MINUTES OF THE LONG RANGE BUILDING COMMITTEE
March 31, 1983 7:30 p.m.

ROLL CALL: MANUEL, BARDANOUVE, OCHSNER, HAFFEY, HIMSL, ETCHART, THOFT, THOMAS - Present
DONALDSON, WALDRON - Excused
Staff Present: PAM JOEHLER, LFA; PATTI SCOTT, SECRETARY

Also present were PHIL HAUCK, Administrator of the Architecture and Engineering Division, and TOM O'CONNELL, Chief of the Facility Planning Bureau.

(Tape #50-001)
CISEL HALL - EASTERN MONTANA COLLEGE

BRUCE CARPENTER, President of Eastern Montana College, provided Exhibit 1. He explained $1.19 million was appropriated in the 1981-83 biennium to remodel Cisel Hall to house their music facility. Exhibit 1 shows the history of how the money was spent. He stated the estimated bid came in at $1.815 million. In working with the Architecture and Engineering Division, it was decided to ask for an additional $624,000, rather than build an inadequate facility.

REPRESENTATIVE HAFFEY went on record as a proponent.

REPRESENTATIVE BARDANOUVE asked why they did not stay within their given appropriation. PRESIDENT CARPENTER stated the project was cut back a couple of times. The project includes 10,000 additional square feet and renovation of 16,000 square feet. Once the plans went out to bid, the funds appropriated would cover only the addition; or the new construction part. REPRESENTATIVE BARDANOUVE asked what was cut back. PRESIDENT CARPENTER stated the original request was cut back by the Board of Regents, and then again before it went out to bid. The cuts were in the size of the facility and the amount of space to be remodeled.

REPRESENTATIVE BARDANOUVE pointed out that if the cut-back still cost more than the original appropriation, then the original plans would not have even come near what was originally requested.

PHIL HAUCK stated the project was scaled down, because the appropriation was scaled down from $1.78 million to $1.19 million. MR. HAUCK stated he thought they could do the project for $1.19 million. However, after receiving the bids, and rather than cut down any further, it was decided to ask for a supplemental.

REPRESENTATIVE BARDANOUVE asked again for clarification on what was cut down. KEN HIEKENS, Administrative Vice President, Eastern Montana College, explained originally they had hoped to remodel both wings of Cisel Hall. It was concluded that only half could be remodeled. The other half was not adaptable to the music hall. Therefore, the addition was proposed. The addition was cut back after the appropriation was approved. Originally, the addition was to have 400-500 seats in the recital hall. This was cut back to 200 seats. The rehearsal hall was also cut back.

PHIL HAUCK stated the remodeling portion was cut back by 50%. MR. HIEKENS thought the new addition portion had been cut back approximately 25%.

SENATOR HIMSL asked if consideration had been given to rescaling and rebidding the project. MR. HAUCK replied yes, but there is a point you reach when it is no longer feasible to cut back.

PRESIDENT CARPENTER stated the other projects he would like to see funded are the "Remodel 1st and 3rd Floors of McMullen Hall" and "Campus Elementary School Remodel."

(Tape #50-241)
MONTANA TECH - ENGINEERING LABORATORY CLASSROOM BUILDING

PRESIDENT DeMONEY presented his agenda. (Exhibit 2) He pointed out there has been a tremendous increase in enrollment in the Engineering program. This past year, there has been an 11% increase; a 50% increase over the last biennium. He stated there is less than 50 feet per student, and 90 feet is the number used to plan with. Planning for student growth is a priority. PRESIDENT DeMONEY stated $4.3 million in pledges, cash, and gifts had been raised by the College. Of this $4.3 million, $800,000 is pledged to the new building. The total request for the building is $5.5 million, with $2.75 million from Long Range funding, and $2.75 million from private contributions. The planning thus far has cost $51,000 and has been paid by the Development Fund.

PRESIDENT DeMONEY presented Exhibit 3, which lists the private contributions.

PROPONENTS

VICE-PRESIDENT TURLEY, Academic Affairs, Montana Tech, explained the need for expansion.

JOHN GRIFFITHS, Montana Tech, reitterated the need for expansion.

(Tape #51-001)
REPRESENTATIVE QUILICI voiced his support. He stated Montana Tech has been trying to get new laboratory facilities since 1978.

REPRESENTATIVE BROWN voiced his support, and stated Representatives Pavlovich and Daily, and Senator Lynch are all in support of the new laboratory.

DR. WESTERN, Head of Physics and Geophysical Engineering, Montana Tech, testified in support.

M. STALLINGS, Assistant Manager, ASARCO (East Helena) stated ASARCO has pledged $200,900 towards this, with $80,000 already donated.

J. SMOLIK, Mine Manager, PLACER-AMEX (Golden Sunlight), testified in support.

K. BARCLAY, Business Development Manager for MULTI-TECH, testified in support.

OPPONENTS

None.

DISCUSSION (Tape #51-334)

PRESIDENT DeMONEY presented a "Fact Sheet" (Exhibit 4) and Reference Material (Exhibit 5). He stated the requested building would be 57,000 square feet, and the size has been cut down twice.

PRESIDENT DeMONEY testified that of the proposed $4.5 million in private funds to be raised, $800,000 has been, and he is sure of another $200,000, bringing the total thus far to $1 million.

SENATOR HIMSL asked if the Board of Regents ever turn down any building requests. IRVING DAYTON, Commissioner of Higher Education, stated yes. The Colleges and Universities submitted 85 projects at a cost of over $60 million. The Regents approved 30 projects at a cost of $20 million. DR. DAYTON stated that had the $1 million in private donations been offered, instead of the proposed $4.5 million, the Regents would have still approved this project, as they felt it was worth it. In other words, Montana Tech did not "buy" the project by saying they would raise half of the funding.

(Tape #51-669)
JEFF MORRISON, Chairman of the Board of Regents, stated the Regents will no longer consider partial funding of State projects, without those funds being clearly in hand.

(Tape #52-001)
EXPAND GREENHOUSE/HEADHOUSE COMPLEX-MSU

PRESIDENT TIETZ, Montana State University, presented Exhibit 6, a detailed proposal for the greenhouse.

PROPONENTS

DR. DWAYNE MILLER, MSU, stated they urgently needed the new facility. With agriculture the leading industry in Montana, the training ground for this industry is very inadequate.

DR. GARY STROBEL, explained in great detail about potato plants. This secretary admires the man for taking his work so seriously.

DR. NORM REESE, MSU explained some of the problems they have in the present facility with testing seeds. They cannot do biological testing of weeds, because there is no controlled greenhouse.

(Tape #52-614)
PRESIDENT TIETZ referred to Page 15 - Exhibit 6, which gives detail on the greenhouse construction and size.

REPRESENTATIVE WALLIN appeared as a proponent.

(Tape #53-001)
CHUCK GEREGE, Rancher in Polson, representing the Montana Nap Weed Action Committee, voiced support.

JO BRUNNER, representing Women Involved in Farm Economics (WIFE), submitted Exhibit 7 and voice her support.

SENATOR CONOVER appeared as a proponent.

REPRESENTATIVE SPAETH appeared as a proponent.

JERRY MURPHY, Montana Farmers Union appeared as a proponent.

PAT UNDERWOOD, Montana Farm Bureau Federation, appeared as a proponent. (Exhibit 8)

MONS TEIGEN, Montana Stockgrowers; Cowbelles; and Wool Growers Association, appeared in support.

DENNIS WANGER, MSU Associated Students, appeared in support. (Exhibit 9)

REPRESENTATIVE SHONTZ appeared in support.

OPPONENTS

None.

(Tape #53-145)
There was lengthy discussion about weed control.

(Tape #53-257)
PRESIDENT TIETZ asked the Committee to also consider the Linfield Hall project. There has been a private donation of $150,000 towards this project. He asked for authorization to spend the $150,000. He also asked for consideration of the Western Triangle Project at Conrad for an office and laboratory facilities.

DISCUSSION (Tape #53-303)

REPRESENTATIVE BARDANOUVE expressed concern over the large amount of requests from the University System, and the limited amount of funds to go around. He asked for guidance from the University System and the Board of Regents in setting priorities. PRESIDENT TIETZ responded that he is very sensitive to the situation. REPRESENTATIVE BARDANOUVE went on to reitterate a situation that happened earlier in the day with a reporter from one of the University newspapers. (There never was an answer to the priority question.)

The Chairman adjourned the meeting at 10:00 p.m. (Tape #53-378)

Rex Manuel

REX MANUEL, Chairman

VISITOR'S REGISTER

HOUSE Long Range Bldg COMMITTEE

BILL ______________________ DATE 3-31-83

SPONSOR ______________________

NAME	RESIDENCE	REPRESENTING	SUPPORT	OPPOSE
Gary Strobel	412 S 14th St Bozeman, MT	Montana State U	✓	
Scott Stallings	4 Aguila Court	Student	✓	
Manley Stallings	Box 672 East Helena	ASARCO Inc	✓	
Jim Smolik	Box 426 Whitehall	Place Amer[illegible]	✓	
Dwane G Miller	111 Heritage Dr, Bozeman	Montana State Univ	✓	
Norman E. Rees	1321 So Montana, Bozeman MT	USDA: ARS: RIL & Montana State University	✓	
Fred W. DeMoney	Butte, MT	Montana Tech	✓	
Roy H. Turley	Butte, MT	Montana Tech	✓	
David L. Edelman	Butte, MT	Montana Tech	✓	
Vernon Griffiths	Butte MT.	Montana Tech	✓	
J. Brunner	Helena	W.I.F.E. MABA greenhouse	✓	
Pat Underwood	Bozeman	MSU Greenhouse MT. Farm Bureau	✓	
Mons Teigen	Helena MSU Greenhouse	MT Stockgrowers, Cowbelles Woolgrowers Graz. Dist.	✓	
Gary Spaeth	Silesia HD 71	MSU Greenhouse	X	
Mary Conover	Broadwin Senate	" "	X	
Bill Tietz	Bozeman	MSU		
Bob Robinson	Helena	DNRC	✓	
Dennis Hemmer	Helena	DSL	✓	

IF YOU CARE TO WRITE COMMENTS, ASK SECRETARY FOR LONGER FORM.

