,500 vehicles per day as estimated by the Montana Highway Department.

The recommended improvements to the road should include roadside rest areas, turn lanes, pedestrian crossings, signed animal crossings, traffic signing and speed control. Site planning and architectural and landscape design of adjacent development should result in an attractive appearance from the highway and a harmonious relationship with the surrounding landscape.

Developments along the highway should give particular attention to the node concept of a site plan as expressed in the plan. Development should relate to such conditions as limiting access to the highway, clustered developments, setback requirements, screening, underground utilities, and appropriate appearance of advertising in relation to the environment.

Roadside rest areas and scenic viewpoints should be developed at relatively frequent intervals where local site conditions are compatible. In the development of scenic viewpoints, they should be so located as to not interfere with the view of the traveling public on the highway.

The county has not adopted the proposed comprehensive plan nor any other plan for the area, even though they do have authority to plan and zone.

In concluding their remarks to the draft environmental impact statement, the Montana Environmental Quality Council suggested attaching a map or scaled-down plat. A plat is included with this statement. The Environmental Quality Council also offered the following concluding comments:

We wish to compliment the Department of Health on its efforts to obtain pertinent information by consulting with appropriate agencies and individuals prior to circulation of the draft EIS. Thank you for your efforts toward compliance with the Montana Environmental Policy Act.

Alternatives Available to Beaver Creek South, Inc.

There are two alternatives available to Beaver Creek South, Inc. One would be to proceed with development of the 95 acres as planned. This would involve all the afore-mentioned environmental impacts. The other alternative would be to develop 10+ acre tracts, thereby not requiring action by the Department of Health and Environmental Sciences.

If the 10+ acre tract concept was to become a reality, the environmental impacts would probably be drastically reduced at this site. Assuming single-family residences, there would be nine living units where 200 were ultimately planned. However, rental apartment units could be

placed on a 10+ acre tract and not be subject to subdivision rules and regulations of the department.

Many would consider no development as a viable alternative but Beaver Creek South, Inc. would not. The 10+ acre concept would be implemented without further state governmental action.

Alternatives Available to this Department

1. Approve the subdivision plat as submitted. From the data submitted, the department gave serious consideration to this alternative. Adequate evidence that a water supply is available has been given. Approved solid waste facilities are available. The sewage treatment system is acceptable. The wastewater disposal system is an experimental method for the climatic and geographic setting of Gallatin Canyon. Therefore, a blanket approval would be premature.
2. Approve the initial phase of Beaver Creek South and base further action on operation of the wastewater disposal system. Exercise of this alternative can be justified in light of concept criteria required by MAC 16-2.14(10)-S14340, Section 69-5001 through 69-5005, R.C.M. 1947, and Section 69-4801 through 69-4827, R.C.M. 1947. The system would have to be monitored. If the evidence indicated there was forthcoming pollution of groundwater, the percolation ponds would be expanded. Five acres are available for this purpose. Dosing rates (average) could be reduced to approximately 0.075 gallons per square foot per day.
3. Refuse to approve the subdivision plat as submitted. Although there would be adverse environmental effects on wildlife and to many a degradation of the aesthetic quality of the area, no legislative mandate is in effect which would give legal justification for refusing to grant subdivision plat approval based on these grounds.

This statement was prepared by Art Clarkson, P.E., Public Health Engineer, B.S. and M.S., Civil Engineering; Donald Zollman, P.E., Public Health Engineer, B.S. and M.S., Civil Engineering; and Alfred P. Keppner, B.S.F., M.S., Soils Scientist, Water Quality Bureau, Environmental Sciences Division, with information furnished by Brelsford and Associates, Morrison-Maierle, Inc., Montana Department of Highways, Montana Department of Fish and Game, Gallatin County Superintendent of School, and others designated therein.

LEGEND

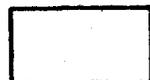
LAND USE ELEMENTS



RESIDENTIAL



COMMERCIAL



GENERAL FOREST

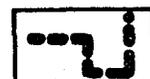


RECREATION

COMMERCIAL USE
DISPERSED ACTIVITY



RIPARIAN AREA



SPANISH PEAKS PRIMITIVE AREA



HIGH (ELEVATION AREA)

CIRCULATION ELEMENT



HIGHWAY 191 AND MAIN ROADS



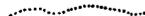
FUTURE HIGHWAY CONNECTION
TO MADISON VALLEY



