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R.I.D. No. 305, Phase

BIG SKY, MONTANA

FACILITIES PLAN MAY 1975 REVISED FEBRUARY 1976



MORRISON - MAIERLE, INC.

CONSULTING ENGINEERS M-M PROJECT NO. 1235-01-18-41

COPY 1 OF 2

Big Sky County Water & Sewer District No. 363 PO Box 160670 Big Sky, Montana 59716 Tel 406-995-2660



MORRISON-MAIERLE, Inc.

consulting engineers



P.O. BOX 1113 / 33 EAST MENDENHALL / BOZEMAN, MONTANA 59715 Telephone 406/587-0721

STREETS . BRIDGES . AIRPORTS . HIGHWAYS . INDUSTRIAL . PLANNING . IRRIGATION . STRUCTURES . WATER SUPPLY . SEWERAGE WORKS

March 12, 1976

BRANCH OFFICES:

P.O. Box 20257 1127 Alderson Billings, Montana 59102 Phone 406/259-5546

910 Helena Avenue Helena, Montana 59601 Phone 406 / 442-3050

122 1st Avenue West Kalispell, Montana 59901 Phone 406 / 756-2281 Mr. John Layman
Director of Maintenance
Big Sky of Montana, Inc.
P. O. Box 1
Big Sky, MT 59716

Dear Mr. Layman:

Thank you for your letter of March 10. We have noted the changes in the Facilities Plan which you mentioned. In addition, a couple of revisions were made before the report was submitted to the State Department of Health. I am enclosing four pages to be inserted in your copy of the report. The three test pages (Table of Contents, page 2, and page 18) should be substituted for the corresponding pages and the drawing (Drawing No. 7) should be added at the end of the report.

Also, I am enclosing a copy of the submittal letter which Willis Wetstein of our Helena office wrote to accompany the Facilities Plan. It makes specific reference to State Department of Health and EPA comments and may help in your review of the plan.

With regard to your other questions, I will need some time to review both the problem of the flume location and that of the lagoon cleaning. I will do this and get back to you so we can discuss these problems.

Sincerely,

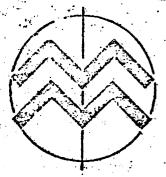
MORRISON-MAIERLE, INC.

David Orbe, P.E.

Branch Manager

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Enclosures - 5



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March 2, 1976

BRANCH OFFICES:

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> Montana State Department of Health and Environmental Sciences Environmental Sciences Division Helena, Montana 59601

Attn: Mr. Don Willems, Chief

. Water Quality Bureau

RE: Facilities Plan - RID 305

Project C300207-01

Gentlemen:

We are re-submitting herewith for your review and approval four (4) revised copies of the Facilities Plan for RID 305, Gallatin County, Montana. This document has been revised to reflect additions and modifications associated with comments in your letter of August 20, 1975 and EPA's letter of August 7, 1975. To better assist you in your review, comments and/or actions taken are listed below as related to the items in these letters.

STATE DEPT. OF HEALTH

Page (Initial Copy)

- 5 Boundary of RID 305 shown on Fig. 2
- 6 Clarified, new page 8
- 8-9 Water quality objectives have been modified, new pages 10 & 11
 - 11 Groundwater and geology information added, new pages 14 through 20

Page Two
Mont. St. Dept. of Health
re: Fac. Plan, RID 305
March 2, 1976

Dept. of Health, cont'd.

Page .

- 12 Weingart's letter was dated March 5, 1971, new page 20
- 13 Time frame for Phase III and ultimate development added to population discussion, new page 22
- 18 Sewage from the Camper Village, Mobile Home Court, Guest Ranch and other miscellaneous developments are included in the Meadow Village flows. New page 24.
- 25 Leakage tests were conducted on all sewer mains during construction, 1971, 1972, 1973, 1974. See new page 37.
- 30 Effluent requirements updated, new page 40.
- 31 Disinfection redefined, regulatory agency replaced with 40 CFR 133, See new page 43
- 32 Bibliography included, see new page 71
- 33 Additional information added on the golf course irrigation disposal system for the treated wastewater. See new page 43 through 47.
- Normal golf course irrigation season will consist of the months of June through October. See discussion on new pages 46-47.
- 35 Discussion on denitrification removed.
- 37 Power costs for Alternate 2 would only pertain to those periods during which the filtration equipment is in operation. An added cost of \$600 per season has been estimated and appears adequate.
- 41 The probable effects of irrigating wastewater on the golf course is discussed in new pages 43 through 47.
- 42 Infiltration-percolation discussion removed. Nutrient effects are dissuced in Section 7.
- 43 Modified see new page 58.
- 44 Modified see new page 65.

Page Three Mont. St. Dept. of Health re: Fac. Plan, RID 305 March 2, 1976

Dept. of Health, cont'd.

<u>Page</u>

- 45 Locations of percolation test holes are shown on Drawing No. 7. Percolation tests were conducted using recommended procedure in "Manual of Septic Tank Practice", see new page 66. Groundwater movement is discussed in Section 7.
- 50 Discussion of previous design alternatives removed.
- 55 Aerators are needed to prevent the holding pond from freezing solid, resulting in fish kill.

EPA LETTER OF AUGUST 7, 1975:

- 1a. The project will not contribute to increased incidence of flooding.
 See Section 10.3, new page 63.
- 1b. New data added on air, wind, odors; see new pages 59 through 62.
- 1c. New data added; see new pages 63-64.
- ld. New data added; see Section 10.5, new page 64.
- 1e. New data added on public involvement; see Section 10.10, new pages 67-68.
- If. The irrigation site (golf course) is located in the area bordered by Lone Mountain Trail, Two Moons Road, and Little Coyote Road, (see Drawing IA.) excluding all residential and commercial developments scattered along the roads and throughout. Residences and condominiums are strung along the edges of the golf course fairways.
- 2a. Samples were obtained during periods of high activity during the ski season of 1975-76. See new page 38.
- 2b. A new section entitled, "9.0 PLAN SELECTION" has been added (pages 52-55) which presents the need for Alternate 2 as the proper plan selection. See also supporting data in Sections 7, 8, and 10.
- 2c. Corrected See new page 49. Cost estimates have also been updated from those shown in the previous issue of the Facilities Plan. A cost for flow measuring equipment has also been added.

Page Four Mont. St. Dept. of Health re: Fac. Plan, RID 305 March 2, 1976

EPA Letter, cont'd.

- 2d. It is necessary to filter prior to the holding pond in order to provide the best quality water in the holding pond which is used as a fish pond. Residents and tourists become in intimate contact with this water. It therefore must also be chlorinated prior to discharge to this pond.
- 2e. The holding pond will be aerated to prevent fish kill from the pond freezing over.
- 2f. Fecal coliform equipment has been added. See new page 49.
- 2g. Manhours for operation of the plan under Alternates 1 and 2 have again been evaluated. Also reviewed with equipment manufacturer. No change in part time operator is suggested.
- 2h. The proposed schedule for completion of this project is as follows:

Approval of Step 1 Facilities Plan - May 1, 1976
Completion of Step 2 - July 1, 1976
Start Construction, Step 3 - Sept. 1, 1976
Complete construction - July 1, 1977

- 2i. Spray irrigation is expected to have little effect on the groundwater quality under the Alternate 2 plan. Under the Alternate 1 plan without filtration, the effect on the groundwater would be greater. See added information under Sections 7, 8, 9 and 10.
- 2j. No reply required.
- 3. See added information, Sections 10.10 and 10.11, new pages 67-69.
- 4. Statement will be furnished.
- 5. No historical or archaeological effects. See added information, Section 10.4, new page 63.
- 6. No project impacts on wetlands.
- 7. No reply required.

Page Five Mont. St. Dept. of Health re: Fac. Plan, RID 305 March 2, 1976

Due to the numerous changes and additions made to this Facility Plan, the document was completely retyped and printed. It would have been a little confusing trying to respond only to the comments.

Please let us know if you have any further questions on this document.

Sincerely,

MORRISON-MAIERLE, INC.

Willis J. Wetstein, P.E.

WJW:el

Encls.

cc: Dave Orbe, M-M, Bozeman



MORRISON-MAIERLE, Inc.

consulting engineers



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STREETS & BRIDGES & AIRPORTS & HIGHWAYS & INDUSTRIAL & PLANNING & IRRIGATION & STRUCTURES & WATER SUPPLY & SEWERAGE WORKS

February 27, 1976

BRANCH OFFICES:

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910 Helena Avenue Helena, Montana 59601 Phone 406/442-3050

122 1st Avenue West Kalispell, Montana 59901 Phone 406/756-2281 Mr. John Layman Director of Maintenance Big Sky of Montana, Inc. P.O. Box 1 Big Sky, Montana 59716

Dear Mr. Layman:

Re: Revised Facility Plan R.I.D. 305

Enclosed please find a copy of the Revised Facility Plan including replies to State Department of Health and EPA comments.

A copy of the transmittal letter prepared by Willis for submittal to the appropriate governmental agencies will be forewarded to you.

John, if you have any questions concerning this, please let me know.

Sincerely,

MORRISON-MAIERLE, INC.

David Orbe, P.E.

Bozeman Branch Manager

gy

Enclosure

cc: Mr. Willis Wetstein

R.I.D. No. 305, PHASE III BIG SKY, MONTANA

FACILITIES PLAN

Prepared By:

MORRISON-MAIERLE, INC. Consulting Engineers

May 1975

Revised February, 1976

Written By:

M-M Project No. 1235-01-18-41

TABLE OF CONTENTS

		<u>I</u>	?age
1.0	SUMMA	ARY, CONCLUSIONS, AND RECOMMENDATIONS	1
2.0	2.1 2.2 2.3 2.4	ODUCTION General Study Purpose and Scope Study Area Boundary Study Area History Implementation	4
3.0	3.1	R QUALITY OBJECTIVES	10
4.0	4.1 4.2	NTORY OF EXISTING ENVIRONMENTAL CONDITIONS Air and Water Quality Existing Wildlife Soils and Vegetation	11
5.0	5.1 5.2 5.3	EWATER SOURCES AND CHARACTERISTICS	21
6.0	SYSTE 6.1 6.2	NTORY OF EXISTING COLLECTION AND TREATMENT EMS Collection System and Interceptor Line Infiltration Inflow Identification Existing Sewage Treatment Facilities	32
7.0	7.1 7.2	General Phase III Alternatives Effluent Treatment 7.3.1 Disinfection 7.3.2 Filtration 7.3.3 Irrigation	40
8.0	8.1	EFFECTIVE ANALYSIS	48
9.0	PLAN	SELECTION	52

TABLE OF CONTENTS (Continued)

		<u> </u>	Page
10.	ENVIR	ONMENTAL EVALUATION	55
		General	
	10.2	Probable Impact of the Project on both the Human and Natural Environment	
	10 3	Flooding	
		Historical and Archaeology Effects	
		Construction Effects	
		Short Term Adverse Effects Upon the Environment	-
	10.7	Probable Adverse Effects which Cannot be Avoide	V
		Environmental Assessment of Alternatives	<i>.</i> u
		Irreversible and Irretrievable Commitments	
		of Resources	
1		Public Involvement	
		Problems or Objections	
REFER	ENCES.		70
ADDEN	אדת		72
711 I DIV		eviations	, 2
		ana State Department of Health Recommendations	
		Letter dated June 17, 1970	
	Feder	ral Water Pollution Control Administration	
		Letter dated July 28, 1970	
	Monta	ana State Department of Health	
		Approval letters of previous construction,	
		R.I.D. 305	
		h 28, 1975 September 21, 1973 June 7, 197	' 2
		mber 16, 1974 July 26, 1973 October 19,	
	May 2	2, 1974 July 5, 1973 October 19,	1971
		mber 28, 1973 June 6, 1973	
•	Noven	mber 27, 1973 January 2, 1973	
DRAWI	NGS		
	1 A	Meadow Village Water & Sewer Systems - Site Pla	
	1B	Mountain Village Water & Sewer Systems - Site P	'lan
	Fil+r	ration Building	
		2 First Floor Plan & Piping Details	
		3 Basement Plan & Piping Details	
		4 Piping Details	
		5 Piping Details	•
		6 Plumbing & Piping Details & Flow Schematic	
	7 8	Site Plan - Golf Course Test Holes	

1.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The existing sewage treatment facilities at Big Sky,

Montana have been constructed under Rural Improvement

District No. 305. At the present state of development the

aeration and storage ponds, spray irrigation facilities,

piping and pumping facilities have been virtually completed

under Phase I and Phase II. The existing system provides for

aeration and storage of wastewater. Phase III will complete

the sewage treatment system. The implementation of Phase III

should be completed before the 1977 golf course irrigation

season, due to limited wastewater storage capacity.

Treatment alternatives investigated expand the existing facilities to provide secondary treatment followed by spray irrigation for nutrient removal. Alternates I and II provide for pumping and chlorination of the wastewater to the existing spray irrigation system. Alternate II includes filtration capabilities not considered in Alternate I.

Alternate II is the recommended method of treatment.

This method is consistent with the 1972 Amendments requiring application of secondary treatment as a minimum and provision by 1983 for applying the Best Practicable Waste Treatment

Technology (BPWTT). The latter provision applies to facilities funded from FY 1975 and later allotments.

Even though the cost analysis shows Alternate I costs to be much less than those of Alternate II, Alternate II is recommended.

It is imperative to prevent any possible health hazard due to contact by the public with applied wastewater. Spray irrigation of unfiltered wastewater on the golf course would create a higher risk of health hazards from physical contact with the unfiltered effluent. Filtration would minimize any undesirable effects upon the climate, soil, vegetation, groundwater, and the air associated with spray irrigation. Thus, the filtration facilities would be an added safety feature.

They hardly mention all the reasons for choosing Littration.

P.R is one.

Note effluent disposal is in an area controlled by new Bry Sky of Montana Inc. In the draft "Inanagement Agreement" for RID 305 this problem was not addressed.

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2.0 INTRODUCTION

2.1 General

Big Sky, Montana, is an unincorporated resort community bordering U.S. Highway 191 approximately 45 miles south of Bozeman in Gallatin County.

The economy of the area is based on recreation, including condominiums, golf course, dude ranch, residential lots and skiing facilities. Big Sky is a planned recreational development divided into two sites, the Meadow Village (elevation 6,300 feet) which will include some 810 developed acres, and the Mountain Village (elevation 7,600 feet) which will include some 335 acres. One thousand two hundred and twenty-five acres will be held in its natural state until needed for future expansion.

2.2 Study Purpose and Scope

Public Law 92500 known as the "Federal Water Pollution Control Act Amendments of 1972" states that the "Administrator" of the Environmental Protection Agency is authorized to make grants to any state, municipality . . . "for the construction of publicly owned treatment works 'provided' the grant applicant has identified the treatment works necessary to meet the anticipated municipal and industrial waste treatment needs over a twenty-year period including any requirements for the acquisition of land for treatment purposes, the necessary wastewater collection system and a program to provide the necessary financial arrangements for the

development of such treatment works." Furthermore, the grant applicant must demonstrate "alternate waste management techniques have been studied and evaluated and the works proposed will provide for the best practicable waste treatment technology."

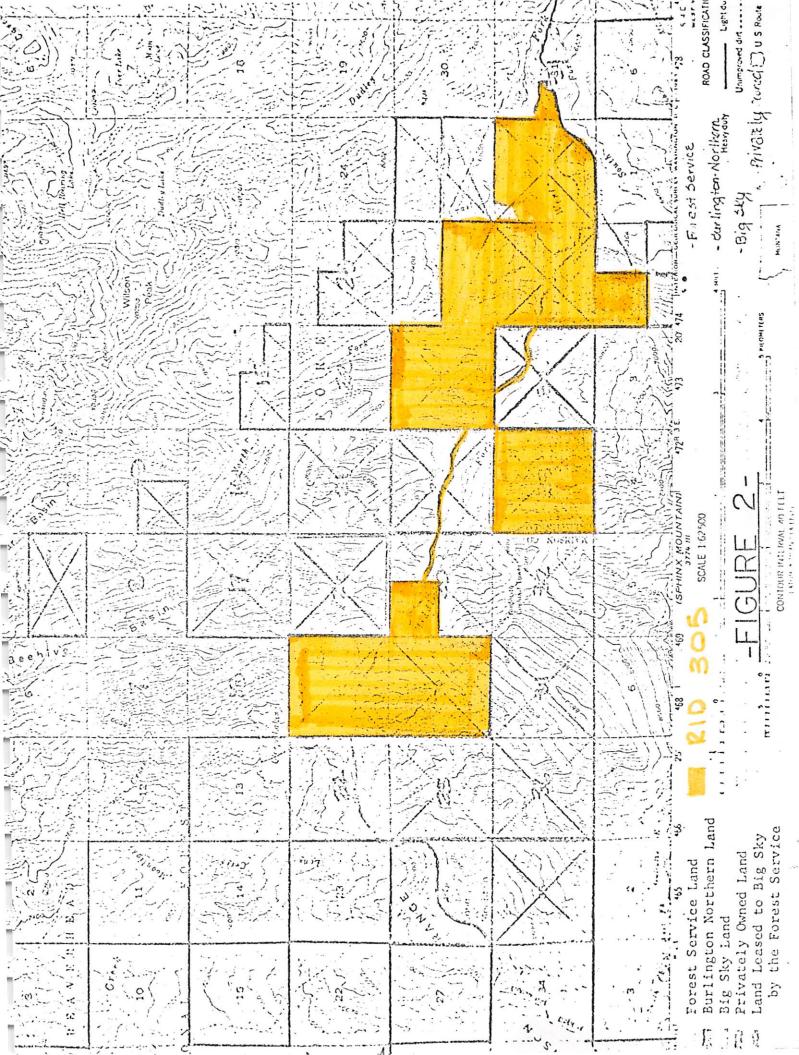
2.3 Study Area Boundary

With the development of the Big Sky complex, it is very probable that some surrounding lands will have development potential. In this case, there would be an advantage to an existing public sewer district which could then service the adjacent areas in addition to the Big Sky facilities.