WHEN TESTIFYING PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

FORM CS-33

VISITOR'S REGISTER

HOUSE Long Range Bldg COMMITTEE

BILL ______ DATE 3-31-83

SPONSOR ______

NAME	RESIDENCE	REPRESENTING	SUP-PORT	OP-POSE
Ed Ayers	Butte, Mt	Mt Tech	-	
Karen Barclay	Butte	Multitech		
Art Western	Butte	Mt Tech		
Gordon Whirry	Great Falls	Davidson & Kuhr Architects		
W.H. Kuhr	Great Falls	" " "		
Greg Sheridan	Butte, MT	MT. Tech		
Chuck Jarecki	Polson, MT.	MT. Knapweed Action Committee		
A.A. van Teylingen	Bozeman, Mt.	Mont. State Univ		
Bill Lannan	Helena	Mont Univ System		-
Bruce H Carpenter	Billings	EMC		
Ken Heikes	—	EMC		
Dave Brown	Butte Rep	Mt. Tech Bldg	✓	
Fritz Daily	Butte Rep	Mt. Tech Bldg	✓	
Bob Pavlovich	Butte Rep	Mt Tech Bldg	✓	
J. D. Lynch	Butte Senator	Mt Tech Bldg	✓	
Tom Staples	Helena	Mt Tech Bldg	✓	
Joe Quilici	Butte	Mt Tech Bldg	✓	
Clay Anderson	Dillon	West Mont College		
Dan High	Dillon	" " "		
Jim Jansen	Dillon	" " "		

IF YOU CARE TO WRITE COMMENTS, ASK SECRETARY FOR LONGER FORM.

WHEN TESTIFYING PLEASE LEAVE PREPARED STATEMENT WITH SECRETARY.

FORM CS-33

Exhibit 1
3-31-83
3-31-83

EASTERN
MONTANA COLLEGE

CISEL HALL

1983-85 Capital Construction Program

Pages 148-49

Supplemental Request to 1981 appropriation needed to have adequate funds to bid project:

1)	Requested of Board of Regents - 1980	$1,780,000
2)	Regents approved for submission to Executive	1,780,000
3)	Included in Executive Request 1981-83	1,190,000
4)	Total pared back project cost as bid June 30, 1982 (includes construction, A/E fees, and State fees)	1,717,022
5)	Total estimated bid, May 1983 (total project as above with contingency and inflation)	1,815,000
6)	Funds available - 1981-83 appropriaton	(1,190,000)
7)	Supplemental funds needed	$ 625,000*

*Highest priority by Board of Regents, August 1982, after roof, maintentance and repair projects - (page 230 of 1983-85 of 1983-85 Capital Construction Program)

KWH
3/83

Exhibit 2
3-31-83
3-31-83

LONG RANGE BUILDING PROGRAM COMMITTEE

MONTANA TECH'S HEARING, MARCH 31, 1983, 7:30 P.M.

AGENDA

I. REGENTS' APPROVED PROJECTS: President DeMoney

II. GOVERNOR'S RECOMMENDED PROJECT - Pages 7, 155-157

ENGINEERING LABORATORY CLASSROOM BUILDING

A. INTRODUCTION AND OVERVIEW: President DeMoney

B. NEED:

1. Vice President for Academic Affairs Turley
2. ~~Dr. Twidwell~~, Head, Metallurgy & Mineral Processing Engineering
3. John Griffith ~~Dr. Western~~, Head, Physics & Geophysical Engineering

C. BENEFITS - INDUSTRIAL WITNESSES:

1. ASARCO (E. Helena) — M. Stallings, Assistant Manager
2. PLACER-AMEX (Golden Sunlight) — J. Smolik, Mine Manager
3. MULTI-TECH — K. Barclay, Business Development Manager

D. SOLUTION: President DeMoney

III. DISCUSSION

Exhibit 3
3-31-83

12/31/82

MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY

CHALLENGE PLAN CONTRIBUTIONS

1.	Raymond Thompson (1 million shares of TMT Stock) For: Grant for various goals in the CHALLENGE PLAN. (Buildings, Equipment, Endowment)	Yet to be Determined
2.	Anaconda Minerals Company For: Married Student Housing/Portion of Income for Professorship in Mining Engineering.	$1,100,000
3.	Zach Brinkerhoff, Jr. For: The Zach Brinkerhoff, Jr. Endowed Chair in Petroleum Engineering.	600,000
4.	Newmont Mining Corporation For: The Newmont Laboratory of Extractive Metallurgy in the new Metallurgy-Mineral Processing Engineering Building.	500,000
5.	Helen Davis Estate For: Scholarship Support.	Yet to be Determined
6.	Hubert Lillis For: A Non-denominational Chapel.	Yet to be Determined
7.	Union Pacific Foundation For: Union Pacific Foundation/Champlin Petroleum Professorship in Petroleum Engineering.	250,000
8.	ASARCO For: Portion of the new Metallurgy-Mineral Processing Engineering Building.	200,000
9.	Gary Energy Corporation For: The Gary Energy Professorship in Petroleum Engineering.	125,000
10.	Montana Power Company For: Property and residences located southwest of campus for unrestricted use by the Foundation.	112,000
11.	Anaconda Minerals Company For: Anaconda Mineral Company Professorships in Geological and Mineral Processing Engineering.	100,000
12.	Exxon Education Foundation For: Salary Supplements for junior faculty in Mining Engineering.	100,000
13.	Anonymous Donor For: Student Loan Fund	100,000

14. AMAX Foundation — 80,000
For: AMAX Foundation Professorship in Mineral Economics.

15. Lee C. McFarland — 76,000
For: Lee C. and Ruth S. McFarland Endowed Fund in support of the Petroleum Engineering Department.

16. MAPCO Incorporated — 75,000
For: The MAPCO Professorship in Petroleum Engineering.

17. Howard R. Lowe — 63,410
For: The Howard R. Lowe Endowed Fund in support of Petroleum Engineering.

18. ARCO Foundation — 50,000
For: The Anaconda Professorship in Mining Engineering.

19. Burlington Northern Incorporated — 30,000
For: Portion of the new Metallurgy-Mineral Processing Engineering Building.

20. Shell Foundation — 26,750
For: Gas Chromatograph Equipment for Petroleum Engineering (8,000); Scholarships and Faculty Improvement in Environmental, Mining and Petroleum Engineering (18,750).

21. AMOCO — 25,000
For: Laboratory Equipment in Petroleum Engineering.

22. Ingersoll-Rand Company — 25,000
For: Partner for a Named Professorship in Mining Eng.

23. Utah International — 25,000
For: Partner for a Named Professorship in Mining Eng.

24. Kaiser Aluminum and Chemical Corporation — 25,000
For: A Scholarship Program in Metallurgy-Mineral Processing Engineering.

25. Harry Brinck Memorial Endowment — Yet to be Determined
For: Scholarship Support.

26. Anonymous Donor — 20,000
For: Portion of the new Metallurgy-Mineral Processing Engineering Building.

27. George A. Cloudy — 16,144
For: The George A. Cloudy Endowed Scholarship Fund.

28. Bechtel Civil & Minerals Incorporated — 15,000
For: Portion of the new Metallurgy-Mineral Processing Engineering Building.

29.	Callahan Mining Corporation For: Mineral Separation Laboratory in the new Metallurgy-Mineral Processing Engineering Building.	15,000
30.	Hess Foundation For: Scholarships and equipment for Petroleum Eng.	15,000
31.	Halliburton Education Foundation For: Engineering Faculty Support.	15,000
32.	Energy Reserves Group For: Equipment and Unrestricted uses for Petroleum Eng.	15,000
33.	CHALLENGE PLAN Cabinet Members For: CHALLENGE PLAN Cabinet Scholarship Endowment.	12,000
34.	Florence Jane Norman Estate For: Florence Jane Norman Endowed Memorial Scholarship.	10,000
35.	Gulf Oil Foundation For: Departmental assistance grant in Petroleum Eng.	10,000
36.	Haynes Foundation For: Scholarship Support.	8,000
37.	Alan F. Griffith Memorial Endowment For: Scholarship Support.	6,982
38.	Fluor Mining and Metals Incorporated For: An Unrestricted grant.	6,000
39.	Walter Todd Scott Memorial Endowment For: Scholarship Support.	5,263
40.	Bill Alberts Memorial Endowment For: Scholarship Support.	5,172
41.	Chevron For: Donation for Petroleum Dept.	5,000
42.	Joy Manufacturing For: An Unrestricted grant to Engineering Science Dept.	5,000
43.	George A. McCracken For: The George A. McCracken Endowed Scholarship Fund.	5,000
44.	Consolidation Coal Company For: Consolidation Coal Professorship in Mining Engineering.	5,000
45.	James Foreman and AMAX Foundation For: An Unrestricted grant.	3,000
46.	Keith Dyas and Gulf Resources & Chemical Corporation For: An Unrestricted grant.	2,000

47.	Kaiser Engineers For: An Unrestricted grant.	2,000
48.	Anonymous Donor For: Portion of the new Metallurgy-Mineral Processing Engineering Building.	2,000
49.	Coeur d'Alene Mines For: An Unrestricted grant.	1,600
50.	Metallurgy-Mineral Processing Engineering Graduates For: Portion of the new Metallurgy-Mineral Processing Engineering Building.	1,550
51.	J.E. Corette For: An Unrestricted grant.	1,006
52.	Ralph Smith For: An Unrestricted grant.	1,000
53.	Tamrock, Incorporated For: Portion of new Metallurgy-Mineral Processing Engineering Building.	1,000
54.	Westmoreland Resources For: An Unrestricted grant.	1,000
55.	Wayne Lenton and AMAX Foundation For: An Unrestricted grant.	300
56.	Jan Dreyer and Johan deBeer For: An Unrestricted grant.	200
57.	Energy Fuels Corporation For: An Unrestricted grant.	250
	TOTAL	$3,899,627