RECREATIONAL TRAILS



SNOWMOBILE TRAIL



HIKING / EQUESTRIAN TRAILS

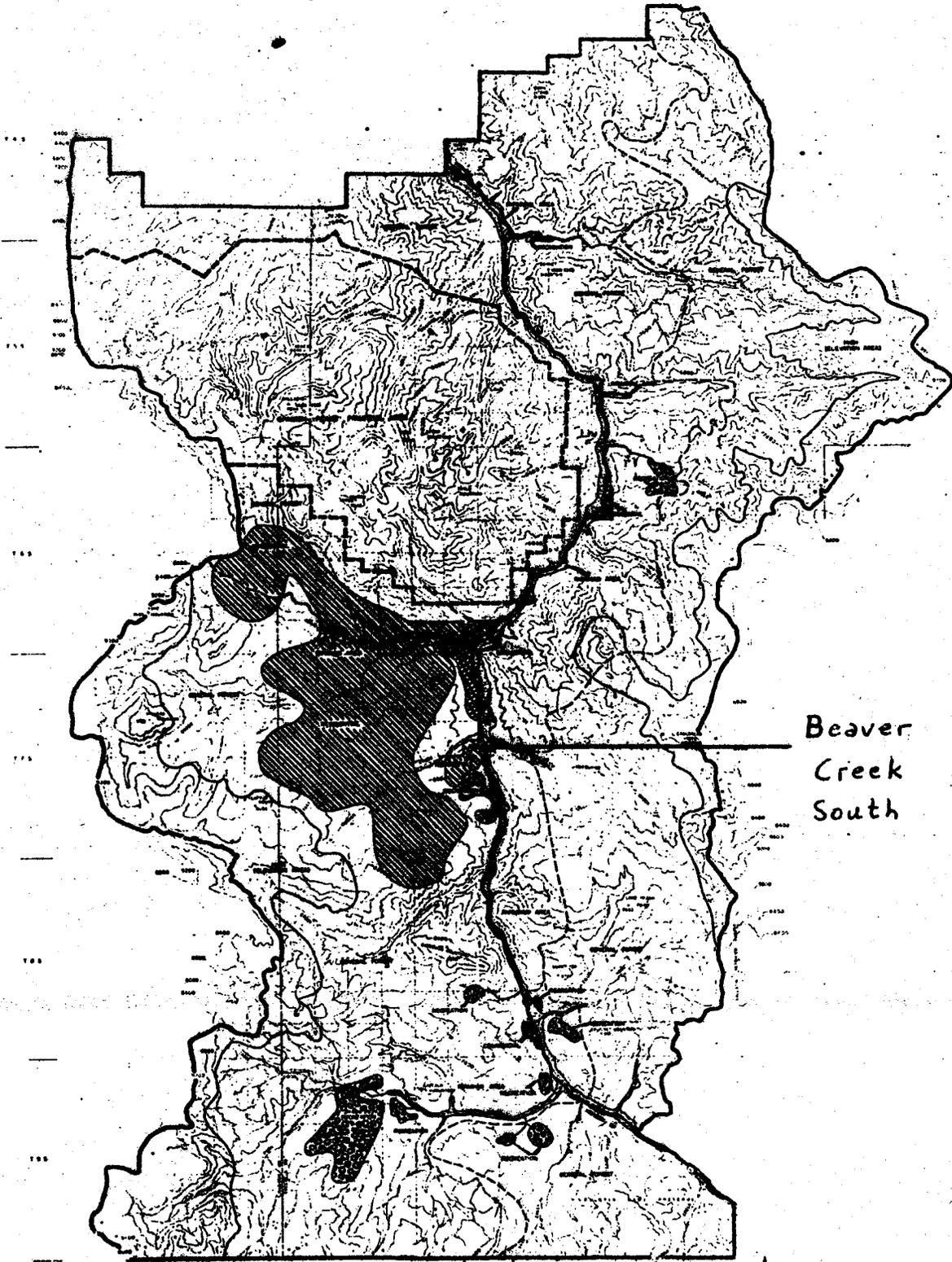


REST AREAS, SCENIC OVERLOOK,
AND PICNIC AREAS

GALLATIN CANYON PLANNING STUDY COMPREHENSIVE PLAN

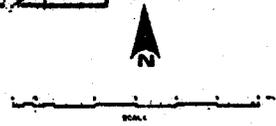
PREPARED FOR
MONTANA STATE DEPARTMENT OF PLANNING
AND ECONOMIC DEVELOPMENT

THE MURRAY-McCORMICK ENVIRONMENTAL GROUP 
ECOSYSTEMS ANALYSIS · PLANNING · ARCHITECTURE · ENGINEERING