Rural Improvement District No. 305 has been created for this purpose and includes lands in both Madison and Gallatin Counties as shown on Figure No. 2. The study area as depicted in Figure No. 2 (R.I.D. 305) was created through public involvement and growth trends of the Mountain and Meadow Villages.

2.4 Study Area History

History of Rural Improvement District began in the summer of 1970 when a report of Preliminary studies on Sanitary Sewer Collection and Treatment Facilities for the Big Sky project was prepared by Morrison-Maierle, Inc. This report was submitted to the State Department of Health on September 23, 1970 and favorable comments were received on the proposed plan from this agency on November 16, 1970.



Rural Improvement District No. 305 was created by the Gallatin County Commissioners in September 1971.

Construction of the Wastewater Treatment Facilities for R.I.D. 305 has been divided into four phases as follows:

- Phase I Construction of the aeration pond, storage pond No. 1 and final pond.
- Phase II Construction of the filtration and control building, less filtration equipment.
- Phase III Construction of pump station and force main to transfer water from storage pond No. 1 to the filtration building and the installation of filtration and chemical feed equipment.

Phase IV - Construction of storage pond No. 2.

Phases I and II of the facility have been completed.

Phase III is scheduled for 1976 construction and Phase IV

will follow several years in the future when development and growth of the community dictates.

Plans and specifications for Phase I of the Treatment Facilities were submitted to the State Department of Health for review and approved in August 1971. The bid opening for Phase I was held in September, 1971, and construction completed in September, 1973. Plans and specifications for Phase II were submitted to the state Department of Health in March, 1972, with the bid opening being held in April. Construction on Phase II was completed in November, 1972.

The plans and specifications for Schedules I & II of the Interceptor Sewer and the plans and specifications for all the various sewage collection lines in the Mountain and Meadow Villages have also been reviewed and approved by the State Department of Health. Phase III of the Treatment Plant contract has been included in the 1975 Fiscal Year priority list to receive Federal Grant Funding. The plans and specifications along with this "Facilities Plan" are being prepared for this grant offer.

The existing sanitary sewer collection system collects sanitary wastes from both the Mountain Village and the Meadow Village. The collection system terminates at a single treatment facility located east of the Meadow Village. The treatment facility will eventually consist of an Aeration Pond, Storage Ponds 1 and 2, Filtration Plant, and Final Holding Pond, with discharge from the Final Holding Pond to the existing golf course during irrigation season.

The existing sewage treatment facilities include the Aeration Pond, Storage Pond No. 1 and Filtration-Control Building, less filtering equipment. See Figure No. 1.

The aeration pond, having a capacity of 8 million gallons, includes aeration equipment to provide oxygenation of the waste water for biological treatment. Storage Pond No. 1, with a capacity of 50 million gallons, serves as a storage facility to store winter waste water following the biological treatment in the Aeration Pond. Storage capability of Pond No. 1 should be adequate to store winter flows generated through mid 1980.

A pump station and force main is scheduled under Phase III improvements to transport the water from Storage Pond No. 1 to the Filtration-Control Building. The Final Holding Pond,

constructed under Phase I, can also receive water from the sedimentation pond on the Middle Fork through an existing pump system. The pumping system required to pump water from the Holding Pond to the golf course is in existence as well as the complete automated golf course sprinkling system.

Rural Improvement District No. 305 has been utilized to complete the aforementioned facilities as Phase I and Phase II of the sewage treatment facilities for Big Sky of Montana, Inc.

The improvement district has applied for federal grant assistance for Phase III construction. The implementation of Phase III should be completed before the end of the 1977 golf course irrigation season, due to the limited winter waste water storage capacity in Storage Pond No. 1.

The completion of Phase III will bring the sewage treatment facility in compliance with the water quality standards of the Federal Water Pollution Control Act of 1972 as ammended and the Big Sky Master Plan.

2.5 Implementation

Montana law provides for the creation of a County Sewer District for the purpose of constructing, financing and operation of sewage collection and treatment facilities. Since the property of R.I.D. 305 is contained within the boundaries of both Gallatin and Madison Counties, a Board of Trustees has been established to administer the affairs of the District.

The administrative body of the Joint County Sewer District is an elected Board of Directors who are resident property owners in the District. The Board of Directors has the power to determine the proposed sewer use changes or to determine area assessments or a combination of both, to defray any project costs. The assessments may be on an area or valuation basis. A chairman selected by the Board of Trustees has responsibility for operation and maintenance of the project. The boundaries of the district may be extended at any time by approval of the qualified property holders in the District.

Rural Improvement District No. 305 has been created for the purpose of building, installing, constructing, acquiring, purchasing, financing, maintaining, managing and operating a sanitary sewage treatment plant for the treatment of sewage as well as the collection and feeder lines associated with the same.

The work of designing and constructing the above described sewage treatment facilities is under the general supervision of Willis J. Wetstein, P.E., Morrison-Maierle, Inc., consulting engineers.

Lands included in Rural Improvement District No. 305 are shown in Figure No. 2.

3.0 WATER QUALITY OBJECTIVES

3.1 Federal Water Pollution Control Act Amendments of 1972

The objective of this act is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. In order to achieve this objective, goals have been established as follows:

- (1) All existing waste water plants achieve "secondary" treatment by 1977.
- (2) Best practical waste water treatment be applied to all plants by 1983.
- (3) Discharge of pollutants into navigable waters be eliminated by 1985.

3.2 Montana State Department of Health & Environmental Sciences

Water Quality Standards adopted by the Montana State

Department of Health includes the State's policy of nondegradation

of existing high water quality. The policy as described in

Section 69-3808.2, Revised Codes of Montana, includes the

following statement:

The state board shall require that any state waters whose existing quality is higher than the established water quality standards be maintained at that high quality unless it has been affirmatively demonstrated to the board that a change is justifiable as a result of necessary economic or social development and will not preclude present and anticipated use of such waters.

4.0 INVENTORY OF EXISTING ENVIRONMENTAL CONDITIONS

4.1 Air and Water Quality

Air. "The valley bottoms in the Gallatin Canyon area are noted for their susceptibility for accumulation of air pollutants as well as localized effects on length of freeze-free season.

Restricted visibility is one outcome of air pollution and is caused by the scattering of light by minute solid or liquid particles (air ions).

Air ion monitoring tests at the Big Sky area in 1972 showed no evidence of reduced air quality except for periods of temperature inversion when a large number of truchs passed the air monitoring site during construction activities.

Laboratory experiments have shown that products from vehicle exhaust have had greater potential for air pollution than combustion products from other fuel sources."

Taking topographic and relocated inversion situations into account, it is assumed that air quality at Big Sky will be about midway between Bozeman and Missoula.

Before comparing potential air quality at these three sites, let us again classify air quality according to the rating illustrated below:

Air Quality Classification

Hi gh	150 large ions cm ⁻³			
Intermediate	150-200 large ions cm ⁻³			
Low	200-250 large ions cm ⁻³			
Very Low	250 large ions cm ⁻³			

Considering a projected population at Big Sky in 1985 of roughly 10,000, we can compute air pollution potential as follows:

^{1&}quot;Impacts of Large Recreation Developments Upon Semi-Private Environments," Montana State University, June 1974, p. 95.

Air Quality Ratings for Given Populations

Population Assumed	Missoula	Bozeman	Big Sky
20,000	74	87	81
10,000	0	93	95

Air quality at Big Sky in 1985 is projected here to be somewhat higher than the present level in Bozeman (95 compared to 93). Air quality at Missoula has reached the point where it has been necessary to appropriate funds for control measures.

Since the nocturnal inversion at Big Sky tends to be well developed compared to Bozeman, the air quality at Big Sky has a diurnal pattern with lowest quality at night (84 percent) and highest quality during the day (100 percent).

A multi-disciplinary team of Montana State University scientists initiated a major socio-economic-ecological study of the Gallatin Canyon area of Montana in the summer of 1970, with supporting funds from the National Science Foundation. Information was gathered to measure the impact of recreation development on water quality, geology, soils, climate, fish, game, recreational land use and socio-economic factors. Following are excerpts from their report entitled "Impacts of Large Recreation Development Upon Semi-Primitive Environment."

[&]quot;The Impact of a Large Recreation Development Upon a Semi-Primitive Environment," Montana State University, May 1972, p. 86.

Geology - John Montagne

Systematic study of the geological factors bearing on future development in the West Fork Basin has revealed that selective methods of procedure will be most beneficial where construction is concerned.

For instance, certain rock types may be considered particularly fragile in an environmental sense. Of these the worst behavior is the black shale and sandstone sequence of Cretaceous age which occupies more surface area in the West Fork Basin than any other rock type. Since the shale possesses the most critical limitations insofar as weight-bearing capacity, slope stability, and water passing ability are concerned, it alone dominates the scene when considering dams, highways, heavy buildings, and water development or disposal facilities.

Gravels which have been spread either from the fronts of glaciers or by streams in the usual course of flood plain development, thinly blanket the abovementioned shale and sandstone sequence in the basin flats. In no case have we discovered thicknesses exceeding 50 feet; most of the gravel sheet is about 30 feet in thickness. The rapid discharge of any wastewater through most of these gravels will result in rapid transmittal of that water to the top of the underlying black shale stratum, at which plane water will tend to be concentrated and run off toward the lower

basin areas, eventually discharging directly into the ground water system, but particularly into the direct stream of the Gallatin River and its tributaries. It is advisable, therefore, that waste water discharged into the gravels be relatively free of contamination.

Hydrogeological Study of West Fork - W.A. Van Voast A continuous record of the stream flows in the West Fork drainage has been obtained since the installation of three semi-permanent water-level recording stations in September, 1970. In addition to these stations, 14 measuring points were located to further subdivide the amount of flow in different areas of the watershed. Results of these measurements point out the need for additional years of record in order to accurately determine stream flow characteristics.

Preliminary examination of well and test-hole records indicate that abundant ground water is available from glaciofluvial sediments of Pleistocene age and recent alluvial deposits in some areas of the West Fork drainage. Analyses of water samples taken from 25 wells and springs inventoried in the area reveal the ground water to be of excellent chemical quality. Ground water is basically a calcium bicarbonate type, low in total dissolved solids but fairly hard.

Chemical Quality of Surface and Ground Water

- John C. Wright

During the initial phase of the study, an intensive investigation was made of the chemical and microbiological quality of ground water and surface waters of the West Gallatin River and its tributaries. Chemically the West Gallatin River is a moderately hard calcium bicarbonate stream. Low nutrient element levels, averaging 0.018 ppm for phosphorus and 0.007 ppm for nitrate-nitrogen, are indicative of the purity of the river. Ground water sources were also low in phosphorus (average 0.005 ppm) but much higher in nitrate-nitrogen (average 0.104 ppm) than surface waters.

The relatively low amount of dissolved substances, and the low nutrient ion concentrations of surface waters in the Gallatin Canyon is in keeping with the pure condition of the Gallatin River and its tributaries.

Microbiological Quality of Surface Water of the West Fork Drainage - David G. Stuart

Coliform, enterococcus and standard plate bacterial counts (used to measure water contamination) revealed that water quality was quite high in areas not directly affected by agriculture. Counts were higher at stations where large numbers of cattle were grazing. A substantial percentage of fecal coliforms were isolated, but there was no way of determining whether these were of animal or human origin.

Microbiological Studies of Ground Water Supplies

Along the West Fork and Adjacent West Gallatin

River - J. J. Jezeski

The results of bacteriological testing from coliform, enterococcus and standard plate counts indicated very little in the way of pollution indicator microorganisms in well water samples. Four of the springs tested were found to contain coliforms consistently but in low numbers. This is to be expected where there is not complete protection from insects, animals, and/or surface runoff and where the physical installations do not permit adequate decontamination.

<u>Water</u>. The examination of both surface and ground water in the Gallatin Canyon area was measured by chemical, bacterial, and aquatic insect determinations has revealed no significant impacts on the quality of water attributed to the Big Sky development other than some sediment during construction.

Extensive ground water and subsurface investigations
were conducted in the Meadow Village and golf course area by
Northern Testing Laboratories, Inc., Great Falls, Montana.
These investigations were conducted in 1970-1972 as related
to the Big Sky construction and domestic water supply studies.
Reference may be made to the following reports prepared for
Big Sky of Montana, Inc. by Northern Testing Laboratories, Inc.:

"Report of Water Supply Investigation," October, 1970

[&]quot;Report of Preliminary Investigations, Sources of Natural Construction Material," March, 1971

[&]quot;Report of Preliminary Investigations of Soil Percolation Capabilities," March, 1971

General information on ground water contained in these reports and other incidental studies by Northern Testing Laboratories follows.

Static groundwater levels in the golf course area fluctuate seasonally with runoff. In general, the static water level slopes with the valley floor, rises in the spring and early summer, falls in the autumn and early winter. Drawing No. 7 shows ground water elevations representative of the level at the time the test holes were drilled, which spans several seasons during more than one year. The ground water in the golf course area flows through a clayey or sandy gravel, overlaying a low permeability shale. Except for the low areas adjacent to the West Fork, the depth to ground water in the golf course area generally exceeds five feet even during the highest period in the spring.

In general, subsurface soils at the golf course area, not including the fill which has been placed to construct the course, are two to four feet of silty clay, overlying sandy or clayey gravel to depths of 15 to 50 feet. Along the floodplain of the West Fork, some peat deposits up to four feet in thickness are present. The aquifer is the gravelly soil, which appears to be rather continuous up the valley walls, as well as upstream from the golf course. To enter the aquifer, irrigation waters must percolate through the surficial soils.

Present aquifer use downstream from the golf course is minimal. A home located about one mile downstream from the lower end of the golf course (near crossing of West Fork and

Lone Mountain Trail) utilizes a spring percolating along the top of shale for a water supply. It is also reported that some other homes downstream from this point use wells or springs for a water supply.

Ground water source testing indicates that the deep wells will furnish water of such quality that chlorination will be the only method of treatment necessary. This source of supply exists in such quantity that the amounts required for the development will not over tax the supply for the indefinite future.

Water supply for the Meadow Village and Sweetgrass
Hills subdivisions is obtained from a 12" well located in the
Meadow Village. The water supply for the Cascade Subdivision
and the Deer Lodge, Hill and Custer Condominiums is from three
6" wells located in the Mountain Village area. The chemical
analysis of each supply is shown below:

Component in Mg/l	Meadow Supply	Mountain Supply	U.S. Public Health Service Drinking Water Quality Standards Maximum Concentrations
Total Dissolved Solids	192.0	38.00	500
Total Hardness	202.0	48.00	
Calcium	49.0	7.20	
Magnesium	19.8	7.50	
Alkalinity as HCO3	220.0	55.00	nim qup
Iron	Trace	0.03	0.03
Chloride	0.7	0.30	250
Sulfate	7.4	5,30	250
Nitrate	1.5	0.06	45
рн	7.7	8.00	

Bacteriological quality of the water is excellent.

Bacteriological quality is checked each month on samples submitted to the Montana State Department of Health.

The existing sewage treatment facilities provide for spray irrigation to apply the treated effluent to the golf course. Removal of pollutants is achieved in the soil mantle by biological assimilation, filtration, chemical transformations and precipitation, ion exchange, absorption, plant uptake and many other physiochemical and physiobiological processes.

Plant uptake is expected to be a major mechanism of nutrient removal. This method of treatment should make no significant changes in the existing surface or ground water quality.

4.2 Existing Wildlife

With vegetation providing food and cover animals typical of mountainous regions thrive in the Gallatin Canyon area. The amount of big game winter range is a critical limiting factor to big game populations.

The Big Sky project area is not part of any migratory route for any of the wildlife presently existing in the area, nor is it winter range for any of the wildlife indigenous in the area. Existing range and pasture resources have previously been utilized for grazing domestic stock.

A letter from the State of Montana, Department of Fish & Game to Mr. Paul Weingart, Supervisor of the Gallatin National Forest, dated March 5, 1971, states "from a wildlife habitat aspect a better site for the development could not have been

selected . . . it is possible . . . that the net effect will be a benefit to fish and wildlife population."

Phase III improvements to the existing sewage treatment facilities will have no effect on existing wildlife.

4.3 Soils and Vegetation

Materials in the valleys are mixtures of cobbles, sands, silts and clays. These and other surface deposits are remnants of intense glacial and washing activity. Foothill and mountain soils are sandy and clayey depending upon the rocks beneath. Ongoing slope processes have eliminated most soil formation on steep slopes. Much soil development has occurred on glacial or associated materials deposited by running water. Wind blown silt is found in large areas of the waterlain valley deposits. Soils are further described in Section 9.5.

Climate and soil conditions have determined the vegetation.

The distribution of vegetation depends upon elevation, temperature, amount and form of precipitation, type of soil, plant diseases, insects, fire and logging activity.

The project area contains grassland and sagebrush, lodgepole pine, douglas fir, spruce fir, and alpine meadows and barrens.

5.0 WASTEWATER SOURCES AND CHARACTERISTICS

5.1 General

The quantity and quality of sanitary sewage collected and treated must be determined for proper design of the collection

and treatment facilities. The development at Big Sky provides a somewhat different situation in determining basis of design than a normal community due to the recreational type activity.

Similar recreational developments in Western United States, as well as planners and engineers in this field, were contacted for information in determining criteria for basis of design.

Also, a report entitled "Basic Waste Characteristics at Winter Recreation Areas" published by the Northwest Regional Office of the Federal Water Quality Administration, was most helpful.