12/31/82

GIFTS-IN-KIND

CHALLENGE PLAN CONTRIBUTIONS

Anaconda Minerals Company (Geological Eng. X-Ray Diffraction Equipment)	$108,500
Anaconda Minerals Company (Environmental Eng. Equipment)	93,705
Anaconda Minerals Company (Complete Computer System)	50,000
Anonymous Donor (EDAX-EXAM Six Energy Dispersive X-ray Analysis System & Automatic Sample Press)	50,000
Anaconda Minerals Company (Mining Eng. Equipment)	44,000
Ingersoll-Rand Company (Portable 600 cfm Compressor)	40,000
Marathon Oil Company (Honeywell Computer)	28,000
Imco (30 T1-58 Calculators & Drilmod/Bossmod Chips)	14,250
Kaiser Aluminum & Chemical Corporation (5 Krouse Wire Fatigue Testing Machines)	10,000
Anaconda Minerals Company (Numonics Digitizer)	8,900
Twin Disc Incorporated (Misc. Equipment)	5,000
Micro Motion (Flow Meter)	4,000
Herbert A.J. Wendel (Collection of Semi & Precious Stones)	3,025
Easton Corporation (Model 46 Variable Pump)	2,623
Dresser Industries (Magcobar drilling manuals)	2,550
Western Company North America (100 engineer handbooks)	2,550
Dresser Industries, Inc. (80 Drilling Mud Manuals)	2,400
Energy Reserves Group (Core Samples)	2,400
Anaconda Minerals Company (2 Computer terminals, Mining Engineering)	2,000
Magcobar Div. of Dresser Industries (Drilling Mud Manuals)	1,800
Western Co. of North America (Tech. Publications)	1,800
Exxon Minerals Company (Portable Alpha Scaler & Scintillation Tube)	1,500

Schlumberger Well Services (Log Analysis Material)	1,500
AMC Corporation (6 cyl. Engine)	1,000
Ford Motor Company (1.3 liter Ford Engine)	1,000
General Motors Corporation (Cadillac 6 liter 8 cyl. Engine)	1,000
Holter Research Foundation, Inc. (Scale Model Nuclear Fusion Device)	1,000
Lufkin (Operator's Manuals on CU80 Pumping Units)	1,000
Montana Power Company (Electric Power Research Institute Library)	1,000
Schlumberger Well Services (Interpretation Manuals)	1,000
Western Company of North America (100 Engineers Handbooks)	1,000
N.L. Baroid Company (Mud Materials)	800
TOTCO Drilling Instrumentation (100 copies 26-26A pub.)	250
Kaiser Aluminumm & Chemical Corporation (Controller, Recorders, etc.)	Undetermined
TOTAL	$489,553

Exhibit 4
3-31-83

FACT SHEET
MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY

NEW ENGINEERING LABORATORY/CLASSROOM BUILDING

HISTORY

• Brakeley, John Price Jones, Inc.	
Planning Study for the Capital Campaign "CHALLENGE PLAN"	August 1978
Feasibility Study	March 1979
• Montana College of Mineral Science and Technology Self-Study	
"A Plan of Action, 1980-85"	September 1980
• Montana Legislative Authorization	
46th Legislature House Bill 144	1979
• "CHALLENGE PLAN" Commences	January 1981
• Board of Regents Approval of Preliminary Planning	
Item #32-503-R0781	July 1981
• Campus Planning and Review of the New Engineering Laboratory/	
Classroom Building	September 1981
• Appointment of Davidson and Kuhr Architects PC	January 1982
Architectural Program and Site Selection	
Initial Study Period	February 1982

Data Gathered from Similar Structures by Architectural Teams & Faculty Members:

University of British Columbia	2/82
Colorado School of Mines	3/82
University of Colorado	9/82

SOURCE OF DOLLARS

• Board of Regents Approve State Support ($2.75 million with $2.75 million from Private Sources)	July 1982
• Board of Regents Authorize Increase of Building Support From $2.75 to $4.5 million State Sources/$1 million Private Sources. (Currently the Montana Tech Foundation has expended $51,765 from Private Sources for planning expenses.)	March 1983

NEED

- Metallurgy Building Built in 1925; College Enrollment: 182
- Physics-Petroleum Building Opened in 1955; College Enrollment: 316
- Engineering Enrollment Growth: Full-time and Part-time 1973 - 309 to 1982 - 1166. Almost a Fourfold Increase.
- Current Laboratory Space: Crowded, Poorly ventilated, etc.

WHO WILL OCCUPY BUILDING?

- Needed Programs for Montana's Economic Growth: Metallurgy - Mineral Processing - Geophysical Engineering - Physics.

BUDGET ANALYSIS

• Building Construction 57,800 sq. ft.		$3,916,000
• Site Development		310,000
• Fixed Equipment		482,000
TOTAL CONSTRUCTION COST ESTIMATE	SUB-TOTAL	$4,708,000
• Movable Equipment		144,000
• Professional Fees		412,670
• Contingencies @ 4% of Total Construction Costs		188,330
• Administration and Testing @ 1% of Total Construction Costs		47,000
TOTAL PROJECT COST		$5,500,000

3/83 - Prepared by Montana Tech Development Office

Exhibit 5
3-31-83

LEGISLATIVE ASSEMBLY

48TH SESSION

LONG RANGE BUILDING PROGRAM COMMITTEE

MONTANA TECH'S HEARING

REFERENCE:
CAPITAL CONSTRUCTION PROGRAM 1983-85
Pages 7, 155-157

THURSDAY, MARCH 31, 1983 7:30 p.m.
Room 108, Capitol Building

Prepared by Montana Tech Administration
Fred W. DeMoney, President
March 1, 1983

LONG RANGE BUILDING PROGRAM COMMITTEE

NAME	PARTY	HOME TOWN	DISTRICT
Rep. Rex Manuel, Chairman	(D)	Fairfield	11
Rep. Steve Waldron	(D)	Missoula	97
Rep. Francis Bardanouve	(D)	Harlem	6
Rep. Gene Donaldson	(R)	Helena	29
Rep. Bob Thoft	(R)	Stevensville	92
Sen. Matt Himsl	(R)	Kalispell	9
Sen. Mark Etchart	(R)	Glasgow	2
Sen. Jack Haffey	(D)	Anaconda	45
Sen. Bill Thomas	(D)	Great Falls	20
Sen. Donald Ochsner	(R)	Miles City	26

FWD/pl

3/1/83

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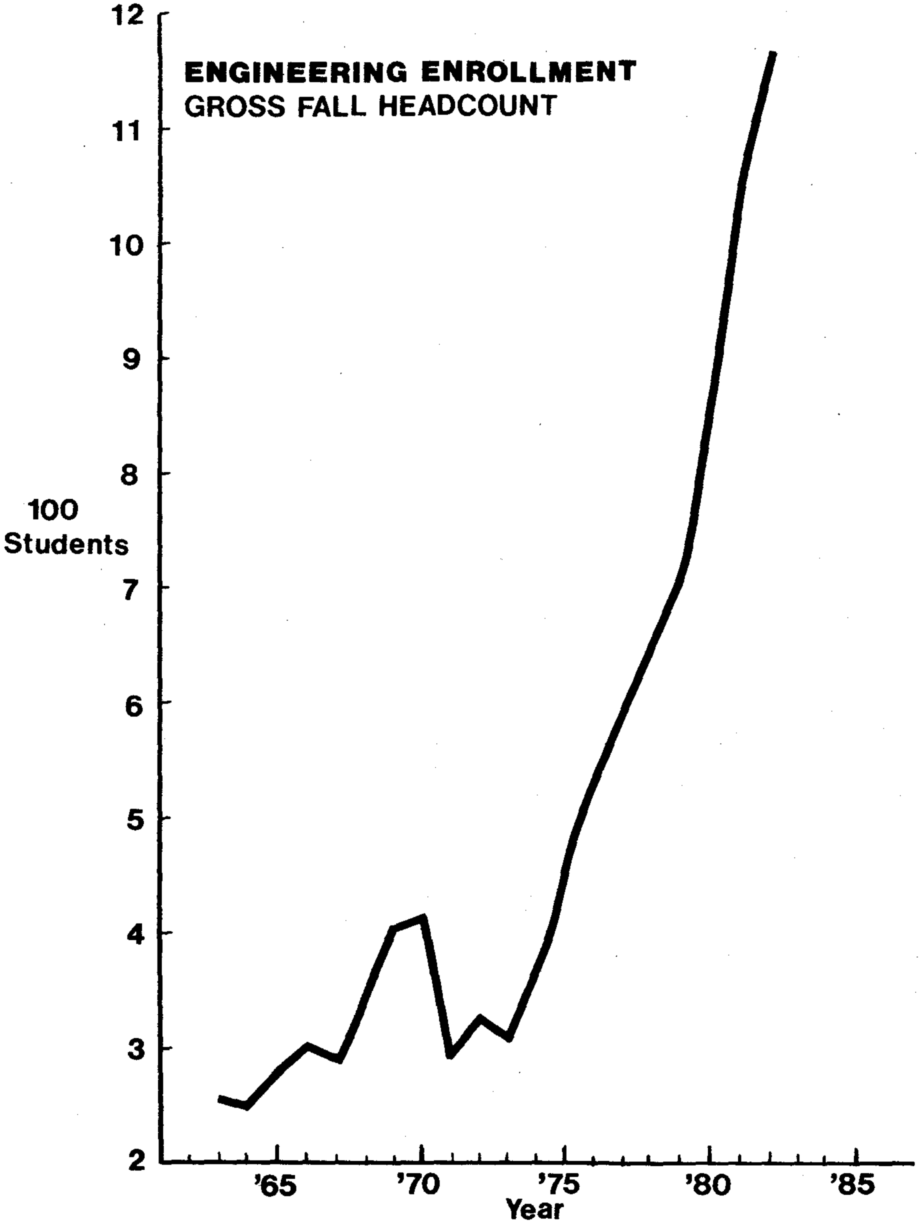
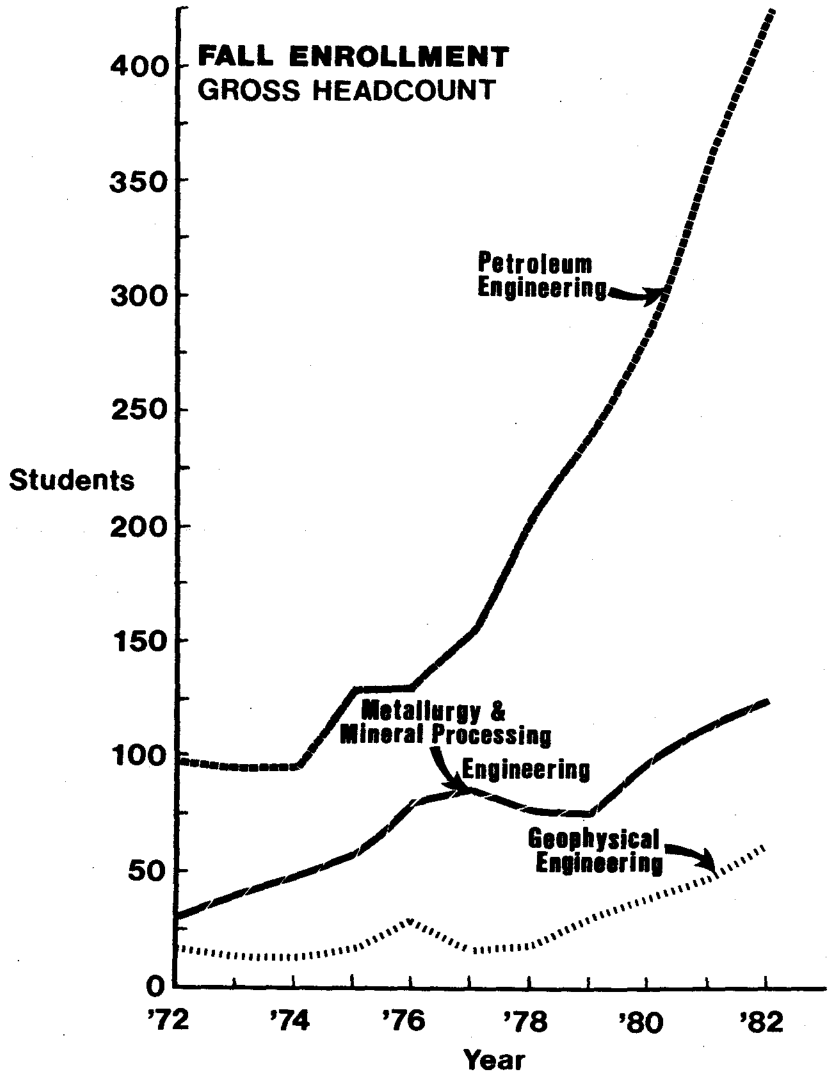