Beaver
Creek
South

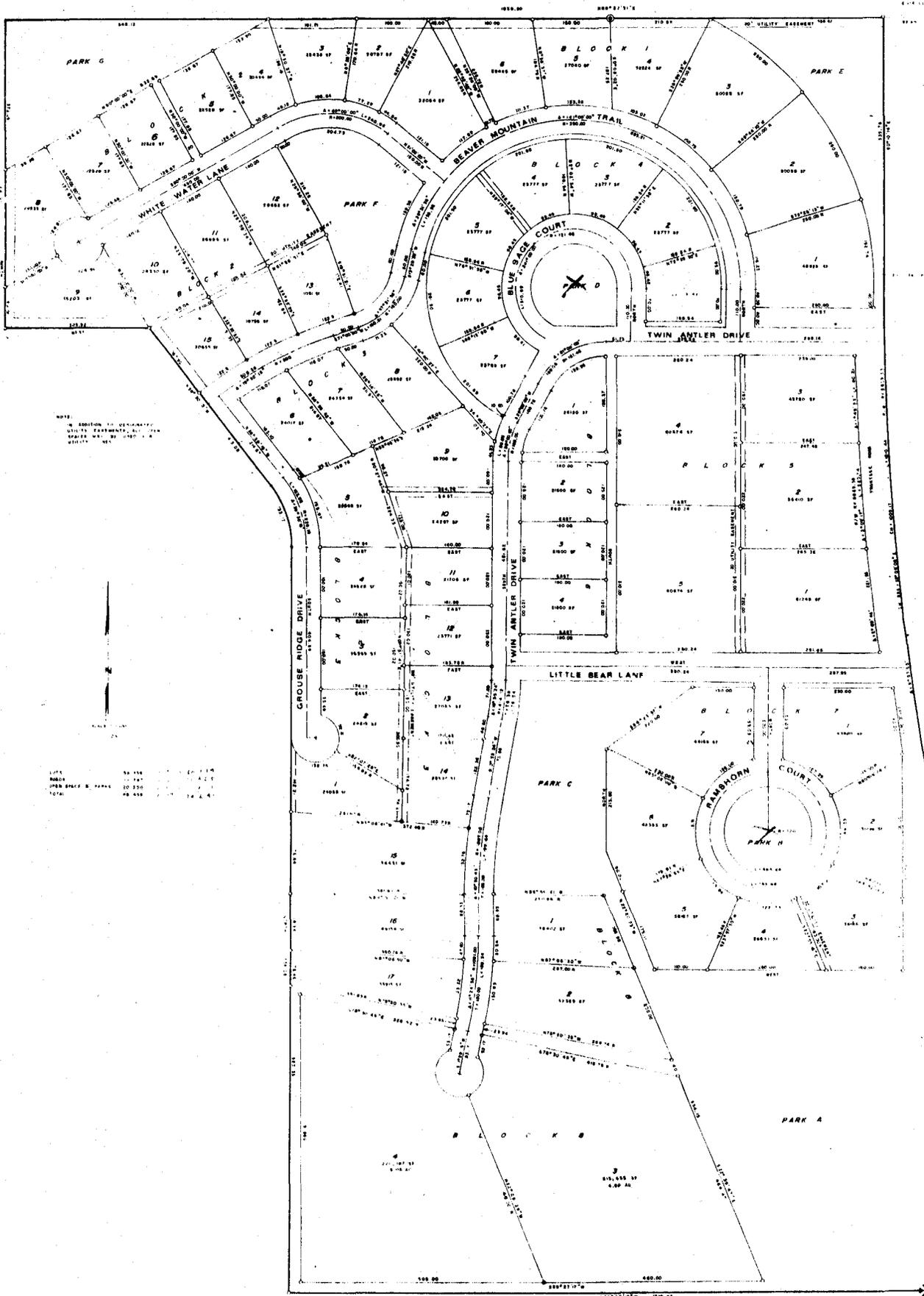
- 1000
- 900
- 800
- 700
- 600
- 500
- 400
- 300
- 200
- 100
- 0



BEAVER CREEK SOUTH

A PLANNED UNIT DEVELOPMENT
SEC. 17, T2S, R4E, MPM

PHASE 1



NOTE:
A. ADDITION TO EXISTING
UTILITY EASEMENTS, AS SHOWN
ON THIS PLAN, SHALL BE MADE AT
OWNER'S RISK.

LOTS	53,476	12,424	1,216
BLK'S	11,847	1,216	1,216
OPEN SPACE & PARKS	20,330	1,216	1,216
TOTAL	85,839	12,424	1,216