The basis of design of a sewer system must also consider the period of time for which it is to be designed. While it is good practice to design for future needs, consideration has to be given to the expected rate of development and the economics involved in providing for future needs.

Sewer pipe lines such as collection laterals, interceptors and outfall lines are usually designed for ultimate development. Sewage treatment plants, pump stations, and other mechanical installations, are designed for a somewhat lesser period with provisions for expanding to ultimate capacity at a future date.

5.2 Population

The following population figures for Phase III and ultimate development are summarized from data furnished by David Jay Flood & Associates, master planners for Big Sky of Montana. Phase III population represents the occupancy at the present time. Populations for ultimate density are projected for 20 years or more.

POPULATION

MOUNTAIN VILLAGE

	Maximum Day & Full Occupancy	
Residents	Ultimate	Phase III
Hotels (2 capita per room)	768	300
Condominiums (4 capita per bedroom)	10,652	3,750
Houses (2 capita per bedroom)	1,990	25
Employees	120	150
TOTAL	13,530	4,225
Non-Residents		
Skiers (week-end day)	700	300
Employees	200	<u>70</u>
TOTAL	900	370

Winter Population

Summer Population
Maximum Day
Occupancy Predicted

Ultimate Phase III
Residents
Otels 720 200

Hotels		720	200
Condominiums		2,500	1,000
Houses		100	20
Employees		300	100
	TOTAL	3,620	1,320
Non-Residents			
Convention Center	•	100	100
Employees		<u> 125</u>	<u>45</u>
	TOTAL	225	145

MEADOW VILLAGE

Winter Population
Maximum Day
Occupancy Predicted

Residents	<u>Ultimate</u>	Phase III
Condominiums Houses Miscellaneous Commercial	400 1,600 <u>135</u>	120 50 15
ror	PAL 2,135	185
Non-Residents Miscellaneous	. 10	0

Summer Population
Maximum Day &
Full Occupancy

Residents		<u>Ultimate</u>	Phase III
Condominiums Houses Miscellaneous & Commerce	cial	1,200 1,800 50	240 250 <u>35</u>
	TOTAL	3,050	525
Non-Residents Guests & Golfers Commercial		100 150	50 50
	TOTAL	250	. 100

The above populations for the Meadow Village include the Camper Village, Mobile Home Court, Guest Ranch and other miscellaneous developments in the vicinity of the Meadow Village.

5.3 Quantity of Sewage

Actual sewage flows will be slightly less than the water consumption of a community or development, not including irrigation. A consumptive loss of 20 percent is commonly used.

A survey of several recreational areas in Western United
States similar to Big Sky indicated a wide variety of average
per capita water and sewage flows. The best source of information on water and sewage flows is contained in a study and
report prepared by B. David Clark of the Federal Water Quality
Administration entitled "Basic Waste Characteristics at Winter
Recreation Areas." This report is a result of studies conducted
at Crystal Mountain, Timberline Lodge and Bachelor Butte resorts
in the states of Washington and Oregon.

Using data from the above report and a consumptive loss # 6 \ of 20 percent, the following per capita sewage contributions were established:

Overnight residents, including hotels, condominiums, houses and employees...... 60 gpcd

Day visitors, skiers and non-resident employees.. 10 gpcd

(gpcd - gallons per capita per day)

The above per capita contributions include allowances for meals and other miscellaneous uses. These figures correspond very closely to the design criteria suggested by Webster-Martin Engineers as follows:

Condominiums..... 50 gpcd

Day Skiers..... 6 gpcd

Restaurants..... 3 gallons per meal served

* low for condos, houses. In any case flow measurement is essential.

The following table is a tabulation of estimated daily sewage flows using population projections presented previously and the above contributions of 60 gpcd for residents and 10 gpcd for non-residents, visitors, skiers, and employees.

MAXIMUM DAILY SEWAGE FLOWS

MOUNTAIN VILLAGE

Winter - Maximum Day @ Full Occup	ancy
Phase III	Ultimate
Residents 4225 capita	13, <mark>530 capi</mark> ta
0.60 = 253,500 gpd	0.60 = 811,800 gpd
Non-Residents 370 capita	900 capita
(1 = 3,700 gpd)	0.10 = 9,000 gpd
TOTAL 257,200 gpd	TOTAL 820,000 gpd
Summer - Maximum Day	
Dhog TTT	Ultimate
Residents 13,200 capita	3,620 capita
Residents 13,200 capita 157.0	3,620 capita @ 60 = 217,200 gpd
Residents 13,200 capita 13%.0 Residents 13,200 capita Residents 145 capita	
Residents 13,200 capita 157.0 60 = 79,200 gpd Non-Residents 145 capita 6 10 = 1,450 gpd	@60 = 217,200 gpd
Non-Residents 145 Capita	<pre>@ 60 = 217,200 gpd 225 capita</pre>

MEADOW VILLAGE

Winter - Maximum Day	
Phase III	Ultimate
Residents 185 capita	2, 135 capi ta
0.60 = 11,100 gpd	0.60 = 128,100 gpd
Non-Residents	10 capita
	0 10 = 100 gpd
TOTAL 11,100 gpd	TOTAL 128,200 gpd

Summer - Maximum Day @ Fu	ll Occupancy
Phase III	Ultimate
Residents 525 capita	3,050 capita
0.60 = 31,500 gpd	0.60 = 183,000 gpd
Non-Residents 100 capita	250 capita
0 10 = 1,000 gpd	010 = 2,500 gpd
TOTAL 32,500 gpd	TOTAL 185,500 gpd

The above sewage flows are maximum daily flows expected at each village for the season indicated. Such flows are used as a basis of design for sizing the sewage treatment facilities, but are not the average daily flows for the development. To get the average annual or seasonal daily flows, one must estimate occupancy rates for the total facilities. Dividing the winter and summer seasons into six months each, the sewage productions are estimated below:

SEASONAL AND ANNUAL SEWAGE
PRODUCTION AND ANNUAL AVERAGE DAILY FLOWS

MOUNTAIN	VILLAGE
----------	---------

Wir	iter	Seas	son
(October	thro	ough	March)

Maximum Day	Phase III 257,200 gpd	Ultimate 820,800 gpd
60 days @ 100 % Max. Day Occupancy 60 days @ 60% Max. Day Occupancy 62.5 days @ 30% Max. Day Occupancy	15.43 MG 9.26 MG 4.63 MG	49.25 MG 29.55 MG 14.77 MG
6-Month Winter Subtotal	29,32 MG	93.57 MG

Summer Season (April through September)

Maximum Day	Phase III 86,050 gpd	Ultimate 219,450 gpd
60 days @ 100% Max. Day Occupancy 60 days @ 60% Max. Day Occupancy 62.5 days @ 30% Max. Day Occupancy	5.16 MG 3.10 MG 1.55 MG	13.17 MG 7.90 MG 3.95 MG
6-Month Summer Subtotal	9.81 MG	25.02 MG
TOTAL ANNUAL FLOW	39.13 MG	118.59 MG
Annual Daily Average Flow = $\frac{\text{Annual Flow}}{365 \text{ days}}$ =	107,200 gpd	324,900 gpd

MEADOW VILLAGE

Winter Season (October through March)

Maximum Day	Phase III 11,100 gpd	Ultimate 128,200 gpd
60 days @ 100% Max. Day Occupancy 60 days @ 60% Max. Day Occupancy 62.5 days @ 30% Max. Day Occupancy	0.67 MG 0.40 MG 0.21 MG	7.69 MG 4.62 MG 2.40 MG
6-Month Winter Subtotal	1.28 MG	14.71 MG

Summer Season (April through September)

Maximum Day	Phase III 32,500 gpd	Ultimate 185,500 gpd
60 days @ 100% Max. Day Occupancy 60 days @ 60% Max. Day Occupancy 62.5 days @ 30% Max. Day Occupancy	1.95 MG 1.17 MG 0.61 MG	11.13 MG 6.68 MG 3.48 MG
6-Month Summer Subtotal	3.73 MG	21.29 MG
TOTAL ANNUAL FLOW	5.01 MG	36.00 MG
Annual Daily Average Flow = $\frac{\text{Annual Flow}}{365 \text{ days}}$ =	13,700 gpd	98,600 gpd
BOTH VILLAGES - COMBINED SYSTEM	Phase III	
Total Annual Flow	44.14 MG	154.59 MG
Annual Daily Average Flow = Annual Flow =	120,900 gpd	423,500 gpd

The maximum daily flow contributed by a combined system serving both villages will occur during the winter, as summarized below:

	Phase III	<u> Ultimate</u>		
Mountain Village - Winter Meadow Village - Winter	257,200 gpd 11,100 gpd	820,800 gpd 128,200 gpd		
Maximum Daily Flow - Combined System	268,300 gpd	949,000 gpđ		

5.4 Quality of Sewage

Quality of sewage refers to sewage "strength" and is an important feature in the design of sewage treatment facilities. Ordinary domestic sanitary sewage contains about 99.9 percent water. The remaining one-tenth of one percent is composed of organic matter such as human wastes, kitchen wastes, greases, solvents and inorganic matter such as sand and grit. About 60 percent of the sewage solids are dissolved in water and about 40 percent are suspended or carried along by the liquid.

Suspended Solids (SS) in sanitary sewage determines the amount of sludge to be expected at the treatment facility. Another equally important factor is the Bio-Chemical Oxygen Demand (BOD). This is the amount of oxygen required for the aerobic decomposition of the organic matter in sewage. Water tends to rid itself of organic matter through oxidation under favorable conditions of aeration and temperature. A sewage treatment facility accelerates this process under controlled conditions.

In a given community or development, the wastes discharged from houses, condominiums, hotels, motels, restaurants, commercial buildings, etc., are combined within the sewage systems to produce relatively constant per capita amounts of organic matter, as measured in terms of SS and BOD. The Federal Water Quality Administrations' study and report on "Basic Waste Characteristics of Winter Recreation Areas" established per capita contributions of SS and BOD as follows:

SS: Overnight Residents - 0.290 lbs. per capita per day

Day Visitors..... - 0.013 lbs. per capita per day

BOD: Overnight Residents - 0.173 lbs. per capita per day

Day Visitors..... - 0.0135 lbs. per capita per day

The above per capita contributions were used to estimate SS and BOD quantities.

SUSPENDED SOLIDS AND BOD MAXIMUM DAY CONTRIBUTIONS

(Pounds Per Day)

MOUNTAIN VILLAGE	Phase III	<u>Ultimate</u>
	Winter - Max. Day @	Full Occupancy
SS	1230	3936
BOD	736	2352
	Summer - Max	imum Day
SS	385	1053
BOD	230	. 629
MEADOW VILLAGE		
	Winter - Max	imum Day
SS	54	620
BOD	32	370
	Summer - Maximum Da	y @ Full Occupancy
SS	154	888
BOD	93	* 531

Using the same occupancy rates used previously for determining average sewage flows, the average contributions of SS and BOD are estimated on the next page.

SUSPENDED SOLIDS AND BOD AVERAGE DAILY CONTRIBUTIONS

(Pounds Per Day)

· .	Phase SS	BOD		Ult:	imate BOD
MOUNTAIN VILLAGE	Winter	Season	(Oct.	through	March)
	774	464		2480	1480
•	Summer	Season	(April	through	Sept.)
	243	144		772	396
		Annu	al Ave	cage	
	509	304		. 1571	909
			·		
MEADOW VILLAGE					
	Winter	Season	(Oct.	through	March)
	34	20		391	233
	Summer	Season	(April	through	Sept.)
	97	59		560	335
		Annu	al Ave	cage	
	66	40		476	284
BOTH VILLAGES - COMBINE	SYSTEM	<u>4</u>		•	
	Winter	Season	(Oct.	through	March)
	808	484		2871	1713
	Summer	Season	(April	through	Sept.)
	340	203		1222	731
		Annu	al Ave	cage	
	575	344		2047	1193

Since this is basically a domestic-type sewage, other wastewater characteristics are estimated as follows:

Constituent	Concentration mg/L
Solids, total	500
Dissolved, total	350
Fixed	200
Volatile	150
Total Organic Carbon (TOC)	150-200
Chemical Oxygen Demand (COD)	350
Nitrogen, (total as N)	20-40
Organic	8-15
Free Ammonia	12-25
Nitrites	0
Nitrates	0
Phosphorous (total as P)	6-10
Organic	2-3
Inorganic	4-7
Chlorides	140
Alkalinity (as CaCO ₃)	75
Grease	7 5

6.0 INVENTORY OF EXISTING COLLECTION AND TREATMENT SYSTEMS

6.1 Collection System and Interceptor Line

The existing sewage collection systems for the Meadow and Mountain Villages are shown on drawings 1A and 1B, respectively,

in the Appendix of this report. The interceptor sewer line from the Mountain Village to the Sewage Treatment Facilities is 6.2 miles long and is not shown on these drawings. A tabulation of these collection lines are shown below.

EXISTING SEWAGE COLLECTION SYSTEM

Mountain Village	
8" P.V.C. Sewer Pipe	15,600 L.F.
10" P.V.C. Sewer Pipe	1,040 L.F.
	1,660 L.F.
Interceptor Line	
	1,140 L.F.
10" P.V.C. Sewer Pipe	
12" P.V.C. Sewer Pipe	8,470 L.F.
14" A.C. Sewer Pipe	3,740 L.F.
14" A.C. Sewer Pipe 16" A.C. Sewer Pipe	1,130 L.F.
18" A.C. Sewer Pipe	3,520 L.F.
Meadow Village	
8" P.V.C. Sewer Pipe	22,680 L.F.
8" A.C. Sewer Pipe	16,910 L.F.
10" P.V.C. Sewer Pipe 16" A.C. Sewer Pipe	3,260 L.F.
16" A.C. Sewer Pipe	1,480 L.F.
24" A.C. Sewer Pipe	1,150 L.F.
TOTAL	96,590 L.F.

NOTE: These quantities do not include any service lines or connections.

Construction of these collection lines were designed using the following considerations:

Minimum Pipe Size - 8 inches.

Pipes were sized to allow for expansion of the system.

Minimum velocity at ½ full - 2 feet per second.

Minimum depth 6 feet to prevent freezing.

Maximum spacing of manholes 400 feet.

Average daily flow - 60 gpcd (overnight)

10 gpcd (day skiers)

Peak design flows:
Laterial collection sewers - 800% of average flow.
Interceptor sewers - 700% of average flow.
Main trunk & outfall sewers - 500% of average flow.

The sanitary sewer collection systems have been designed for the ultimate growth of the areas to be served, plus some allowances for expansion. The gravity collector, trunk and interceptor lines are sized to handle peak flows expected at ultimate density.

Specifications for these sewer projects allow a maximum infiltration of 500 gallons per day per mile of sewer, per inch of pipe diameter. This is pretty much an industry standard and is the maximum allowed by State Department of Health regulations. All projects were inspected and the contractor was required to test the sewer mains either with water or air pressure. All lines have been constructed since 1971 and are in a relatively new condition.

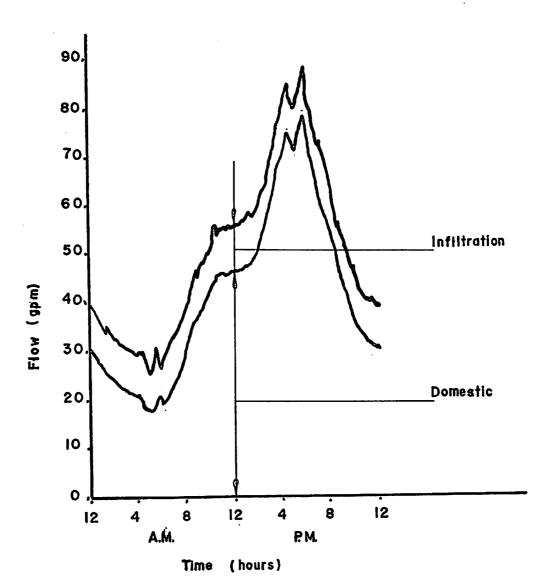
6.2 Infiltration Inflow Identification

Sewage flow rates at Big Sky, Montana, will differ somewhat from month to month depending upon the fluctuations in resident populations and the number of day visitors.

The following curve was developed from sewage flow rates taken during he month of November 1974. During this month both the numbers of resident occupants and day visitors were very low since the golf, skiing and other recreational facilities were at a minimum for the year.

Mountain Village sewage travels approximately 6.2 miles before reaching the sewage treatment facilities located below the Meadow Village. The length of time required for this travel is approximately two hours.

Sufficient sewage flow measurements were taken to determine if there was any infiltration, and if so, where it was occurring. A physical examination at key manholes was used to obtain data for this analysis.



Note Infiltration would be low generally in November

The only significant infiltration detected in the Big
Sky sewage collection system during the flow measuring tests
occurred in the sewer lines between manholes 157 and 159 in
the Mountain Village. This line, located just west of the
Mountain Village Lake, had an infiltration rate of approximately
10 to 12 gallons per minute. This sewer line is scheduled
for repair by Big Sky of Montana, Inc. maintenance forces
during the summer of 1976.

During July, 1974, a considerable amount of infiltration was found in the Guest Ranch sewer line and one manhole in Meadow Village required patching. The deficiencies were corrected in 1974 and these sources of infiltration were virtually eliminated.

Minor amounts of infiltration were found in the sewer lines from the Guest Ranch and from the collection line of Spotted Elk Road in the Meadow Village. These sources of infiltration contribute less than 0.6 gpm which is less than the allowable specified maximum of 500 gallons per day, per miles of sewer, per inch of pipe diameter.

Since the collection systems are new, infiltration inflow studies were minimal. Flow measurements were taken in the early morning hours to evaluate and locate any sources of infiltration.