MONTANA TECH IS EDUCATING ENGINEERS
FOR TOMORROW'S INDUSTRIAL GROWTH

In just the past six years, engineering enrollment has increased more than three and half times.



MONTANA STUDENTS AT TECH WANT
ENGINEERING CAREER EDUCATION

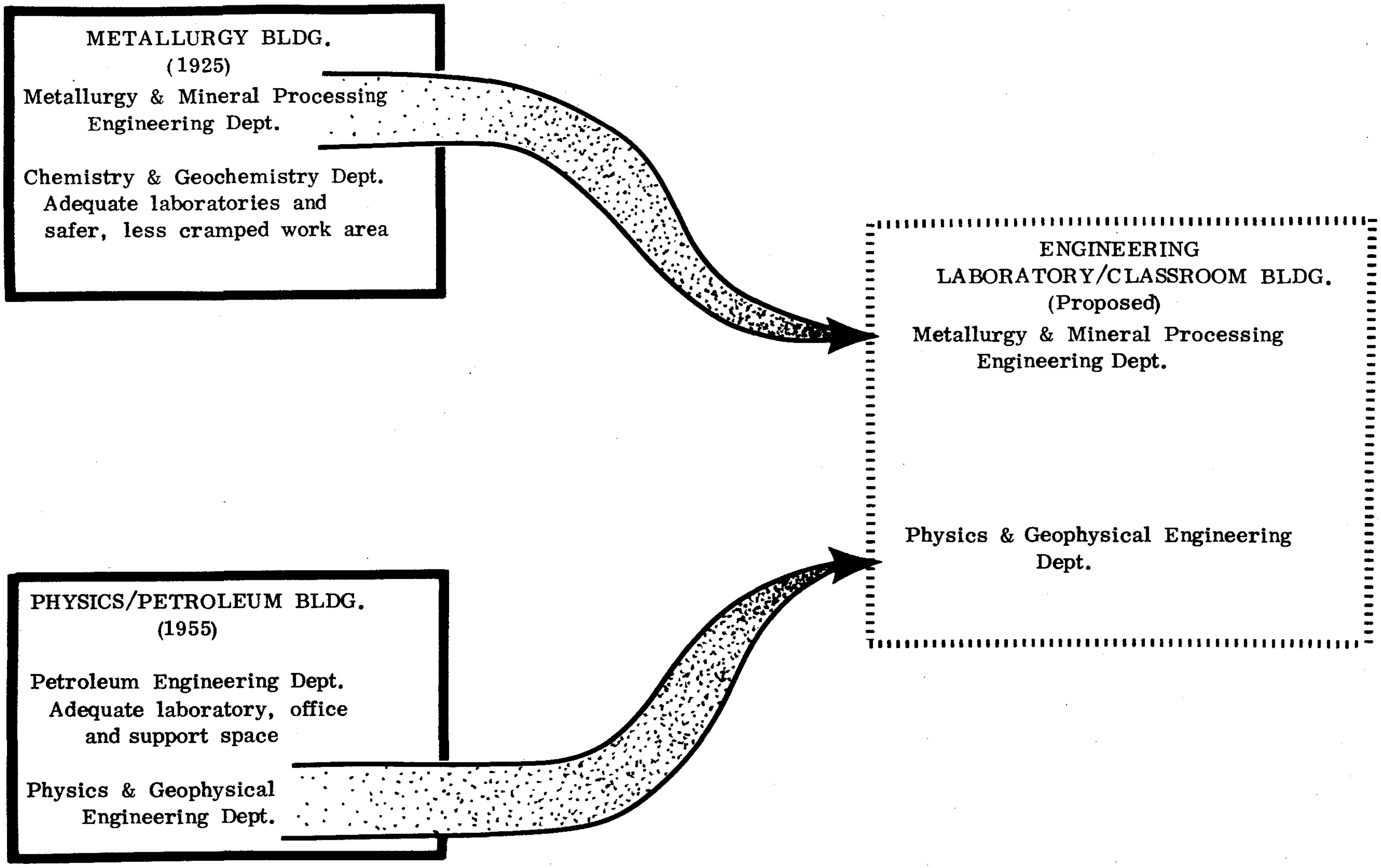
Enrollment growth in these departments has underscored need for more space and modern laboratories and classrooms.

3/11/83

Figure 1

Figure 2

STUDENTS WAIT TO TAKE TURNS IN CROWDED MINERAL PROCESSING ENGINEERING LABORATORY



PROPOSED ENGINEERING LABORATORY/CLASSROOM BUILDING WILL BENEFIT STUDENTS IN FOUR MAJOR INSTRUCTIONAL DEPARTMENTS AT MONTANA TECH

When the Metallurgy &Mineral Processing Engineering Department and the Physics & Geophysical Engineering Department move to the proposed building, they will vacate space needed by the Petroleum Engineering Department and the Chemistry Department.