Flow measurements were taken at junctions of major laterals during the daytime hours to establish per capita flows for the areas served. Those tests were conducted

during the latter part of November, 1974, on which dates the Big Sky complex had a resident and overnight population varying from 100 to 125. Considering the population and areas served, it was not possible to access per capita flow with any degree of accuracy. Per capita rates are discussed in Section 5.1.

The flow measurements conducted in November, 1974, were made to confirm leakage tests and flow measurements made during construction of the sewer mains during the years 1971, 1972, 1973 and 1974. All sewers were tested by air or water tests to meet a maximum allowable infiltration of 500 gallons per inch per mile per day. The majority of these tests were conducted during the months of June, July, August and September.

6.3 Existing Sewage Treatment Facilities

The existing sewage treatment facilities as constructed under Phases I and II include the following:

- Phase I: Pond earthwork, clay lining for aeration pond, storage pond #1, and holding pond, outfall sewer, backwash piping, aeration equipment and piping, pond inlets, intake lines, drains, and manholes.
- Phase II: Construction of filtration building, including chlorine contact chamber, golf course pumping facilities with related piping and aeration equipment.

Design and construction of Phases I and II includes provisions for Phase III construction, including provisions for the filtration equipment proposed under Alternate II.

See Drawings 1A, 1B, 2, 3, 4, 5 and 6 for site plans and details of the existing treatment facilities.

The wastewater disposal site consists of an existing 18-hole golf course, complete with automatic sprinkling system. The golf course is located in the area bordered by Lone Mountain Trail, Two Moons Road and Little Coyote Road, as shown on Drawing No. 1A bound herein. Residential and commercial developments are located adjacent to these roads within the golf course area.

The aeration pond includes aeration equipment to provide oxygenation of the wastewater for biological treatment. Storage pond #1 serves as a storage facility to store winter wastewater following the biological treatment in the aeration pond. The storage capability of pond #1 should be adequate to contain wastewater generated through the winter months for populations projected through mid 1980 or longer.

Treatment Plant Wastewater Samples. Samples of raw sewage and treated aeration pond effluent were taken at three different times during high occupancy periods at the ski resort during the winter of 1975-1976. The results of these tests are as follows:

Date	Raw S	Raw Sewage		nd Effluent
	BOD	SS	BOD	SS
12-16-75	102 mg/l	193 mg/l		,
1- 7-76		Sample 1 Sample 2	25.5 mg/l 25.5 mg/l	30.7 mg/l 24.7 r.g/l
2-22-76	127 mg/l	138 mg/l	20.0 mg/l	14.4 mg/l

The 8 MG constant volume aeration pond is projected to normally produce an effluent with solids and BOD below 25 mg/l before overflowing into the 50 MG storage pond.

Raw sewage flows into the aeration pond without any prior treatment. No sludge handling, drying or disposal facilities are necessary as the sludge is retained in the pond and is continually being digested and reduced by aeration. During the winter months, the pond may freeze over, but the aeration continues without interference.

The existing 50 MG storage pond will take up fluctuations due to the golf course irrigation seasons. Wintertime flows up to the beginning of the next irrigation season will be stored in the storage ponds without overflow. The normal operation of the system would have the sotrage pond level drawn down to a minimum at the end of the golf course irrigation season.

Under Phase III improvements, the effluent will be drawn from the storage pond and conditioned further by sand filtering (under Alternate II) and chlorinated before being pumped into the holding pond where it will be stored for irrigation requirements at the 18-hole golf course.

Capacity of the filtering facilities (Alternate II) for the initial 18-hole course is suggested at 300,000 gpd with expansion to 900,000 gpd in the future for a 27-hole course. The effluent from the filtering facilities would be chlorinated prior to entering the final holding pond.

The 19-MG effluent holding pond supplies storage for golf course irrigation requirements and contains aerators to prevent the pond from freezing over and resulting in fish kill.

7.0 TREATMENT AND DISPOSAL ALTERNATIVES

7.1 General

The objectives in constructing a treatment facility are to abate the health hazards associated with sewage contamination of water supplies and to preserve the integrity of the existing eco-system. No discharge should be allowed to the river or groundwater unless such discharge is of the same or better quality than what already exists.

The treatment and disposal facilities for this community are proposed to accomplish objectives of the Federal Water Pollution Control Act by treating and reusing the water as a beneficial commodity to the golf course. The system will provide a land disposal system which will maintain the chemical, physical, and biological integrity of the ground water and surface waters in the area.

Completion of the Phase I and II portions of the treatment plant allow only treatment of the sewage in the aeration
pond and storage of this treated effluent in storage pond No. 1.
Completion of Phase III is necessary to transport the contents
of the storage pond to the filter building to further condition
the water before entering the holding pond for pumping to the
golf course.

7.2 Phase III Alternatives

Two alternatives have been considered as follows for Phase III improvements:

- Alternate I Construction of pump station and supply
 line to treatment building, plus installation of chlorination equipment.
- Alternate II Construction of pump station and supply
 line to treatment building, plus installation of chlorination and filtration
 equipment.

The basic difference in the two alternatives is that Alternate II includes filtration equipment while Alternate I does not.

The treatment building which will house the chlorination and filtration equipment was constructed under Phase II. The chlorine contact tank is a part of this structure, located under the floor slab. See Drawing No. 3 attached. The design of the treatment building allowed for the installation of filtration and chlorination equipment, consequently the installation of this equipment under Phase III will not require new structures or modification of the existing treatment building structure.

The new pump station will house two pumps, each with a capacity of approximately 250-350 gallons per minute. The supply line to the treatment building will be 8 inches in diameter. A return line to the aeration pond will also be

installed, which will provide a means of recirculating the storage pond contents through the aeration pond. Controls will be provided in the pump station so that recirculation can be accomplished independent of supply to the treatment building.

A clay lining was placed in the existing storage pond Mo. 1 during the summer of 1974. From visual observations, Mullition it is apparent that some leakage through the lining exists with and sealing of the storage pond is proposed under both Alternates I and II. An application of S.G. 40 Bentonite as manufactured by the American Colloid Company (Lovell, Wyoming) is proposed to solve this exfiltration. Further study and testing will be conducted to determine the extent of the problem and the application method and rate to be used. The aeration pond was sealed in a like manner in 1972. The final holding pond has also experienced some leakage and sealing procedures may have to be applied to this pond in addition to storage pond No. 1.

7.3 Effluent Treatment

7.3.1 Disinfection

Disinfection is defined as the destruction of disease-causing organisms. Treatment is not considered complete until the wastewater has been disinfected. Chlorination of the wastewater prior to discharge to the land is the recommended method of disinfection for Big Sky. A detention time in excess of 30 minutes will be provided at peak flows and at a chlorine residual of 1 mg/L.

7.3.2 Filtration

Alternate II provides for mixed media filtration.

Filtration, as applied to wastewater, is the physical process of separating suspended solids from the liquid by passing the liquid through a porous media. Filtration rates from 3.5 to 7.5 gallons per square foot per minute are proposed. Algae are not excluded from "40 CFR 133" definitions of suspended solids and must therefore be dealt with. Concentrations vary widely, usually ranging from 5-10 mg/L up to 40-50 mg/L in aerated lagoons.

To remove these concentrations of algae and other suspended solids, a filter media is proposed under Alternate II and minor amounts of alum or polyelectrolite addition may be added to aid filterability if necessary. Backwash water from the filters would be returned to the aeration pond.

7.3.3 Irrigation

Golf course irrigation with the sewage plant effluent is practical and feasible. It offers aesthetic values by not directly discharging sewage plant effluent to the receiving stream and provides a savings in the application of commercial fertilizers to the golf course. The treatment efficiency of crop irrigation is the highest of all types of land application. The major reasons are the relatively low application rates allowing for removal of nutrients by plant uptake. Organic matter is removed by absorption in the soil. The removal of BOD, suspended solids, nitrates and phosphates under proper operation should be 95 percent or more.

The following table presents information on typical removal efficiencies for selected projects.

REMOVAL EFFICIENCY AT SELECTED SITES³

	Loading					y, %	
Location	rate, in./wk.	BOD	SS	N	P	E. Coli.	Reference
Lake Tahoe, California ^a	13.4			36	91	96 ^b	366
Cincinnati, Ohio ^C (sand)	11.2	95		20	30		10
Cincinnati, Ohio ^C (silt loam)	11.2	95		50	96		10
Cincinnati, Ohio ^C	11.2			85	99		106
Pennsylvania State University ^d	4.0	98	99	91	99	99	90
Melbourne, Australia ^C	1.3	98	97	90	80	98	51

^aData on runoff during 1964; operation ceased in 1968.

The present irrigation site consists of an 18-hold golf course consisting of approximately 100 acres. Under ultimate development the course will be expanded to about 200 acres.

bRemoval from chlorinated secondary effluent.

CExperimental outdoor lysimeters six feet deep at Taft Sanitary
Engineering Center.

dRemovals from secondary effluent at three-foot depth.

eRemovals from raw wastewater at four- to six-foot depth.

^{3&}quot;Wastewater Treatment and Reuse by Land Application,"
Volume II - EPA - 660/2 - 73 - 006b, August, 1973, p. 55.

The existing crop consists of approximately 98 acres of fairway grass in the following proportions: Kentucky Bluegrass - 50%, Creeping Red Fescue - 30%, Marion Bluegrass - 15%, and Annual Rye - 5%, with two acres of trees and grass planted with Pencross Creeping Vent. Crop water requirements and expected nutrient uptake are summarized below.

ESTIMATE CROP WATER REQUIREMENTS AND EXPECTED NUTRIENT UPTAKE

Crop	Water Requirement in./day	Nitrogen lb./acre/yr.	Phosphate lb./acre/yr.	
Grass (Big Sky Golf Course)	.23	150 - 200	50 - 70	

Average dosing of the secondary treated effluent would amount to approximately 0.100 inches per day for the Phase III and 0.175 inches per day for the ultimate development. The dosing rate is low and allows for the uptake of nutrients by the crop. The soil holding capacity, precipitation and net evaporation rate will determine the amount of make-up water required to meet crop water requirements. Make-up water to satisfy golf course water requirements will be supplied from the sedimentation pond in the Middle Fork of the Gallatin River.

The existing golf course sprinkler irrigation system consists of four basic zones as follows:

Zone A - 33 Fairway sprinkler heads, 37 tee & green heads
Zone B - 36 Fairway sprinkler heads, 33 tee & green heads
Zone C - 34 Fairway sprinkler heads, 76 tee & green heads
Zone D - 43 Fairway sprinkler heads, 37 tee & green heads

The fairway heads are rated at approximately 90 gpm and the tee and green heads are rated at about 50 gpm. The maximum rate of application of these heads is about 0.23 inches per hour.

The system is completely automated to start and stop
through a timed programmer. Maximum capacity of the supply
pumps to the golf course is about 1000 gpm. The sprinkling
system programmer thus allows only the number of heads to operate
at one time to match this supply, i.e. 11 fairway heads @
90 gpm, 20 tee and green heads @ 50 gpm, or a combination
thereof. Each sprinkler head has a "valve in head" feature
which is electrically controlled by satellite controllers.
The "on" time of each sprinkler head can be individually adjusted
through the satellite controller from 0-11 minutes. This gives
the operator considerable flexibility in varying water application
rates to specific areas as dictated by ground slopes, soil
holding capacities, etc.

The golf course irrigation season will normally consist of the months of June through October, although the season may be lengthened or shortened for a specific year, depending on the precipitation. During the irrigation season, the dosing schedule is fluctuated in accordance with precipitation received. Water is applied only in the amounts to keep the golf course in a good playing condition. Shortening of this season will not cause serious problems until such time that the development reaches the storage pond capacity limitations. At this point, consideration should be given to adding storage pond No. 2.

The maximum amount of water that can physically be applied with the present 1000 gpm supply to the existing 18-hole golf course is about 0.53" per day with 24-hour full-time sprinkling. However, sprinkling is limited only to the plant requirements which is less than 50 percent of this amount during the driest part of the year.

The oxidation treatment process effluent can be expected to contain the following nutrient constituents before application to the golf course:

Nitrogen (Total as N)

Organic 8 - 15 mg/L Nitrate - 19 mg/L

Phosphorous (Total as P)

Organic - 3 mg/L

Inorganic - 5 mg/L

Rapid oxidation of organic nitrogen and phosphorous compounds on the ground following application is expected to render nearly all of the nutrients available for crop use.

Thus, the total nutrient loading concentrations in the applied wastewater will result in a maximum nitrogen loading of approximately 112 pounds per acre per year for Phase III and 196 pounds per acre per year at ultimate development. Maximum phosphorous loadings will be approximately 29 pounds per acre per year for Phase III and 52 pounds per acre per year at ultimate development. These loadings fall within the reasonable projections for seasonal nutrient uptake by the golf course grass, thus nutrient removal is expected to approach 100 percent.

8.0 COST EFFECTIVE ANALYSIS

8.1 General

An integral part of the planning process is the determination of the direct costs associated with providing the alternate facilities. Direct costs are those items for which monetary outlay must be made. Included are capital costs for construction, replacement costs, operation and maintenance costs, engineering fees, and legal and administrative services.

A monetary evaluation, or cost-effective analysis, involves comparing the direct costs of the alternatives at a specific instant time. This may be accomplished by either of two methods - present worth or annual costs.

The present worth of an alternative is the equivalent sum of money that would have to be invested now at a given interest rate to provide the exact amount of funds to make all expenditures during the life of the project. Present worth consists of reducing all future differences between alternatives to a single equivalent present sum. Annual cost is the cost pattern of each alternative converted into an equivalent uniform series of costs at a minimum required rate of return.

The interest rate to be used for these calculations is 7 percent. Project life is set at 20 years, although pipelines and structures normally have economic lives nearer to 40 to 50 years.

8.2 Cost Estimates of Alternatives

The following cost estimates are based on present estimated construction costs. Considerable variation in the relative cost of specific items or materials, equipment and service may be expected.

CONSTRUCTION COSTS

	Alternate I	Alternate II
Booster Station	\$33,500.00	\$33,500.00
Return Lines (1,350 L.F.)	15,700.00	15,700.00
Seal Storage Pond	15,500.00	15,500.00
Filtration Equipment	-0-	174,000.00
Chlorination Equipment	2,250.00	2,250.00
Flow Measuring Equipment	3,000.00	3,000.00
TOTAL CONSTRUCTION COSTS	\$69,950.00	\$243,950.00

Note: The above costs have been adjusted by approximately 12 percent to allow for inflation from the 1975 to the 1976 construction season. Flow measuring equipment has been added to accurately monitor wastewater flows.

LAB EQUIPMENT

Lab equipment will include apparatus for testing dissolved oxygen, settlable solids, chlorine residual, fecal coliform, and PH. The estimated cost is \$1,000.00

ENGINEERING AND INSPECTION

Engineering and inspection costs for Phase III are estimated at \$9,500 for Alternate I, and \$12,000 for Alternate II.

LEGAL AND ADMINISTRATIVE

Legal and administrative services are estimated at 1.5 percent of Alternate II construction costs, to be \$3,650.00

* With Federal funding I estimated RID 305 share of cost at about \$90,000.

TAL

INTEREST DURING CONSTRUCTION

Interest during construction is calculated by the formula:

Interest = I \times P/2 \times C

I = the interest (discount) rate = 9.5%

P = construction period in years = ½ year

C = total capital expenditure

The capital expenditure upon which the interest will be paid is equal to 25 percent of all items eligible for grant funding plus 100 percent of those items not eligible for grant funding.

OPERATING COSTS

Estimated operating costs of Alternates I and II are presented below. The operating costs include costs for power, chemicals, and labor only.

ESTIMATED ANNUAL OPERATING COSTS Phase III (107,200 gpd)

<u>It</u>	<u>cem</u>	Alternate No. 1	Alternate No. 2
	ower Costs	\$2,300.00 250.00	\$2,900.00 150.00
3. La		3,000.00	5,280.00
	TOTALS	\$5,550.00	\$8,330.00

Power rates were used as obtained from the present rate schedule of the Montana Power Company. Chlorine dosages vary from 5ppm for Alternate No. 1 to 3ppm for Alternate No. 2 at an estimated cost of \$0.15 per pound. Labor and maintenance costs vary from 250 man-hours per year for Alternate No. 1 to 440 man-hours per year for Alternate No. 2 at an estimated cost of \$12.00 per hour. This would be on a part-time basis for a licensed plant operator employed by the Big Sky of

Montana, Inc. maintenance department. Alum and polyelectrolete feed equipment has been provided and may be used when needed, however, costs for these chemicals are not included in this report.

Operation and maintenance costs for the spray irrigation system are not included in this report.

These facilities are operated and maintained by Big Sky of Montana, Inc. personnel in the administration and operation of the golf course. Phase III construction should have no effect on the existing irrigation system. However, it is anticipated that Alternate I will raise maintenance costs if deletion of the filtration facilities proposed in Alternate II causes any problems due to clogging of the spray nozzles.

TREATMENT ALTERNATIVES Cost Estimate

<u>Item</u>	Alternate No. 1	Alternate No. 2
Construction Cost	\$ 69,950.00	\$243,950.00
Laboratory Equipment	1,000.00	1,000.00
Engineering & Inspection	9,500.00	12,000.00
Legal & Administrative	3,650.00	3,650.00
Interest	1,660.00	5,794.00
TOTAL	\$ 85,760.00	\$266,934.00
Operation & Maintenance	5,550.00	8,330.00
PRESENT WORTH	\$144,556.00	\$355,182.00
ANNUAL COST	13,645.00	33,525.63

9.0 PLAN SELECTION

Although numerous concerns have been expressed in the past regarding the Big Sky Recreational Area in general, no objections or concerns have ever been expressed regarding the proposed wastewater treatment and disposal method. Utilizing the golf course as a means of disposal was one of several treatment and disposal alternatives considered in the Preliminary Studies and Report 4 which was prepared during the early planning period for the recreational complex. Numerous meetings and public hearings were held regarding the Big Sky complex, at which meetings and hearings, the plan for the wastewater collection and treatment was presented. considerable review and discussions by the Big Sky planners, local county government and health authorities, State Department of Health and EPA, the plan was selected to provide secondary treatment, filtration and golf course irrigation for disposal. The environmental impact statement for this development was presented with this wastewater treatment and disposal plan. To provide a treatment and disposal system of a lesser quality than presented to the people through previous meetings and the environmental impact statement would be unfair to these people and a misrepresentation of the goals of this development. It is, therefore, recommended that Alternate 2, which includes filtration, be the selected plan for the Phase III work.

⁴Preliminary Studies and Report, "Sanitary Sewer Collection and Treatment Facilities," Big Sky of Montana, Inc., August, 1970, Morrison-Maierle, Inc.

It is recongized that the monetary costs of Alternate 2 are more than Alternate 1; however, other things which were considered in the original plan, such as reliability, environmental effects, aesthetics, public acceptability, meeting goals and objectives, etc. have contributed heavily in recommending the Alternate 2 plan. These considerations are discussed briefly below.

Environmental Effects - The filtration system of

Alternate 2 will have considerably less effect on the water

quality of the surface and ground waters of the area. This

is related to the reduced pollution load applied to the ground.

Reliability - The Alternate 2 system provides greater reliability of treatment due to the filtration capability. Plant upsets on the biological process or careless operation and maintenance could result in undesirable discharges of organics, algae, or other pollutants which can be buffered with the filtration system under Alternate 2, but not under Alternate 1.

Aesthetics and Public Acceptability - In order for the people to accept the use of wastewater in a recreation pond or on a golf course, the treated water will have to be aesthetically pleasing and be purified to a state that no harmful health effects will result if intimate contact is made with the water. The final pond, which is the last storage facility before the water is pumped to the golf course, is also used as a fish pond. This pond is located

in the immediate vicinity of the Meadow Village commercial area, and children (and probably adults too) can be expected to play in this water. Even though golf course sprinkler application is not planned while golfers are on the course, it occasionally happens or is necessary. The golfers can come under intimate contact with the wastewater, not only under this condition, but at most anytime following a sprinkling application. Alternate No. 1 treatment will not be able to provide the continual treatment and reliability that the people expect or will accept.

Meeting Goals and Objectives - Alternate 1 treatment without filtration will not meet goals and objectives set forth by the planners, RID 305 Board of Directors, or the local, state and federal health regulatory agencies.

The ranking of the two alternates for each category is as follows:

		Alternate 1	Alternate 2 (With Filtration)
1.	Environmental Effects	2	1
2.	Monetary Costs	1	2
3.	Implementation Capacity	Тò	ss-up
4.	Contribution to Objectives and Goals	2	1
5.	Energy and Resources Use	ĺ	2
6.	Aesthetics	2	1
7.	Reliability	2	1
8.	Public Acceptability	2	1
Cor	mposite Ranking	2	1

On the basis of effluent requirements, environmental effects, water quality goals and objectives, aesthetics, public acceptability and reliability, the Alternate 2 system, which includes filtration, was selected as the appropriate plan.

10.0 ENVIRONMENTAL EVALUATION

10.1 General

Rural Improvement District No. 305 has applied for State and Federal grant assistance. The grant is for construction of Phase III, an addition to the existing sewage treatment facilities. This grant will be controlled by the Environmental Protection Agency general grant regulations (40 CFR Part 30) which provides minimum guidelines for Federal grant assistance to the State and interstate agencies.

The environmental impact of the proposed alternatives will be minimal. No dislocation of businesses or individuals is foreseen nor changes in the employment outlook with the exception that a treatment plant operator will be required to oversee the operation of the facilities.

The purpose of this project is to have a complete sewage treatment facility which will provide tertiary sewage treatment improving the present system, consisting of aeration and storage to conform with the Big Sky Master Plan.

The major construction effort involves sealing of the storage pond, and installation of a pumping station and

return line from the storage pond to the treatment building. Filtration and chemical feed equipment with related pumping and piping in the treatment building will complete Phase III.

10.2 Probable Impact of the Project on both the Human and Natural Environment

a. General. The only environmental effects of the Phase III project would be those associated with spray irrigation of the treated effluent to the existing golf course. Neither alternative would effect changes in land usage.

The performance of a land application system can be measured in terms of its effects on the terrain eco-system.

The effects of land application of wastewater on the climate, soil, vegetation, ground water, and air will be descirbed in this section. Due to a higher quality of treated wastewater, Alternate 2 will have a lesser effect than Alternate 1 on the environment.

b. Climate. Evaluation of the effect of large land application systems on local climatic conditions is difficult because of the lack of observations. However, it is possible to draw certain conclusions on the basis of observations in the vicinity of large irrigation enterprises, from investigations around large evaporative cooling towers for industry, and on the basis of various theoretical considerations.

The climate changes that accompany irrigation enterprises are relatively local in extent. Air moving over an irrigated tract will rapidly pick up moisture and the air temperature will cool. Within the first few hundred feet in all but the

most arid region, the air will have essentially reached equilibrium. Once the air has left the moist area, turbulent mixing will, within just a few miles, reduce its moisture content to its original low value and return the temperature to its value upwind of the irrigated tract.

- c. <u>Soil</u>. Soil is affected by the application of wastewater, and in many cases the effects are beneficial. Soil fertility is increased by the addition of nutrients. Soil tilth is increased by the addition of organics. Wastewater will infiltrate into the soil at moderate rates. Section 7 discusses application rates and nutrient loadings with their affects on the golf course system. It is anticipated that the application of wastewater will have very little affect on the soil structure. There is a potential of changes in soil permeability and soil structure should excessive amounts of sodium be introduced to the wastewater by water softening processes. This potential is slight, however, since water softening is minimal.
 - d. <u>Vegetation</u>. The application of wastewater to crops is very beneficial because of the natural fertilizers and nutrients in the liquid. Virtually all essential plant nutrients are found in wastewater.
 - e. Ground and Surface Waters. Pollution of the ground water by wastewater applied to the land is an environmental effect that must be guarded against.
 - 1. Nutrient, Organic and Bacteriological Effects
 Section 7 discusses the effects of nutrients to the
 golf course. The potential of excessive ground water

mounding is nil. Removal of suspended solids, BOD, microbiological and bacteriological constituents is anticipated to be essentially 100 percent in the plant and soil mantle. Alternate 2 treatment and disposal system would thus have no adverse impacts on the quality or the use of ground water or surface water in this area. The effects of Alternate 1, although considered to be minimal also, have a higher potential of occurring than Alternate 2.

2. TDS Effects

The TDS concentration in the ground water is affected by the leaching of minerals from the soil. The U.S. Public Health Service has recommended maximum level for TDS of 500 mg/L in public water supplies. TDS buildups in ground water as a result of sprinkler irrigation are expected to be minimal due to application rates and quantity of ground water flow.

3. Trace Elements

Trace elements include heavy metals, such as chromium, lead or copper, and refractory organics. Heavy metals may be fixed in the soil and rendered nontoxic by bacteria. Chemical precipitates that are formed can be leached out of the soil if a heavy loading occurs or if a significant decrease in pH occurs.

Organics that are degradable are easily oxidized in the soil matrix and refractory organics are usually fixed in the soil by absorption.

The movement of bacteria and viruses with the irrigated water is not likely to cause a threat to health

f. Air. Concern for effects on the air from land application centers around the use of sprinklers. The effects of land application on air include generation of aerosols and odor. Odors are not produced by spraying but can be spread that way. Odors are generally a sign of system overloading, poor treatment, poor management, or both, provided the wastewater applied has not become septic or anaerobic. Once a wastewater becomes anaerobic it is difficult to spray, aerate, or spread it without producing some odors.

Although winds are light or calm much of the time, when present, they are from a northwesterly direction blowing away from all businesses and residences in the Meadow Village. Refer to monthly wind roses and charts compiled by James Heinbach of Montana State University on the following pages.

With proper operation, no odors should develop from either the present treatment facility or the sprinkler irrigation disposal system on the golf course. The design of the aeration facilities is adequate to maintain aerobic conditions. have been experienced from the existing facility since it was put into operation in 1973.

The chances of odors from the sprinkler disposal system on the golf course will be greater with the Alternate 1 system without filtration than with Alternate 2 which includes filtration. This is due to the fact that higher organic loadings will be applied to the final pond and sprinkler system without the filtration system.

MONTHLY RESULTANT WIND SPEEDS AT THE TWO BIG SKY WIND SITES

Month	Mountain Village		Meadow Village	
	Wind Direction In Degrees	Wind Speed(mph)	Wind Direction In Degrees	Wind Speed(mph)
Sept. ^a 1973 Oct. Nov. Dec. Jan. 1974 Feb. Mar. April May ^a	285 295 265 212 304 308 314 314 314	1.0 1.8 1.4 2.3 3.5 2.6 3.9 2.8 3.8	245 268 287 355 1 3 16 343 275	1.7 1.9 0.7 1.4 1.6 2.0 2.2 0.6 3.2

aOnly parts of months sampled.

g. Summary. The probable impact on both the human and natural environment will not have any significant consequence.

The environmental assessment of Alternates 1 and 2 are discussed in Section 9.5.

The proposed improvements will have no effect on existing land uses and will have no effect on the present water table.

The project is not controversial nor is it likely to generate controversy since it consists mainly of planned expansion of existing facilities.

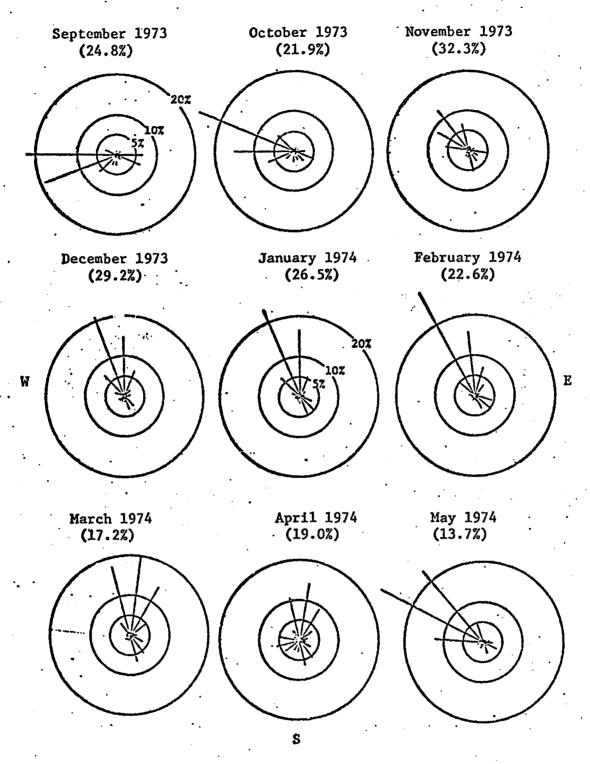


Fig. 3. Monthly Wind Roses for Meadow Village, indicating percent of time the wind blows from a given direction. Sept. 1973 through May 1974. (Numbers indicate Calm and Variable %)

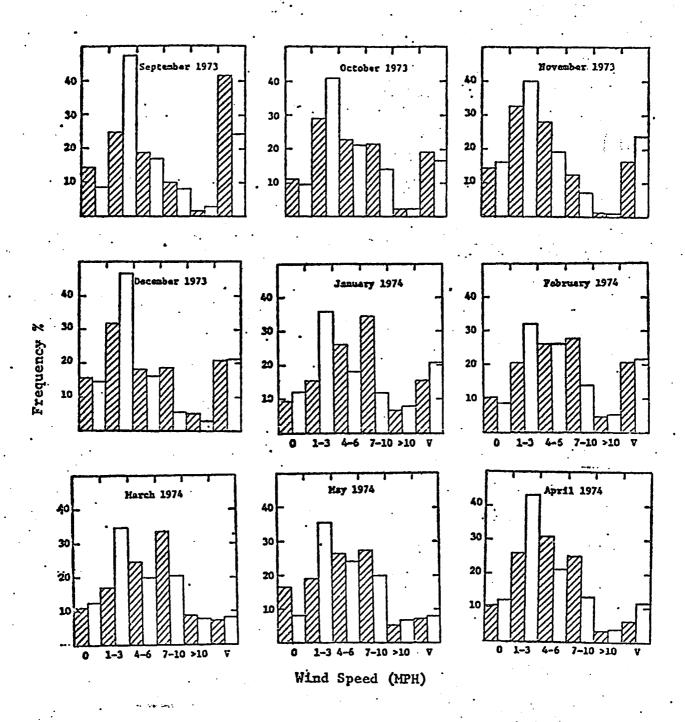


Fig. 4. Frequencies of Wind Classes (MPH) at Mountain Village and Meadow Village (V indicates Variable Winds)

10.3 Flooding

The project will not contribute to increased incidence of flooding by either reduced hydraulic capacity of the floodway or increased downstream flows. The existing treatment plant is located above the 100-year flood plain. Design and construction of the proposed pump station under Phase III improvements will be done so that these improvements will not be affected by the 100-year flood.

10.4 Historical and Archaeology Effects

Preliminary archaeological surveying in the West Fork area of the West Gallatin River yielded evidence of seven archaeological sites on the Big Sky property and two sites on property contiguous to the Big Sky holdings. All of the sites located were open seasonal campsites on glacial till or local colluvium and alluvium. None of the campsites were characterized by lengthy cultural and/or depositional histories. Sites were indicated by random surface finds or chipping debris from the manufacture of stone artifacts. No visible surface features such as burials, cairns, tipi rings or rock lines were found.

Additional surveying and testing will allow determination of the nature and extent of the cultural deposits in each of the various sites. At the present time, however, there are no funds available to continue this phase of the study, and other sources of funding are being investigated.

This work was done by Mr. Larry Lahren as included in the Preliminary Report entitled The Impact of a Large Recreational
Development upon a Semi-Private Environment: A Case Study, as
Prepared by Montana State University, April, 1971.

This project does not effect any of the historical or archaeological sites mentioned above.

10.5 Construction Effects

Constructin of the booster station and return line will cause no nuisances to residences or businesses. The existing sewage treatment facilities and trout pond lie between all construction sites and existing buildings resulting in complete isolation of all work areas. Traffic will in no way be impaired by this project.

10.6 Short Term Adverse Effects Upon the Environment

Construction estimates indicate that it will take approximately 60 to 90 days for the actual construction. In order to minimize adverse effects upon the environment, the construction specifications will require the contractor to comply with appropriate state water and air pollution requirements. Areas disturbed during construction (i.e. pump station and supply line) will be seeded to reduce dust and siltation.

10.7 Probable Adverse Effects which cannot be Avoided

The existing treatment facilities' environmental effect will not be adversely increased by this project.

10.8 Environmental Assessment of Alternatives

Alternates 1 and 2 both provide for a new pumping station with supply line for use between the storage lagoon and the filtration building and chemical feed equipment in the filtration building. The only differentiation between the two alternatives is that Alternate 2 provides for filtering equipment.

Phase III improvements will provide tertiary quality waste treatment utilizing the existing sewage treatment facilities as described in Section 6.3 through the spray irrigation process of effluent disposal.

The spray irrigation process applies treated wastewater to the land using spray nozzles for further treatment and reuse. Plant uptake is expected to be the major mechanism of nutrient removal, especially nitrogen.

Percolation tests were conducted by Northern Testing
Laboratories, Inc. in March, 1971. Those which correspond to
the area occupied by the existing 18-hole golf course are
shown below. Drawing No. 7 bound herein shows approximate
locations of these holes.

DH No.	Depth	Soil Type	Percolation Rates Minutes/Inch		
P-1	8.41	GRAVEL, Clayey	15		
P-2	4.9'	GRAVEL, Clayey	40		
P-3	1.8'	CLAY, Silty	. 60		
P-4	2.4'	CLAY, Silty	60 ·		
P-5	8.1'	GRAVEL, Sandy	30		
P-6	7.0'	GRAVEL, Sandy	30		

Field percolation tests were conducted in hand-excavated holes, using the recommended procedure in the "Manual of Septic Tank Practice," HEW, Public Health Service.

These tests have an average percolation rate of 0.57 inches per hour. The loading rate of wastewater is affected by condition of the soil, climate, and crop. The liquid loading rate will be adjusted to the crop use, soil holding capacity and the percolation rate of the soil in any areas that ponding may occur.

From the logs of the percolation holes, typically the top 6 to 12 inches is topsoil with some organic matter. The zone from 12" to the limits of the borings is predominately gravel with varying amounts of sand, silts, clays and boulders.

Several "representative" samples obtained from the field investigations were analyzed for their partical sizes and distribution as shown below.

			Moisture			
			Content	Percent Retained		
DH No.	Depth in Feet	Classification	Percent	Gravel	Sand	Silt-Clay
P-13	5.0 - 6.5	SAND, Gravelly		32	45	-23-
P-14	5.5 - 7.5	SAND, Gravelly		38	45	-17-
P-17	3.0 - 9.6	GRAVEL, Sandy-Clayey	11	43	29	-28-
P-18	0.0 - 2.8	SAND, Clayey	12	23	39	-38-
	4.0 - 6.0	GRAVEL, Sandy	9	67	20	-13-
P-19	4.0 - 6.0	GRAVEL, Sandy	11	54	27	-19-
P-20	4.5 - 10.0	GRAVEL, Sandy	13	65	21	-14-

As stated in Section 7.3.3, the treatment efficiency of crop irrigation is the highest of all types of land application.