Figure 3

3/11/83

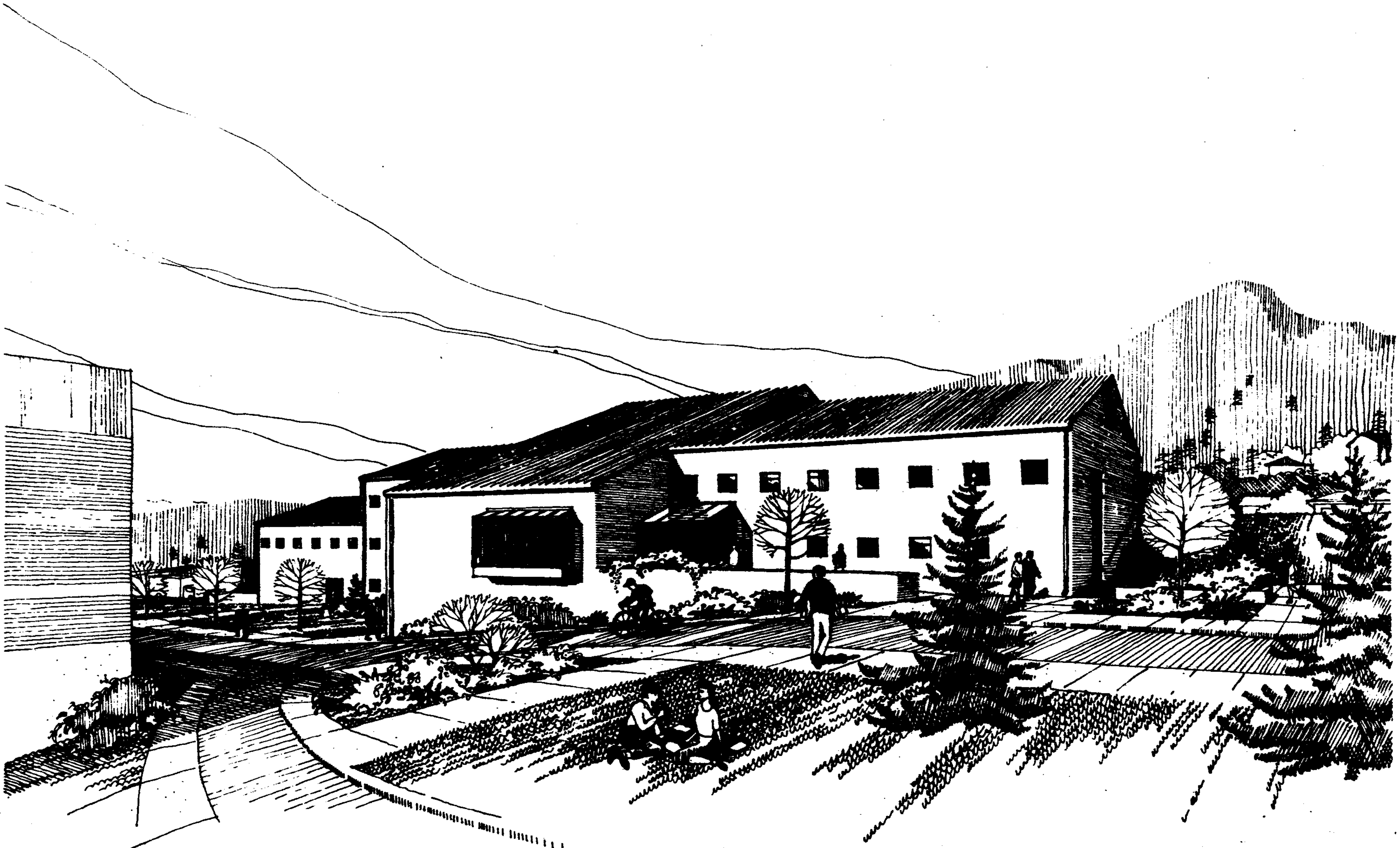


Figure 4

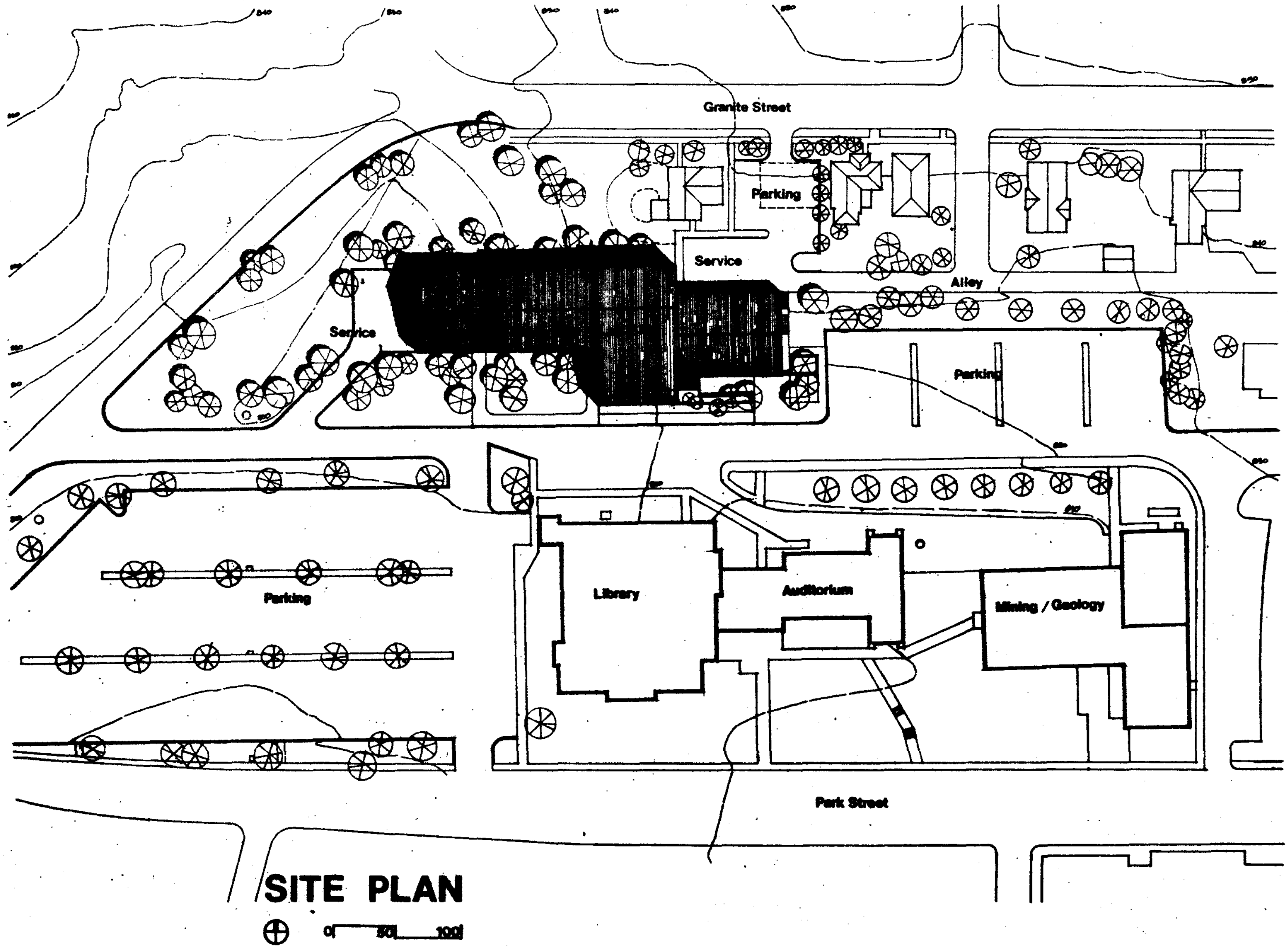
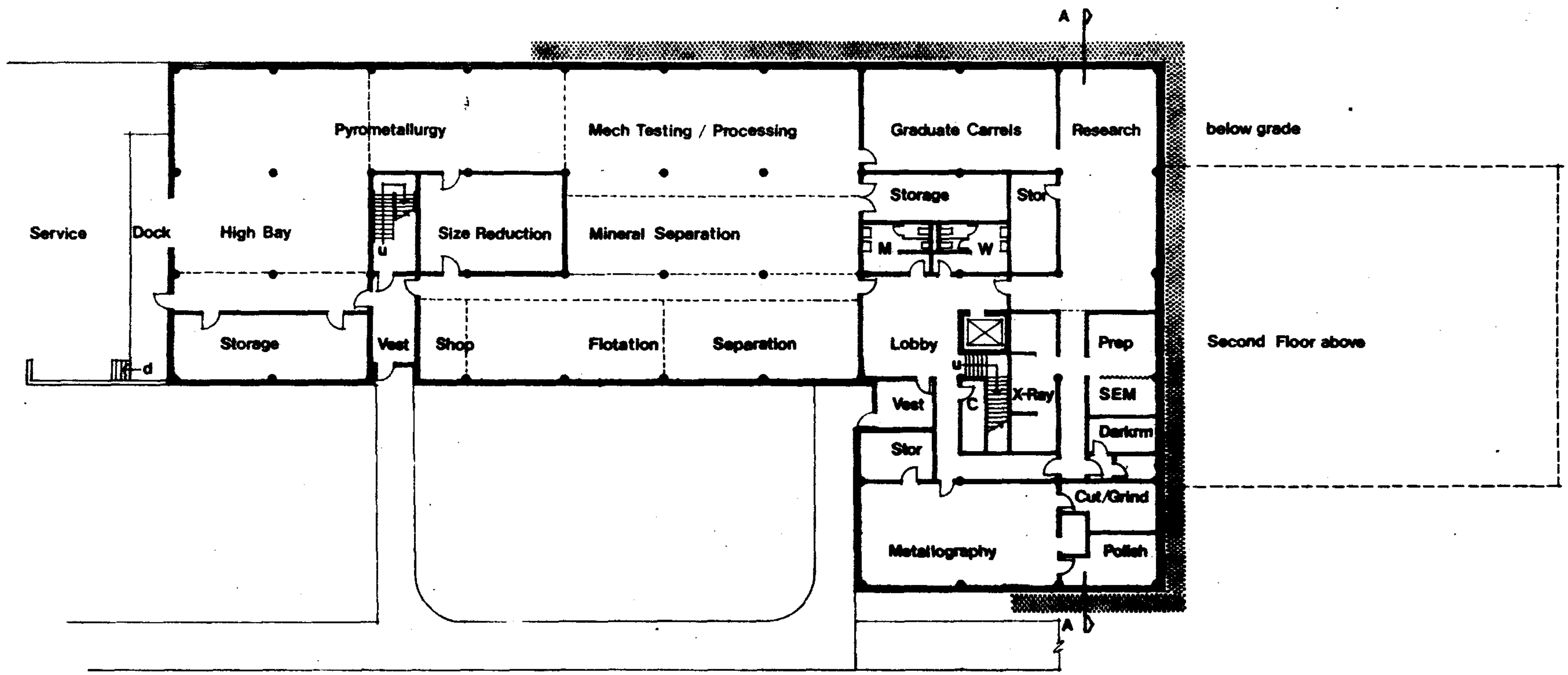

Granite Street
Parking
Service
Alley
Service
Parking
Parking
Library
Auditorium
Mining / Geology
Park Street
SITE PLAN
0 50 100'