Any environmental effects of Phase III construction and operation would result from the spray irrigation disposal of wastewater. Alternate 2 which provides filtration facilities, should correct environmental difficiencies, if any, that may result from Alternate 1. These filtration facilities would remove most of the suspended solids and algae. Use of effluent without filtration will create a higher risk of operating problems, and will result in a higher risk of possible health hazards that may be associated with physical contact of unfiltered effluent on the public golf course and in the final pond adjacent to the commercial area.

The higher degree of treatment using Alternate 2 is an environmental consideration.

10.9 Irreversible and Irretrievable Commitments of Resources

The only irreversible and irretrievable commitment of resources are those materials used in the actual construction of the project. It is doubtful that this material would need to be reclaimed for future use.

10.10 Public Involvement

"Notices of Intention to Expand and Enlarge Special Improvement District" were mailed to all of the property owners of record within the expanded district area on April 26, 1973.

The County Commissioners of Gallatin County held a public hearing on April 30, 1973, in Bozeman, Montana to hear and pass upon any and all protests that may be made to the establishment of R.I.D. No. 305.

The County Commissioners of Madison County held a public hearing on May 2, 1973 to hear public response to the establishment of R.I.D. No. 305.

The public has also been involved in the Environmental Impact Statement, dated July, 1971, prepared for the purpose of land exchange for the recreation complex.

There has been no adverse public opinion from public hearings, statements from various groups, letters, polls or elections on the wastewater treatment or disposal system.

There have been environmental controversies resulting from the total recreation project, but for the most part, have been resolved. Public opinion in the improvement district area favors waste treatment Alternate No. 2 which includes filtration prior to spray irrigation.

10.11 Problems or Objections

Rural Improvement District No. 305 has coordinated its various projects through both Gallatin and Madison County Commissions and the State Department of Health and Environmental Sciences. We know of no problems or objections raised by these agencies or any other federal, state or local bodies. There are some objections to Alternate No. 1 since the filtration equipment included in Alternate No. 2 has been the plan accepted by the public at public hearings and meetings and in the Environmental Impact Statement. A change in the proposed quality of treated wastewater applied to the final pond and golf course at this point will cause great concern.

It would make public acceptability of this disposal process much more difficult and public acceptability has the highest of priorities for this development.

"which provide for the protection and propogation of fish, shellfish, and wildlife and provides for recreation in and on the water..." The attainment of "zero discharge" is not achievable at any price. R. L. Sanks expressed it quite properly by stating, "the framers...of the law were convinced either that: (1) land disposal would be a universal panacea, or (2) tertiary treatment would remove all pollutants, or (3) zero doesn't really mean zero, but 'almost'." The proposed methods are based on sound wastewater treatment principles and are capable, if properly managed, of achieving removal of pollutants to a level consistent with existing quality parameters.

⁵Sanks, R.L.; Asano, T.; and Ferguson, H.; "Engineering Investigations for Land Disposal." <u>Proceedings of the Fourth Environmental Engineers Conference</u>. (Bozeman, Montana: Montana State University, 1973)

REFERENCES

REFERENCES

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 - 5. "Report of Preliminary Investigations of Soil Percolation Capabilities," Special Report prepared for Big Sky of Montana, Inc. by Northern Testing Laboratories, Inc. of Great Falls, Montana, March, 1971.
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 - 7. "Report of Water Supply Investigations," Special Report prepared for Big Sky of Montana, Inc. by Northern Testing Laboratories, Inc. of Great Falls, Montana, October, 1970.
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- 9. "Wastewater Treatment and Reuse by Land Application," Vol. II, EPA 600/2 73 006b, August, 1973.

APPENDIX

ABBREVIATIONS

gallons per minute gpm gallons per day gpđ gallons per capita per day gpcd million gallons MG milligrams per liter mg/L parts per million ppm milliliter ml suspended solids SS biochemical oxygen demand BOD total dissolved solids TDS cubic feet per second cfs centimeter CM lineal feet L.F.



IOHN S. ANDERSON, M.D.

Finie of Moninan

State Department of Acalile

HELENA, MONTANA

June 17, 1970

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JUN 18 1870

Morrison—Matrice

Mr. Willis Wetstein Morrison-Maierle, Inc. 910 Helena Avenue Helena, Hontana 59601

Dear Hr. Wetstein:

This is in reference to our discussion on minimum treatment requirements for the Big Sky recreational complex on the West Fork of the Gallatin

For any sewage discharged during low water, we are requesting a minimum DOD reduction of 95 percent; minimum 90 percent phosphate removal, and a coliform content of less than 1,000 per 100 ml. If a mechanical treatment plant is used, we request that a pend with a minimum size of one acre per 2,000 people be provided as final effluent treatment.

Any wastes discharged during high water should have a minimum DOD reduction of 85 percent and a coliform content of less than 1,000 per 100 The final disposal point of t'. sewage should be determined after the needed stream measurements are mad: :: the area. We recommend that stream gaging stations be established at any of the points where you are proposing to discharge sewage so flow information can be obtained before final design is made.

We feel that the above treatment will permit the development to meet the anti-degradation clause of the State's Water Quality Standards. Being the discharge point will probably be close to an interstate stream, We are sending a copy of this letter to the Federal Water Quality Administration for their comments.

Sincerely yours.

. D. G. Willems, P.E., Chief

Water Pollution Control Section . Division of Environmental Sanitation

City-County Health Department, P. O. Pox 639, Pozemen, Hontana . Pederal Water Quality Administration, Pittock Black, Room 501, Portland, Oregon



UNITED STATES DEPARTMENT OF THE INTERIOR FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

MISSOURI BASIN REGION 911 Walnut Street, Roam 702 Konsas City, Missouri 64106

July 28, 1970

Natrly actianto:
Regional Director
(E-SC)

Mr. C. W. Brinck, Secretary
Montana Water Pollution Control Council
Division of Environmental Sanitation
Montana State Department of Health
Laboratory Building
Helena, Montana 59601

Dear Mr. Brinck:

On June 17, 1970, your office mailed a copy of Mr. D. G. Willems' letter to Mr. Willis Wetstein, Morrison-Maierle, Inc., to the Regional Director, Northwest Region, Federal Water Quality Administration. The Regional Director forwarded the copy of the letter to our office for comments because the project under discussion is in the Missouri River Basin drainage.

The Big Sky development will undoubtedly induce much future development. Since actions taken now may well establish precedent, we feel that stringent waste treatment requirements are in order to protect the high quality streams both now and in the future.

The minimum biochemical oxygen demand (EOD) and phosphate removals indicated in your letter appear satisfactory providing the receiving stream flows are adequate. We suggest that you establish a limit on suspended solids as chlorination is much more effective when the suspended solids are low. We suggest a limit of 10 or 15 mg/l suspended solids in the treated waste effluent.

As the treated wastes will be discharged to relatively high quality waters, we suggest that lower coliform densities be considered. We therefore recommend that you limit the total coliform counts to 200 per 100 ml.

Additional safeguards must be considered when chlorinated wastes are discharged to low flow streams. Fish, especially trout, are extremely sensitive to chlorine and small concentrations can be lethal. Therefore, after chlorinating to reduce coliform concentrations, we recommend that some means be specified to deplete the residual chlorine before discharge to the receiving waters.

Mr. C. W. Brinck July 28, 1970 Page 2

In your letter to Mr. Wetstein you specify treatment requirements during "low water" and "high water" flows. These flows should be defined.

We appreciate having the opportunity to comment on treatment requirements in for this project while it is in the early project while it is in the early project while to the control of th

Yours very truly,

JOHN M. RADEMACHER Regional Director

Ecc: State Health Officer

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File - Big Sty Subdivisions WW



Department of Health and Environmental Sciences

John S. Anderson M.D.
pirector

RECEIVED APR 2 1975

March 28, 1975

Mr. Gus Raaum, President Big Sky of Montana, Inc. P. O. Box 1 Big Sky, Montana 59716

Re: Cascade Subdivision,
Block 1, Addition 1,
Madison County, Montana.
No. 28-75-1377 E.S. 75/78

Dear Mr. Raaum:

The plans and supplemental information relating to the water supply and sewage disposal facilities for the above-referenced subdivision have been reviewed by personnel of the Water Quality Bureau. All of the documents and data required by Section 69-5001 through 69-5009, R.C.M. 1947 have been submitted and found to be in compliance therewith.

Two copies of the certificate of subdivision plat approval are enclosed. The original is to be filed with the plat at the office of the county clerk and recorder. The duplicate is for your records.

Sincerely yours,

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

DGW: AWC: sh
Enclosures
cc: Worrison-Maierle, Inc., 910 Helena Avenue, Helena
Chris Kraft, Sanitarian, Courthouse, Dillon
Environmental Quality Council, Helena

STATE OF MOSTANA DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES CERTIFICATE OF SUBDIVISION PLAT APPROVAL (Section 69-5001 through 69-5009, R.C.M. 1947)

W/CAK

County Clerk and Recorder Madison County Virginia City, Montana

Ho. 28-75-1377 E.S. 75/78

HIS IS TO CERTIFY THAT the plans and supplemental information relating to public water supply system and public sewage disposal system for the publiciation known as Cascade Subdivision, Block 1, Addition 1, located a Madison County, Montana, have been reviewed by personnel of the Mater quality Bureau, and,

HAT the documents and data required by Section 69-5001 through 69-5009, R.C.W. 1947 and the rules of the Board of Health and Environmental Sciences made and promulgated pursuant thereto have been submitted and found to be in Empliance therewith, and,

MIAT approval of the plat of said subdivision is made with the understanding hat the following conditions shall be met:

MIAT the lot sizes as indicated on the plat to be filed with the county lork and recorder will not be further altered, and,

THAT the public water and sewer systems have been constructed around the erimeter of this area, and

That plans for the proposed water and sewage systems to serve the condominium omplexes will be reviewed and approved by the department before construction is started, and,

HAT departure from any critoria set forth in MAC 16-2.14(10)-514340 when erecting a structure and appurtenant facilities in said subdivision is grounds for injunction by the Board of Health and Environmental Eclences.

YOU ARE REQUESTED to record this certificate by attaching it to the map of plat of said subdivision filed in your office as required by law.

DATED this 28th day of March, 1975.

JOHN 6. ANDERSON, M.D., DIRECTOR

Bve

D. G. Willows, P.li., Chief

Water Quality Bureau

Environmental Sciences Division

J. Williams)





Department of Health and Environmental Sciences

John S. Anderson M.D.

November 16, 1974

RECEIVED

MORRISON - MARRIES

Mr. Willis Wetstein Morrison-Maierle, Inc. 910 Helena Avenue Helena, Montana 59601

Re: Master Plan and Design Criteria for Water and Sewer System, Mountain Village, Big Sky of Montana, Gallatin County. E.S. 73/582

Dear Mr. Wetstein:

The master plan for water and sewer facilities has been reviewed and is found to be acceptable as presented.

Detail plans for each phase of development will be necessary for review and approval before construction of that phase is started. We shall look forward to receiving the working plans when they are prepared.

Very truly yours,

A. W. Clarkson, P.E. Water Quality Bureau

Environmental Sciences Division

AWC:sh

cc: Gus Raaum, President, Big Sky of Montana, Box 1, Big Sky Mr. David Penwell, Big Sky of Montana, Box 1, Big Sky City-County Health Department, Box 639, Bozeman

west



John S Anderson M.D.

May 2,-1974

Copy to

Morrison-Maierle, Inc. 910 Helena Avenue Helena, Montana 59601

ATTENTION: Willis Wetstein, P.E.

Re: Sweetgrass Hills Water System, Big Sky, Gallatin County, Montana. Received March 29, 1974. E.S. 74/178

Gontlemen:

The above-referenced plans have been reviewed by engineers of the Water Quality Eureau and were found to be satisfactory. Approval of the plans is given herewith.

This approval is given with the understanding that construction will be started within two years of this date. If more than two years elapse before beginning construction, it shall be necessary to resubmit the plans when construction is contemplated.

Sincerely yours,

John S. Anderson, M.D.

Director

JSA: ANC: sli

cc: Mr. Bing Lancaster, Vice President in Charge of Construction,

Big Sky

City-County Health Department, Box 639, Bozeman



December 28, 1973

Willis J. Wetstein, P.E. Morrison-Maierle, Inc. 910 Holena Avenue Helena, MI 59601

> Re: E.S. 73/573. Sewer for RID #305 Guest Ranch Sewer Line, Big Sky, Montana

Dear Mr. Wetstein:

The plans and specifications for the above mentioned project have been reviewed by engineers of the Environmental Sciences Division, were found to be satisfactory, and are herewith approved.

Construction of the project should be in accordance with the plans and specifications. Any deviations from the proposed plans and specifications must have the prior approval of the State Department of Health and Environmental Sciences.

If construction of this project has not been started within two years of the date of this letter, it will be necessary to resubmit plans and specifications for review and approval before beginning construction.

Sincerely yours,

Director

JSA:NHG:v1f

cc: City-County Health Department, Box 639, Bozeman

Capet to -R.O.



November 27, 1973

John S. Anderson M.D.

Willis J. Wetstein, P.E. Morrison-Maierle, Inc. 910 Helena Avenue Helena, MT 59601

Re: E.S. 73/288. Water System for Mountain Village, Schedule 2. Big Sky, Montana

Dear Mr. Wetstein:

The plans and specifications for the above mentioned project have been reviewed by engineers of the Environmental Sciences Mivision, were found to be satisfactory, and are herewith approved.

Construction of the project should be in accordance with the plans and specifications. Any deviations from the proposed plans and specifications must have the prior approval of the State Department of Health and Environmental Sciences.

If construction of this project has not been started within two years of the date of this letter, it will be necessary to resubmit plans and specifications for review and approval before beginning construction.

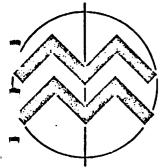
Sincerely yours,

John S. Anderson, M.D.

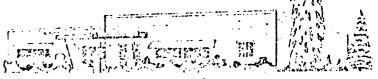
Director

JSA:WIG:v1f

cc: City-Co. Health Dept., Box 639, Bozeman



MORRISON-MAIERLE, Inc. consulting engineers



910 HELENA AVENUE / HELENA, MONTANA 59601 Telephone 406/442-3050

ireets & Bridges & Airforts & Highways & Industrial & Planning & Irrigation & Structures & Water Supply & Sewerage Works

BRANCH OFFICES:

;27 Alderson Phone 259-5546 Lillings, Montana 59102

3 East Mendenhall Phone 587-8612

czeman, Montana 59715

November 16, 1973

RECEIVED NOV 19 1973

Mr. Gary Griffith
Big Sky of Montana, Inc.
Big Sky, Montana 59716

RE: Mountain Village Booster Station

Dear Gary:

Enclosed is a copy of the pump curve and manual for the Johnston Vertical Turbine pumps furnished at the Dountain Village Booster Station. The pumps wery changed from 3500 to 1750 RPH speed, but the rated capacity and head is still the same. The change was for the better, since you will have less wear and tear on the slower speed pump.

Please let me know if we can be of further assistance.

Sincerely,

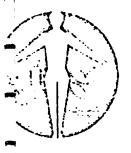
WORDA'SON-MAIERLE, INC.

Willis J. Wetstein, P.E.

WJW:el Encl.

cc: M-M, Bozeman office





September 21, 1973

Mr. Willis Wetstein Morrison-Maierle, Inc. 910 Helena Avenue Helena, Montana 59601

Sewer and Water Extension to Meadow Village, Schedule IV E.S. 73/418

Dear Mr. Wetstein:

The plans for the above mentioned project have been reviewed by engineers of the Water Quality Bureau, were found to be satisfactory, and are herewith approved.

Construction of the project should be in accordance with the plans. Any deviations from the proposed plans must have the prior approval of the State Department of Health and Environmental Sciences.

If construction of this project has not been started within two years of the date of this letter, it will be necessary to resubmit plans for review and approval before beginning construction.

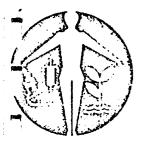
Sincerely yours,

John S. Anderson, M.B.

Diréctor

JSA:DMZ:sh

cc: City-County Health Department, Box 639, Bozeman



Department of Health and Environmental Sciences

July 26, 1973

John S. Anderson M.D

RECEIVED JUL 3 1 1973

Ronald Olmstead Morrison-Maierle, Inc. P. O. Box 1113 Bozeman, MT 59715

Re: E.S. 73/248. Sewer Improvements for Mountain Village, Schedule II, Big Sky, Montana

Dear Sir:

The plans and specifications for the above mentioned project have been reviewed by engineers of the Environmental Sciences Division, were found to be satisfactory, and are herewith approved.

Construction of the project should be in accordance with the plans and specifications. Any deviations from the proposed plans and specifications must have the prior approval of the State Department of Health and Environmental Sciences.

If construction of this project has not been started within two years of the date of this letter, it will be necessary to resubmit plans and specifications for review and approval before beginning construction.

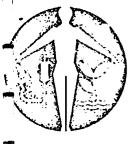
Sincerely yours,

John S. Anderson, M.D.

Director

JSA:WHG:vlf

cc: City-County Health Department, Box 639, Bozeman Morrison-Maierle, Inc., 910 Helena Ave., Helena



Department of Health and Environmental Sciences

July 5, 1973

John S. Anderson M.D.

RECEIVED JUL 1 8 1973

Ronald E. Olmstead Morrison-Maierle, Inc. 33 East Mendenhall Bozeman, MT 59715

Re: E.S. 73/252 Sewer and Water Extension for Meadow Village Collection System Schedule IV, Big Sky, Montana

Dear Sir:

The plans and specifications for the above mentioned project have been reviewed by engineers of the Environmental Sciences Division, were found to be satisfactory, and are herewith approved.

Construction of the project should be in accordance with the plans and specifications. Any deviations from the proposed plans and specifications must have the prior approval of the State Department of Health and Environmental Sciences.

If construction of this project has not been started within two years of the date of this letter, it will be necessary to resubmit plans and specifications for review and approval before beginning construction.

Sincerely yours,

John S. Anderson, M.D.

Director

JSA:WHG:vlf

cc: City-County Health Department, Box 639, Bozeman



Department of Health and Ei Vironmental Sciences

June 6, 1973

John S. Andorson M.D.

Mr. Willis Wetstein Morrison-Maierle, Inc. 910 Helena Avenue Helena, Montana 59601

Re: Plans and specifications, Mountain Village Interceptor Sewer, Schedule II, RID No. 305, Gallatin and Madison Counties.

Dear Mr. Wetstein:

We have reviewed the plans and specifications on the above project and find the proposed sewer system to generally be satisfactory. It is noted that the slope of the line between MH 144 and MH 145 is twenty percent. Sewers on twenty percent slope must be securely anchored with concrete anchors or equal spaced not over 36 feet on centers.

Montana's existing water quality standards require that reasonable measures be taken to minimize sedimentation from man's activities. Since the sewer line installation and access road is within a few feet of the Middle Fork throughout most of the project, the specifications must be more explicit on precautions to be taken to minimize sedimentation of the stream. As a minimum, we feel the following should be included:

- 1. A statement indicating that no channel changes will be allowed.
 - 2. More detailed description of equipment to be used and construction methods allowed for stream crossings.
 - 3. Information on methods to be used to rapidly stabilize cut and fill slopes and excavations to avoid erosion problems. This probably would involve establishment of some type of vegetative cover on slopes, trenches and barrow areas.
- / 4. The culvert installation section should describe the ripraps on structures needed to prevent erosion.

Enclosed for your information is a copy of our general guidelines for road construction and maintenance to prevent water pollution. Some of the items in these guidelines may be useful to you.

If you have questions on any of these comments, please contact our office.

Sincerely,

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Water Quality Bureau

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a Big Sky Con.



JOHN S. ANDERSON M.D.

*XXXXXXXXXXXX

Director

Willis J. Wetstein Morrison-Maierle, Inc. 910 Helena Ave. Helena, MT 59601

State of Montana

State Department of Health

HELENA, MONTANA 59601

January 2, 1973

EECHVED

JAN 1 1 1973

MORRISON-MAIERLE

Re: E.S. 72/469. Sewer for RSID No. 305, Mountain Village. Big Sky of Montana, Gallatin County, Montana.

Dear Sir:

The plans and specifications for the above mentioned project have been reviewed by engineers of the Environmental Sciences Division, were found to be satisfactory, and are herewith approved.

The construction of the project should be in accordance with the plans and specifications. Any deviations from the proposed plans and specifications must have the prior approval of the State Department of Health and Environmental Sciences.

If construction of this project has not been started within two years of the date of this letter, it will be necessary to resubmit plans and specifications for review and approval before beginning construction.

Sincerely yours,

John S. Anderson, M.D.

Director

JSA:WHG:vlf

cc: John S. Mest, M.D., Co. Health Off., P. O. Box 639, Bozeman



JOHN S. ANDERSON. M.D. MOROMOVINGHAREN.

Director_____

State of Montana

State Department of Health

and Environmental Sciences HELENA, MONTANA 59601

June 7, 1972

Mr. Willis J. Wetstein Morrison-Maierle, Inc. 910 Helena Avenue Helena, Montana 59601

Re: Gallatin County RSID #305.

Sewage Treatment Facilities Phase II. Filtration Building.
Received March 12, 1972
E.S. 72/200

looking to see the

Dear Mr. Wetstein:

Please excuse the delay in reviewing the filtration building plans. We have now completed our review and have the following comments, many of which were discussed with you in our office.

- 1. No piping or other connections should exist in any part of a treatment works, which, under any conditions, might cause the contamination of a potable water supply. We, therefore, recommend that adequate backflow prevention be provided on the 1 1/2 inch domestic water line.
- 2. A clear glass, gas-tight window should be installed in the exterior door or interior wall of the chlorinator room to permit viewing of the chlorinator without entering the room.
- 3. The 10-inch line connecting the aeration chamber to the fresh water supply line should be eliminated. You indicated that this line will be used annually to drain the chlorine contact tank. We recommend that this effluent be discharged to Manhole No. 57 or otherwise recycled to the aeration or storage ponds. We realize that the treatment plant has the capability of providing tertiary treatment; however, as you mentioned, the plant will not be operated to remove a majority of the phosphate in the wastewater. A discharge of this partially treated wastewater, such as annual draining of the chlorine contact tank, would not meet the minimum treatment requirements needed for a discharge to the West Gallatin River.

Mr. Wetstein Page 2 June 7; 1972

If you have any questions concerning these comments, please contact our office.

Sincerely,

Donald M. Zollman

Public Health Engineer

Water Quality Bureau

Environmental Sciences Division

DMZ:sh

cc: C. Wyman Taylor, R.S., County Sanitarian, Box 639, Bozeman



JOHN S. ANDERSON, M.D. EXECUTIVE OFFICER

State of Montana

State Department of Health

HELENA, MONTANA 59601

October 19, 1971

Mr. Willis J. Wetstein Morrison-Maierle, Inc. 910 Helena Avenue Helena, Montana 59601

Re: Big Sky of Montana, Inc.
Sanitary Sewer Collection System.
Schedule II. Received June 30,
1971. E.S. 71/188

Dear Mr. Wetstein:

The plans and specifications for the above mentioned project have been reviewed by engineers of the Division of Environmental Sanitation and are found to be satisfactory and are herewith approved.

The construction of the project should be in accordance with the plans and specifications. Any deviations from the approved plans and specifications during construction must have the prior approval of the State Department of Health. If construction of this project has not been started within two years of the date of this letter, it will be necessary to resubmit plans and specifications for review and approval before beginning construction.

Sincerely yours,

John S. Anderson, M.D. Executive Officer

JSA: DMZ: sh

cc: City-County Health Department, Box 639, Bozeman



JOHN S. ANDERSON, M.D. EXECUTIVE OFFICER

State of Montana

State Department of Health

HELENA, MONTANA 59601

October 19, 1971

Mr. Willis J. Vetstein Morrison-Naierle, Inc. 910 Helena Avenue Helena, Montana 59601

Re: Big Sky of Montana, Inc.
Gallatin County RSID No. 305.
Phase I - Sewage Treatment
Facilities. 1235-01-03.
Received August 26, 1971.
E.S. 71/290

Dear Mr. Wetstein:

The plans and specifications for the above mentioned project have been reviewed by engineers of the Division of Environmental Sanitation and are found to be satisfactory and are herewith approved.

The construction of the project should be in accordance with the plans and specifications. Any deviations from the approved plans and specifications during construction must have the prior approval of the State Department of Health. If construction of this project has not been started within two years of the date of this letter, it will be necessary to resubmit plans and specifications for review and approval before beginning construction.

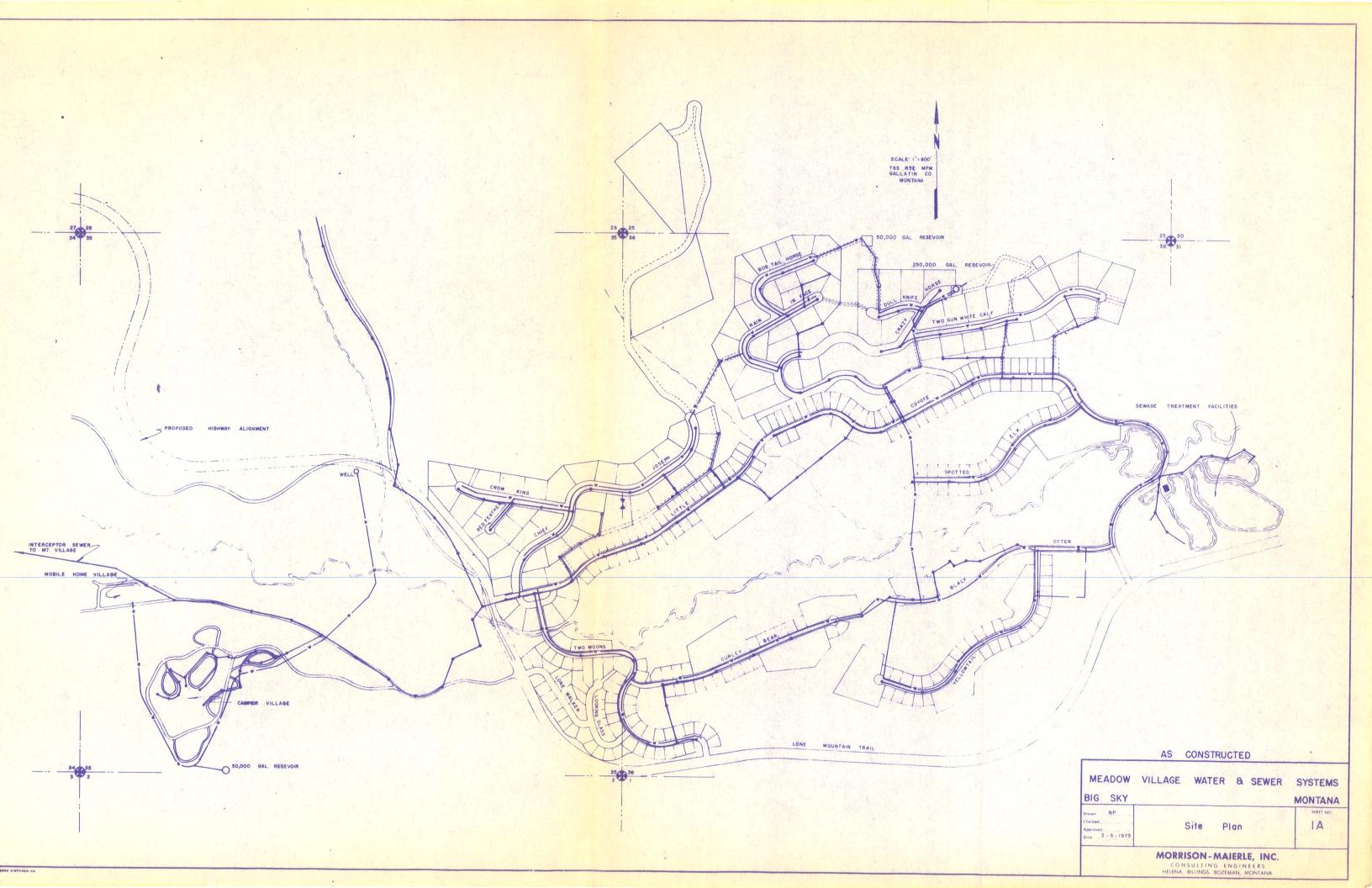
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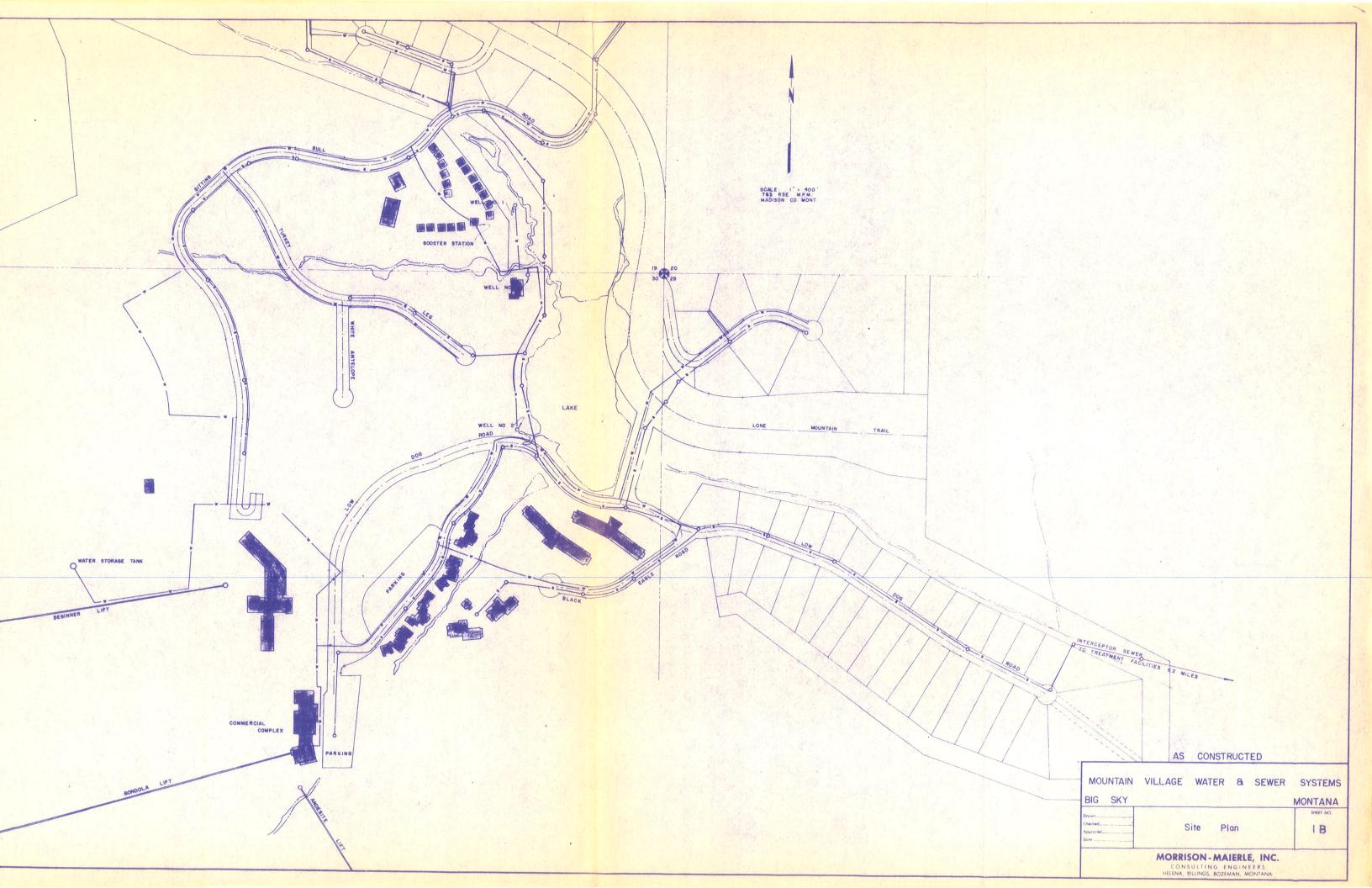
John S. Anderson, M.D.