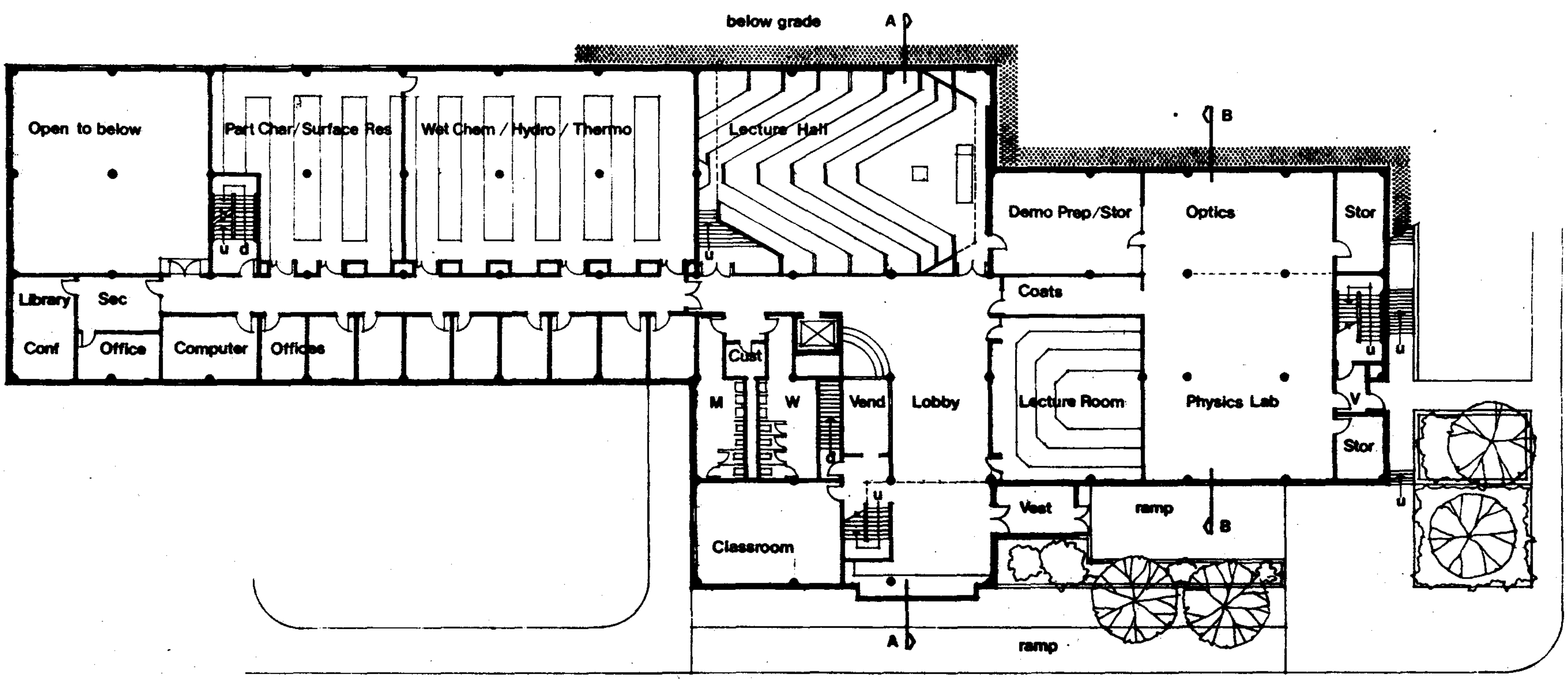
Figure 5



FIRST FLOOR PLAN

0 10 20 40

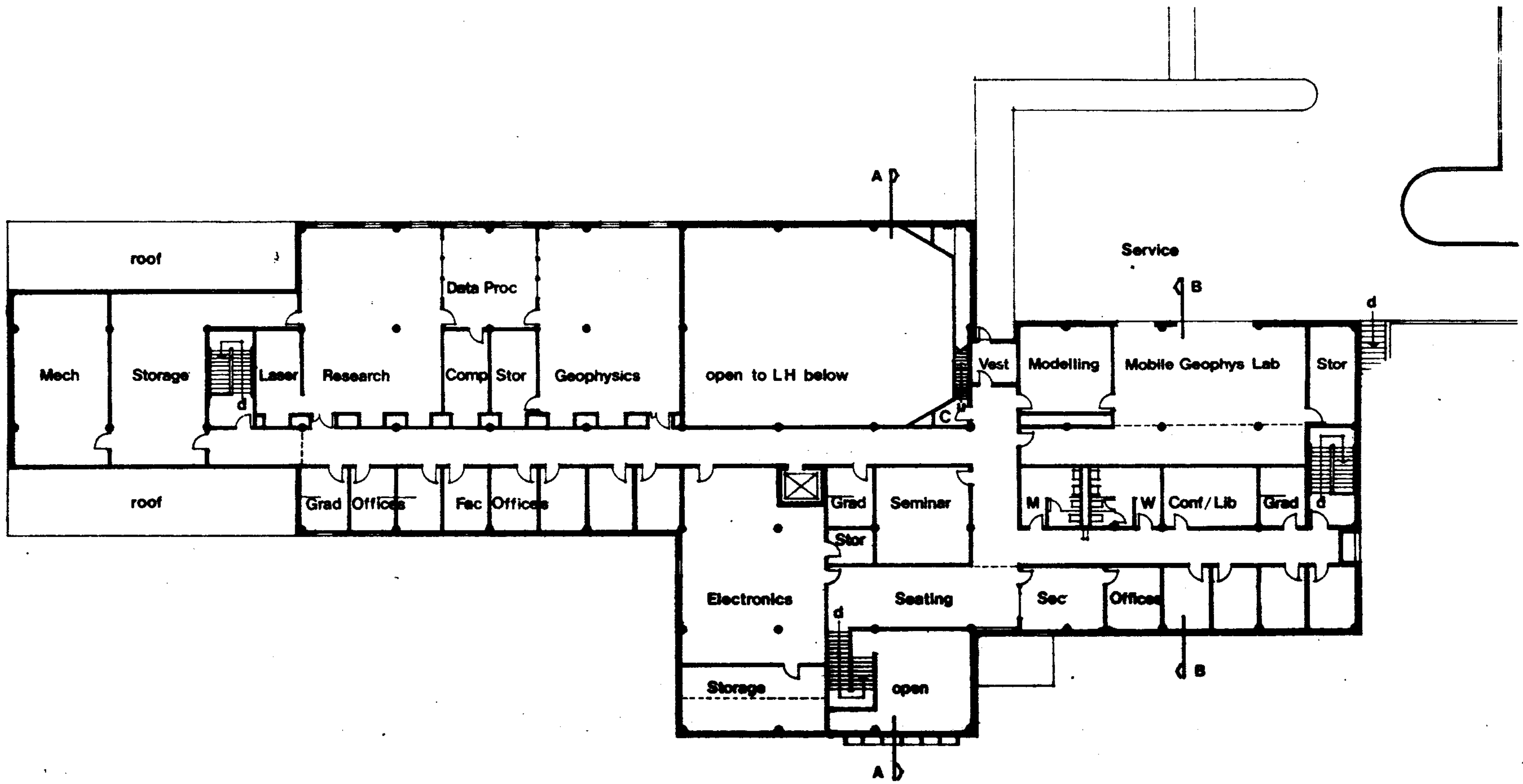
Figure 6



SECOND FLOOR PLAN

0 10 20 40

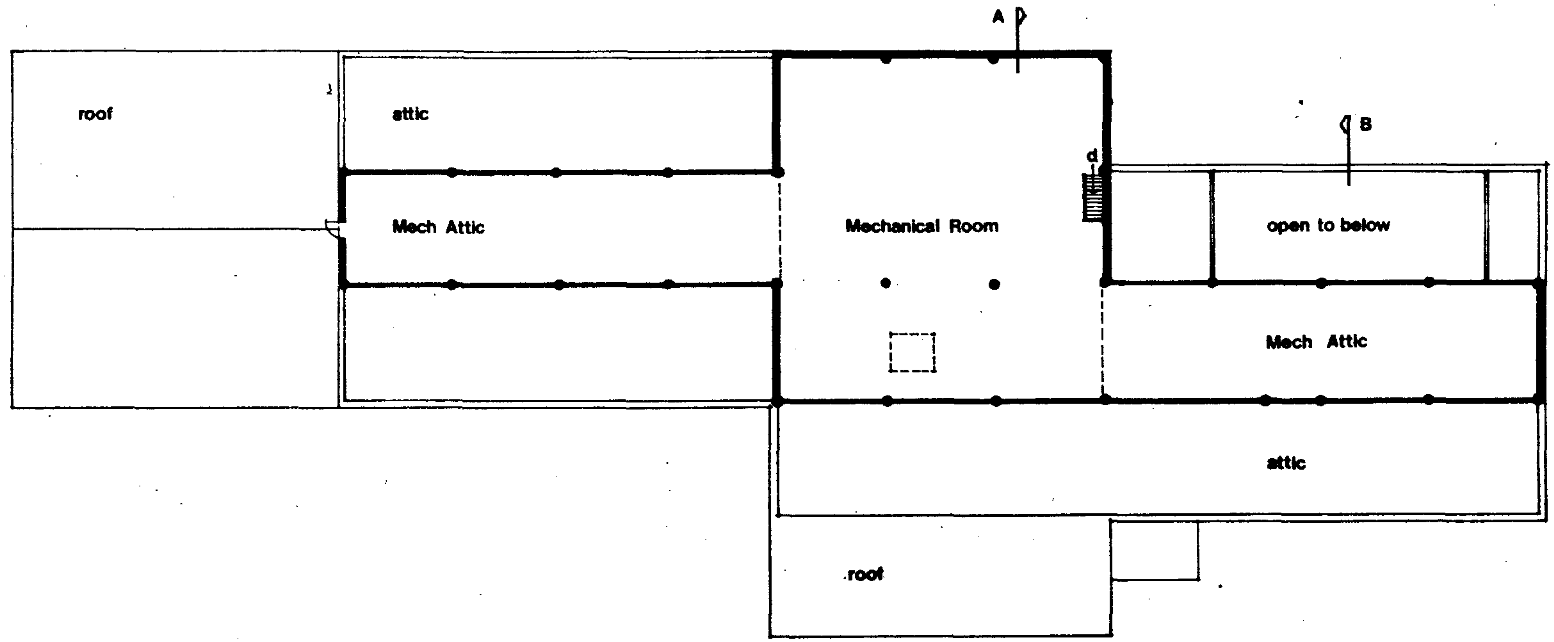
Figure 7



THIRD FLOOR PLAN

0 10 20 40

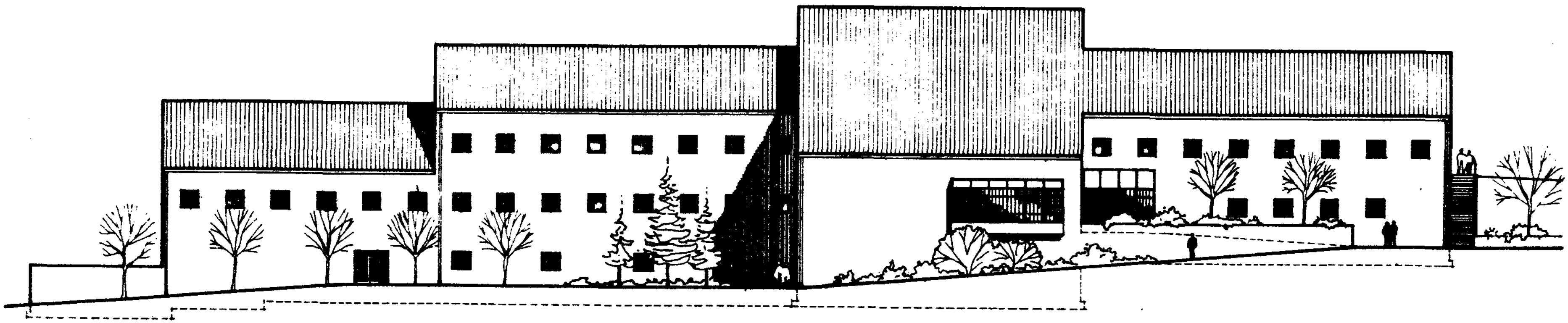
Figure 8



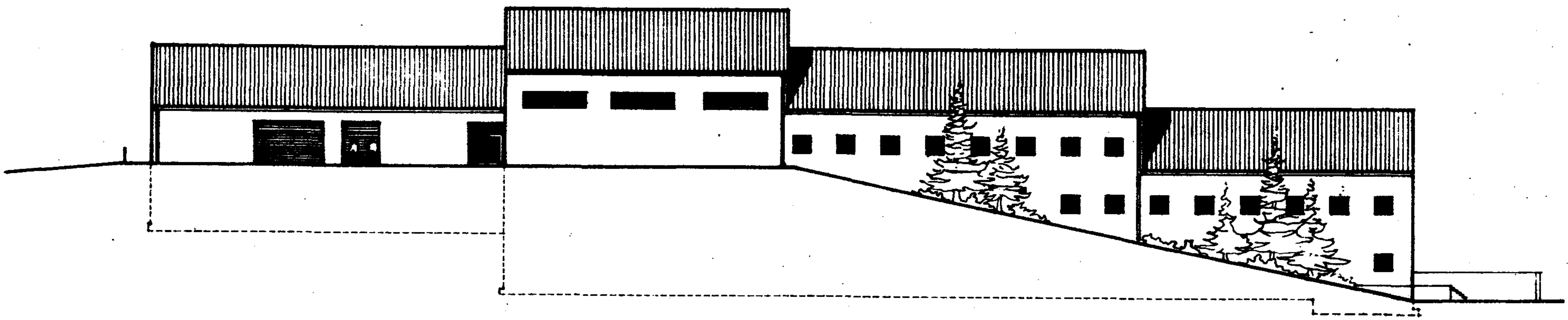
MECHANICAL LOFT PLAN

0 10 20 40

Figure 9

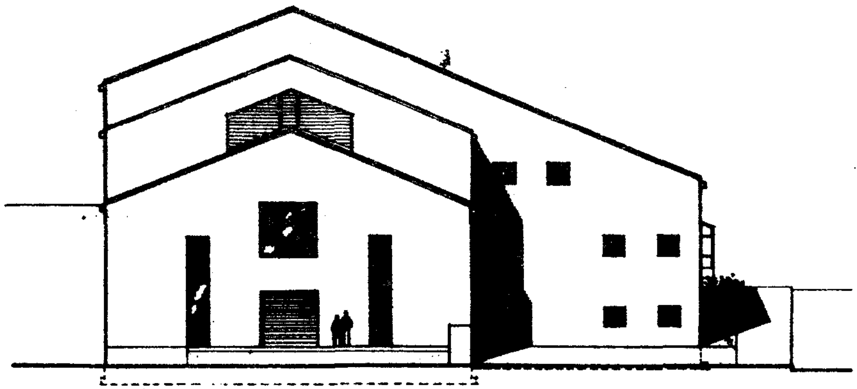


SOUTH ELEVATION

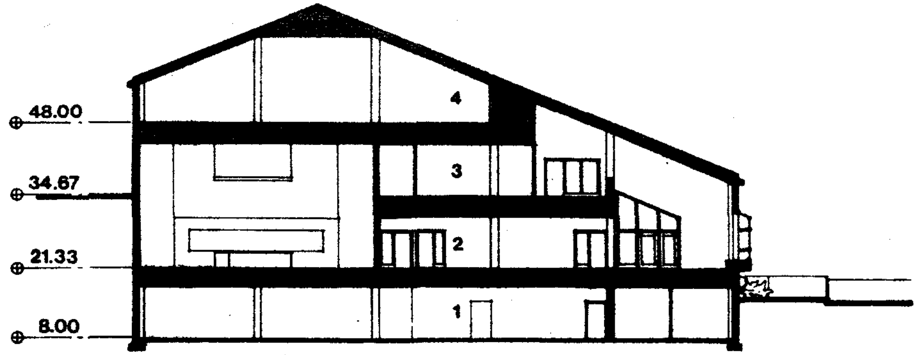


NORTH ELEVATION

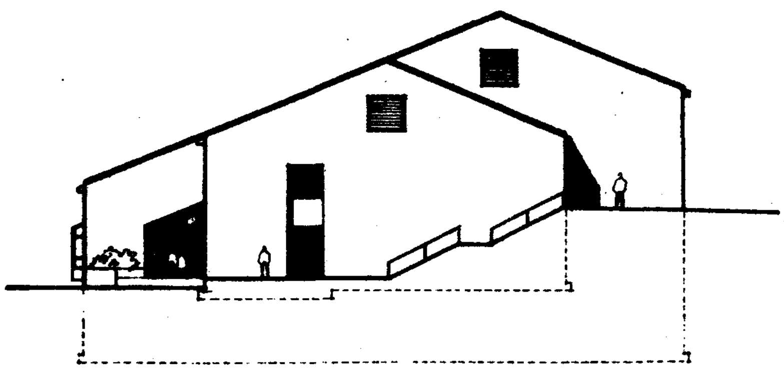
Figure 10



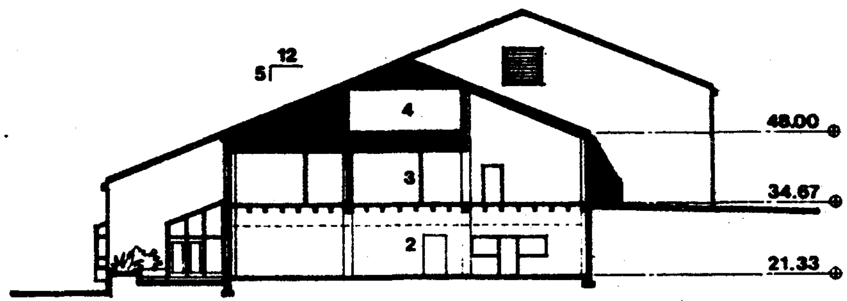