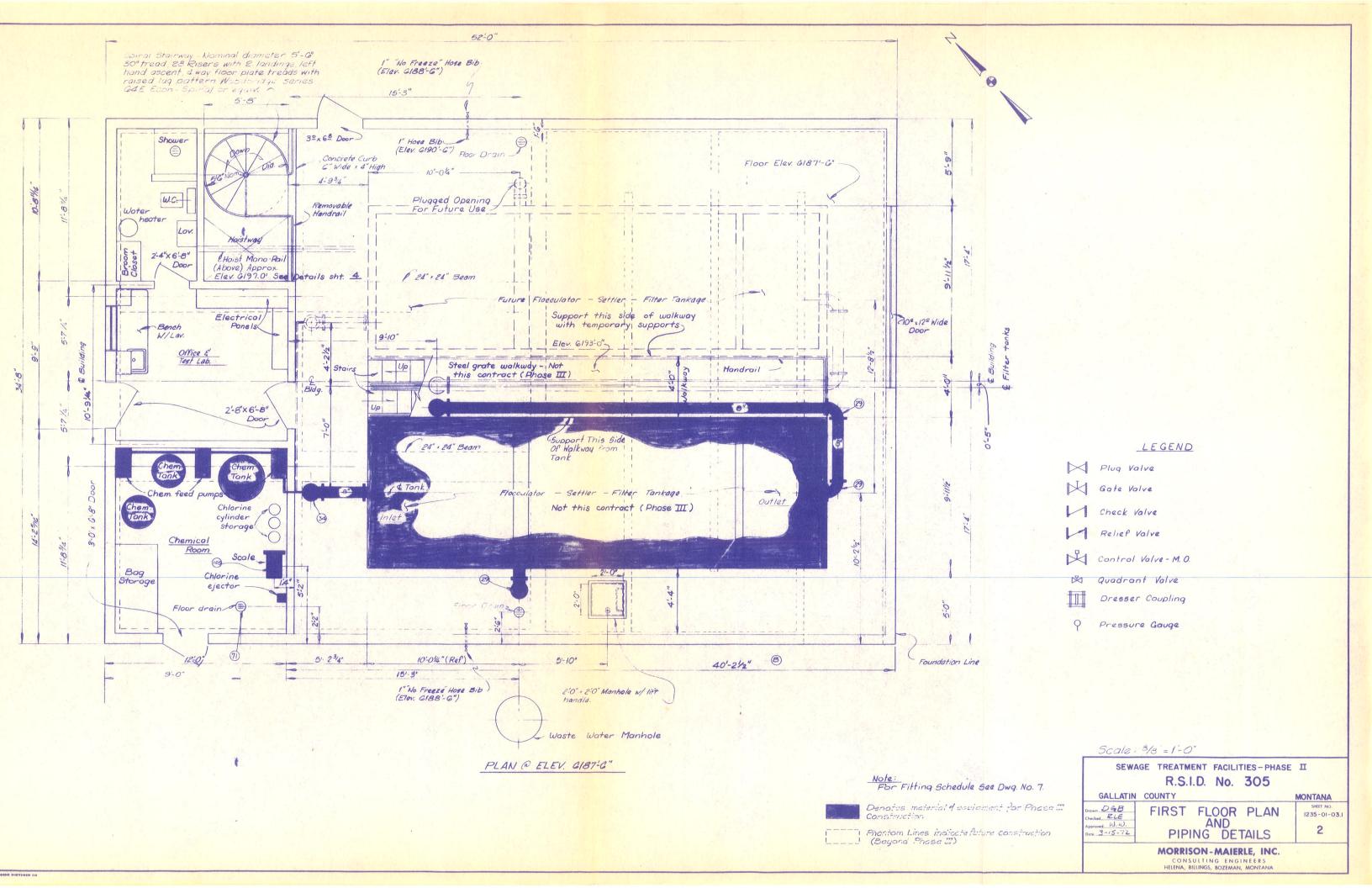
Executive Officer

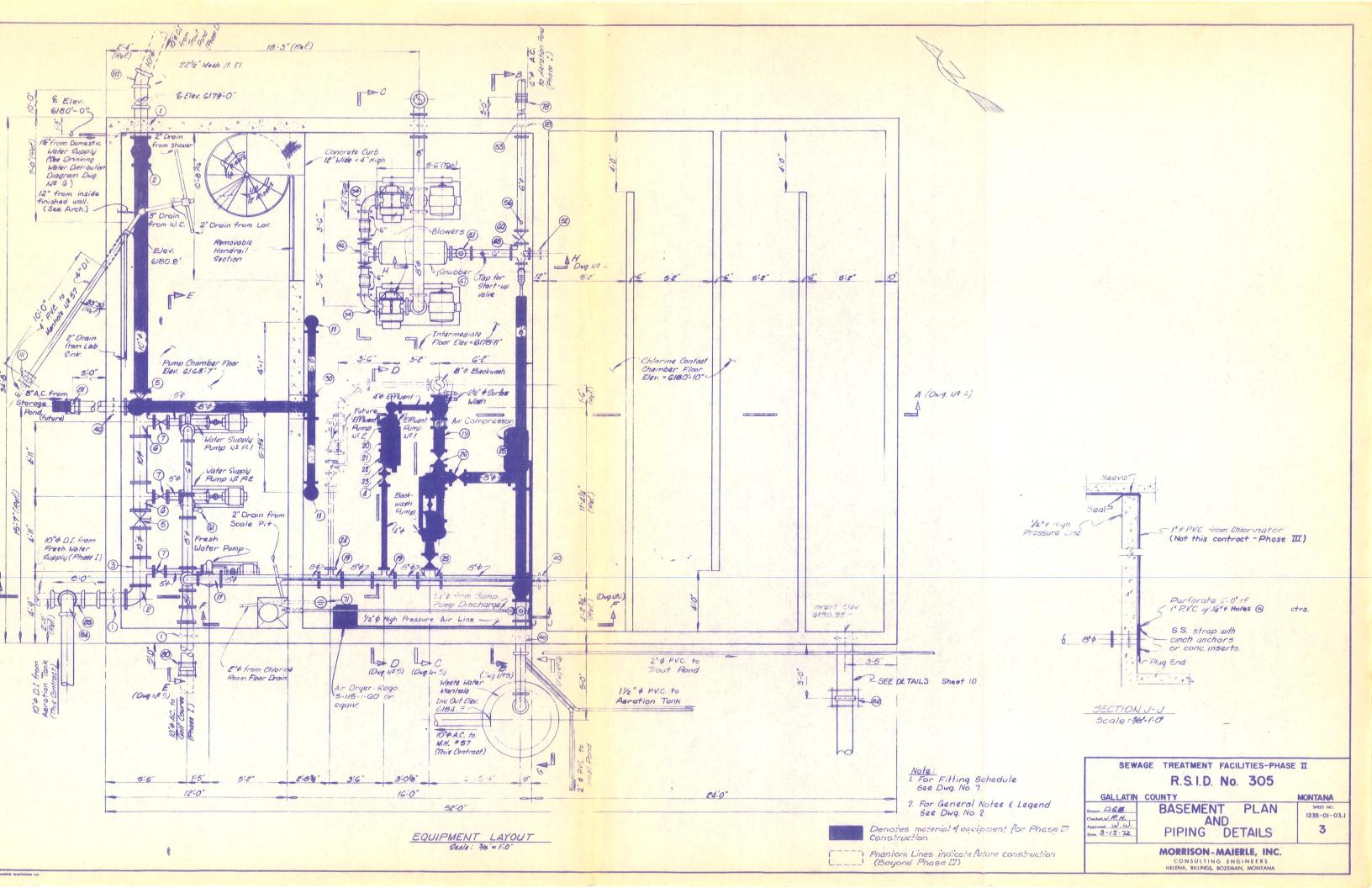
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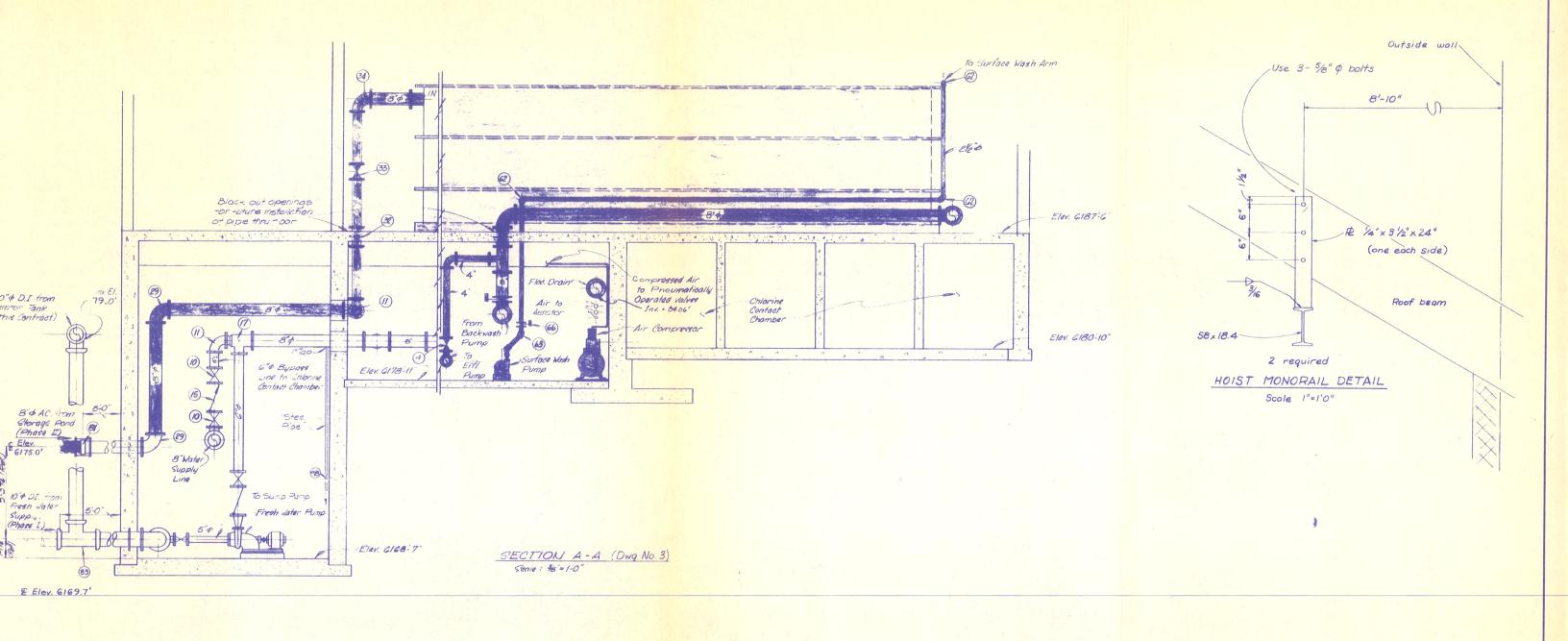
cc: City-County Health Department, Box 639, Bozeman











Note:
1. For Fitting Scheaule See Dwg. No. 7.
2 For General Notes & Legend See Dwg. No 2

Denotes material & equipment for Phase II Construction

| Phoniom Lines indicate future Construction | (Beyond Phase II)

SEWAGE TREATMENT FACILITIES - PHASE II

R.S.I.D. No. 305

GALLATIN COUNTY

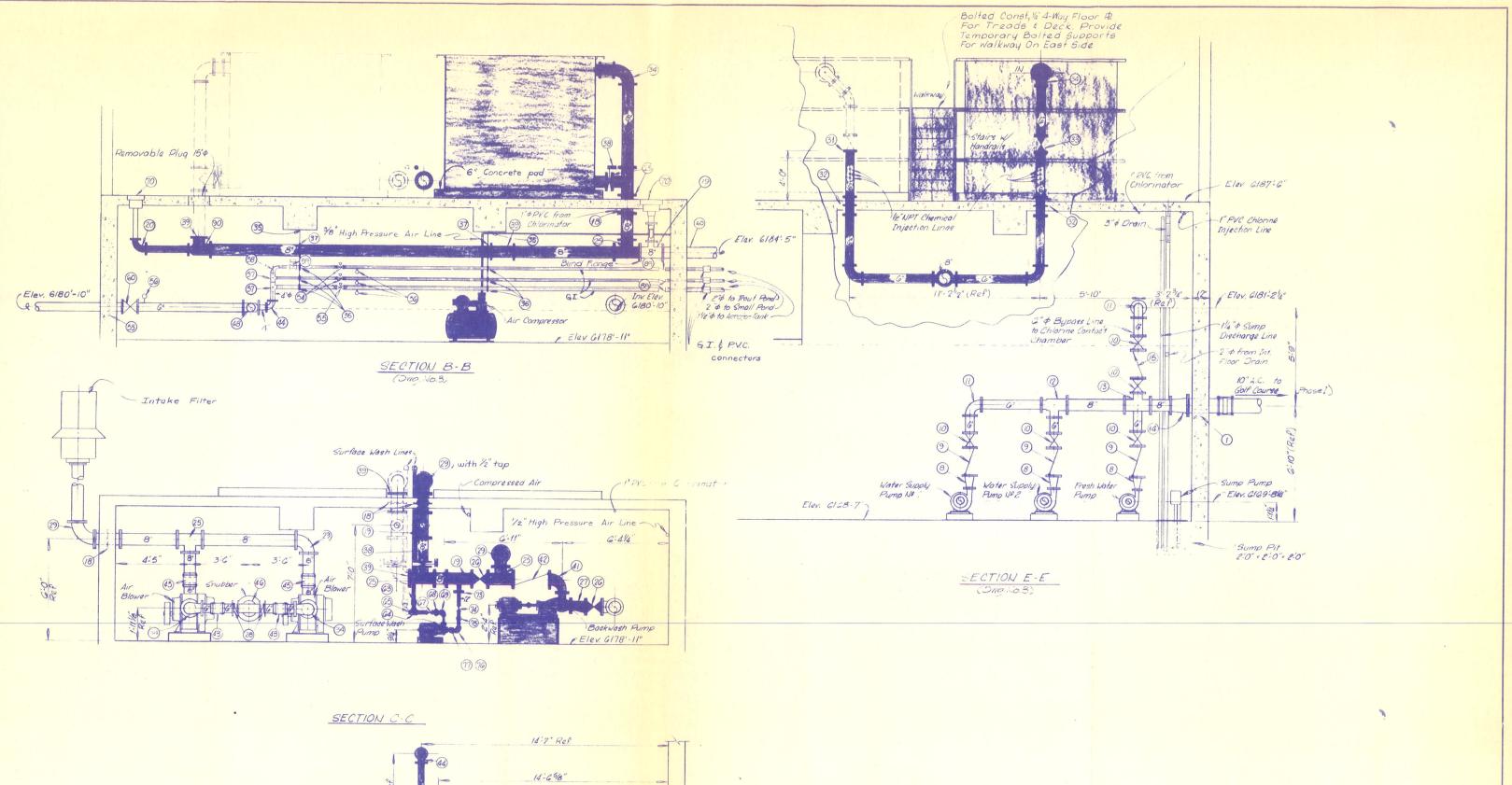
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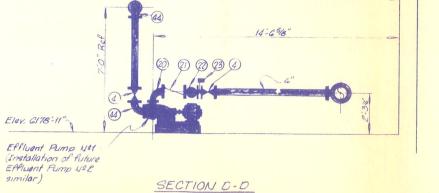
Drawn D.G.B.
Checked J.P.H.
Approved M. W.
Drown D.G.B.

PIPING DETAILS

MORRISON - MAIERLE, INC.
CONSULTING ENGINEERS
HEIRA, BILLINGS, BOZEMAN, MONTANA

NE DIETZGEN





(Drg. 1.6.3)

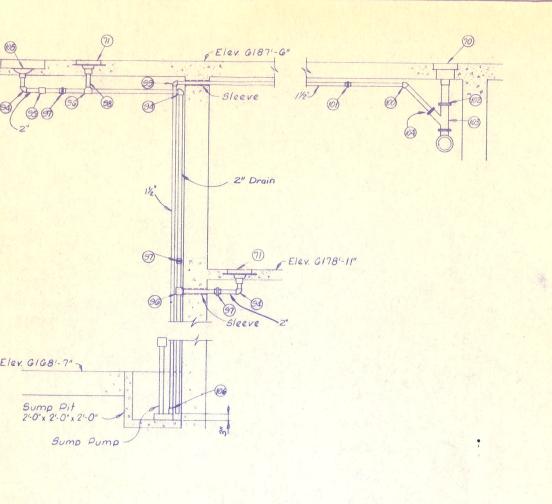
Note: 1. For Sections See Dwg No. 3 2 For Fitting Schedule See Dwg. No. 7 3. For General Notes & Legend See Dwg No.2 Denotes material & equipment for Phase II

Construction

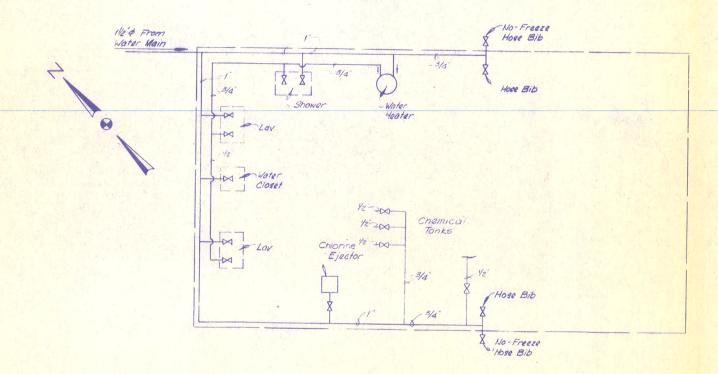
| Phantom Lines indicate future construction | (Beyond Phasa III)

Scale 3/8"=1'-0" SEWAGE TREATMENT FACILITIES-PHASE II R.S.I.D. No. 305 GALLATIN COUNTY MONTANA own DGB 1235-01-03 PIPING DETAILS pproved W.W. 5

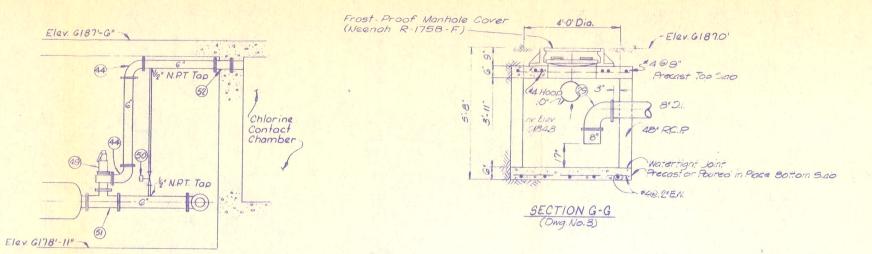
MORRISON-MAIERLE, INC.

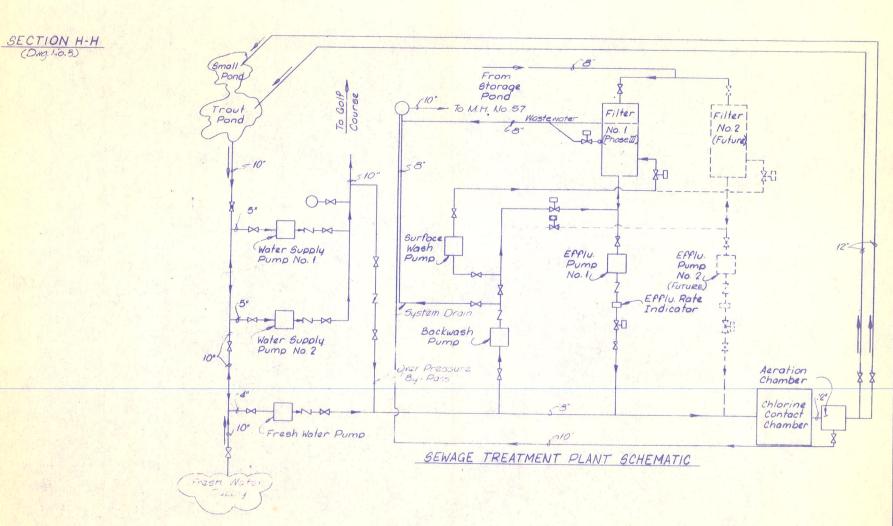


SECTION F-F (Dwg. No.3)



DOMESTIC WATER DISTRIBUTION DIAGRAM





Note: 1. For Sections See Dwg. No. 3

2. For General Notes & Legend See Dwg. No. 2

SEWAGE TREATMENT FACILITIES-PHASE II

R. S.I.D. No. 305

GALLATIN COUNTY

MONTANA

Drown D GB
Checked RLE
Approved W.W.
Doit 3-15-72

FLOW SCHEMATIC

6

MORRISON - MAIERLE, INC.

CONSULTING ENGINEERS
HELENA, BILLINGS, BOZEMAN, MONTANA

THE DIETZGEN CO