WEST ELEVATION



SECTION A

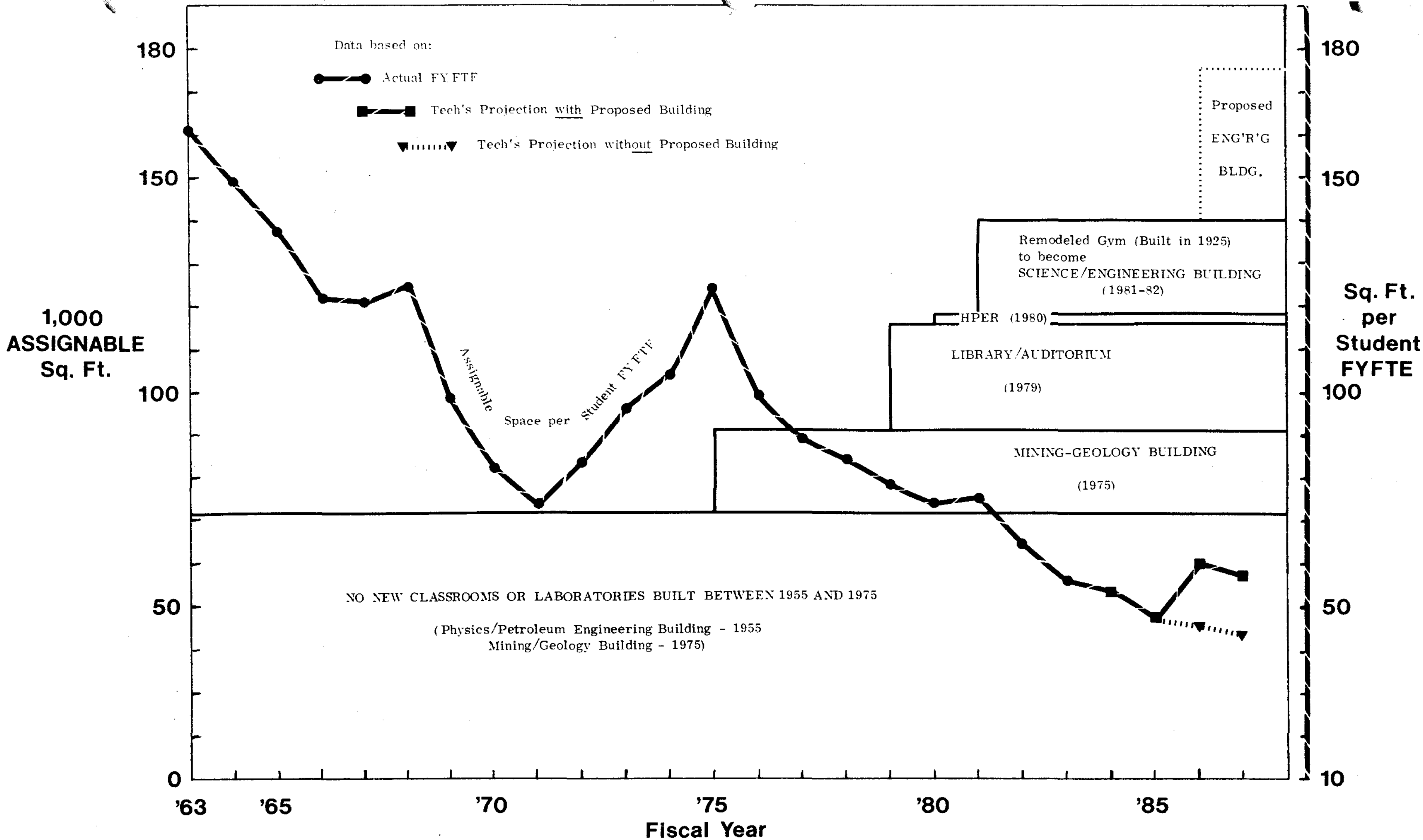


EAST ELEVATION



SECTION B

Figure 11



SPACE PER STUDENT HAS SHRUNK BADLY AT MONTANA TECH

Tech's rocketing enrollment growth has caused severe crowding in laboratories and classrooms despite limited construction and remodeling efforts. Based on Assignable Square Feet, as defined in the Department of Higher Education and Welfare's 1973 "Facilities Inventory & Classification Manual", space per FY FTE student at Tech is less than half what it was in 1962; and conservative projections indicate a continuing shrinkage.

Figure 12

3/11/83

MINERALS AND METALS	NET IMPORT RELIANCE* AS A PERCENT OF APPARENT CONSUMPTION**	MAJOR FOREIGN SOURCES (1975-1978)
COLUMBIUM	100	BRAZIL, CANADA, THAILAND
MICA (sheet)	100	INDIA, BRAZIL, MADAGASCAR
STRONTIUM	100	MEXICO, SPAIN
TITANIUM (RUTILE)	100	AUSTRALIA, JAPAN, INDIA
MANGANESE	98	SOUTH AFRICA, GABON, BRAZIL, FRANCE
TANTALUM		THAILAND, CANADA, MALAYSIA, BRAZIL
BAUXITE & ALUMINA	93	JAMAICA, AUSTRALIA, GUINEA, SURINAM
CHROMIUM	90	SOUTH AFRICA, U.S.S.R., S. RHODESIA, TURKEY, PHILIPPINES
COBALT	90	ZAIRE—BELG.-LUX., ZAMBIA, FINLAND, CANADA
PLATINUM—GROUP METALS	89	SOUTH AFRICA, U.S.S.R., UNITED KINGDOM
ASBESTOS	85	CANADA, SOUTH AFRICA
TIN	81	MALAYSIA, THAILAND, INDONESIA, BOLIVIA
NICKEL	77	CANADA, NORWAY, NEW CALEDONIA, DOMIN. REP.
CADMIUM	66	CANADA, AUSTRALIA, MEXICO, BELG.-LUX
POTASSIUM	66	CANADA, ISRAEL
MERCURY	62	ALGERIA, SPAIN, ITALY, CANADA, YUGOSLAVIA
ZINC	62	CANADA, MEXICO, HONDURAS, SPAIN
TUNGSTEN	59	CANADA, BOLIVIA, REP. OF KOREA
GOLD	56	CANADA, U.S.S.R., SWITZERLAND
TITANIUM (ilmenite)	46	AUSTRALIA, CANADA
SILVER	45	CANADA, MEXICO, PERU, UNITED KINGDOM
ANTIMONY	43	SOUTH AFRICA, CHINA MAINLAND, MEXICO, BOLIVIA
BARIUM	40	PERU, IRELAND, MEXICO, MOROCCO
SELENIUM	40	CANADA, JAPAN, YUGOSLAVIA, MEXICO
GYPSUM	33	CANADA, MEXICO, JAMAICA
IRON ORE	28	CANADA, VENEZUELA, BRAZIL, LIBERIA
IRON & STEEL SCRAP	(22) NET EXPORTS	
VANADIUM	25	SOUTH AFRICA, CHILE, U.S.S.R.
COPPER	13	CANADA, CHILE, ZAMBIA, PERU
IRON & STEEL PRODUCTS	11	JAPAN, EUROPE, CANADA
SULFUR	11	CANADA, MEXICO
CEMENT	10	CANADA, MEXICO, NORWAY, BAHAMAS.
SALT	9	CANADA, MEXICO, BAHAMAS
ALUMINUM	8	CANADA
LEAD	8	CANADA, PERU, MEXICO, HONDURAS, AUSTRALIA
PUMICE & VOLCANIC CINDER	4	GREECE, ITALY

* NET IMPORT RELIANCE = IMPORTS-EXPORTS
* ADJUSTMENTS FOR GOVT'T AND INDUSTRY STOCK CHANGES.

** APPARENT CONSUMPTION = U.S. PRIMARY
* SECONDARY PRODUCTION + NET IMPORT RELIANCE.

Figure 13

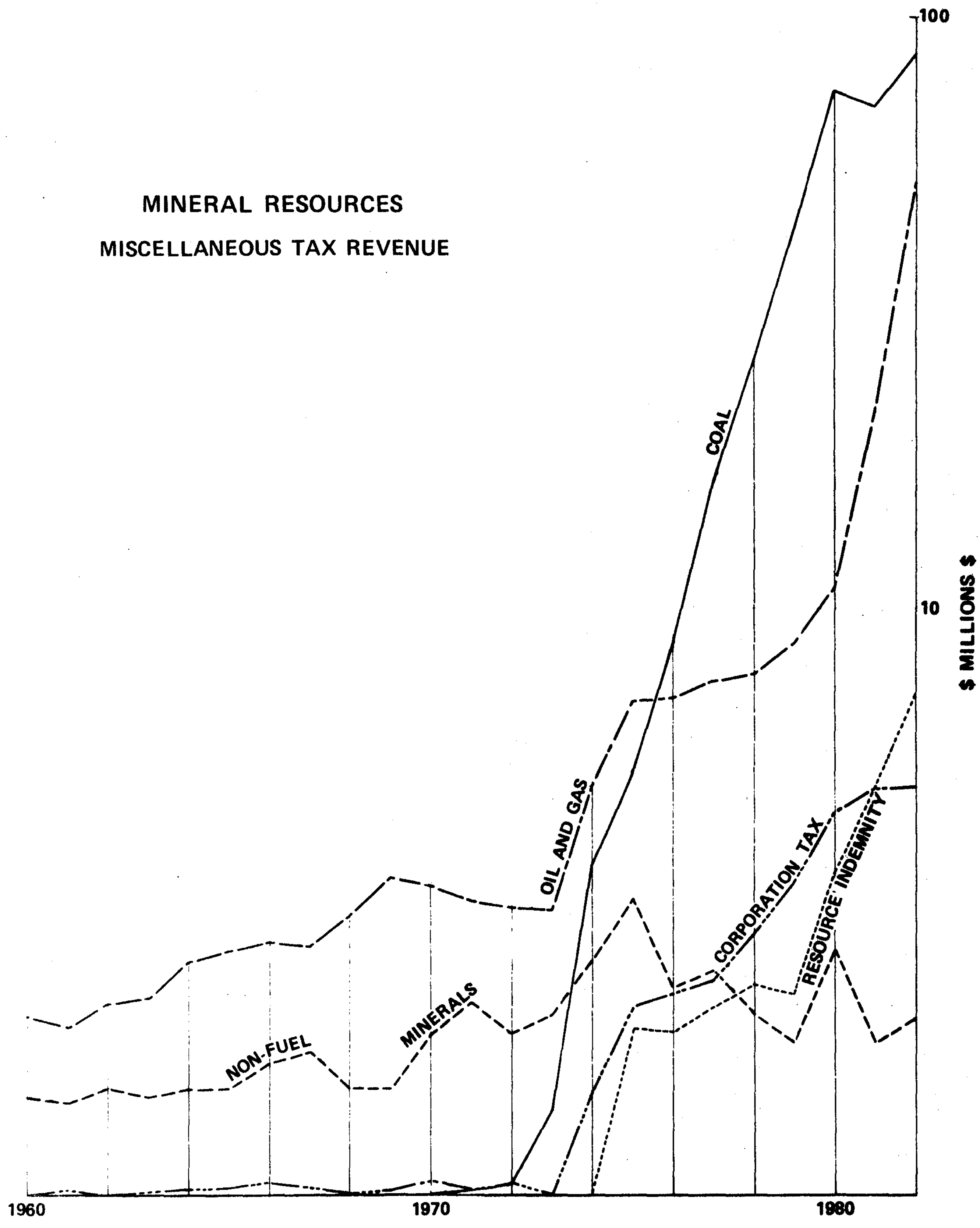

MINERAL RESOURCES
MISCELLANEOUS TAX REVENUE
COAL
OIL AND GAS
CORPORATION TAX
RESOURCE INDEMNITY
NON-FUEL
MINERALS
100
10
$ MILLIONS $
1960
1970
1980

Figure 14

Table 1

MONTANA TECH

TECH'S PEER GROUP
(College & University Funding Study - Legislative Finance Committee, March, 1982)

Colorado School of Mines Golden, Colorado	2420 FYFTE 78-79 $\boxed{3240}$ FYFTE 82-83 34% Increase
New Mexico Institute of Mining and Technology Socorro, New Mexico	826 FYFTE 78-79 $\boxed{1309}$ FYFTE 82-83 58% Increase
South Dakota School of Mines and Technology Rapid City, South Dakota	1626 FYFTE 78-79 $\boxed{2435}$ FYFTE 82-83 50% Increase
Montana Tech Butte, Montana	1139 FYFTE 78-79 $\boxed{2048}$ FYFTE 82-83 80% Increase

WA/pl

3/14/83

Table 2

MONTANA TECH

ABET ACCREDITED
B.S. ENGINEERING PROGRAMS:
MINERALS INDUSTRY RELATED
(49th Annual Report, Accreditation Board for Engineering & Technology
Year Ending September 30, 1981)

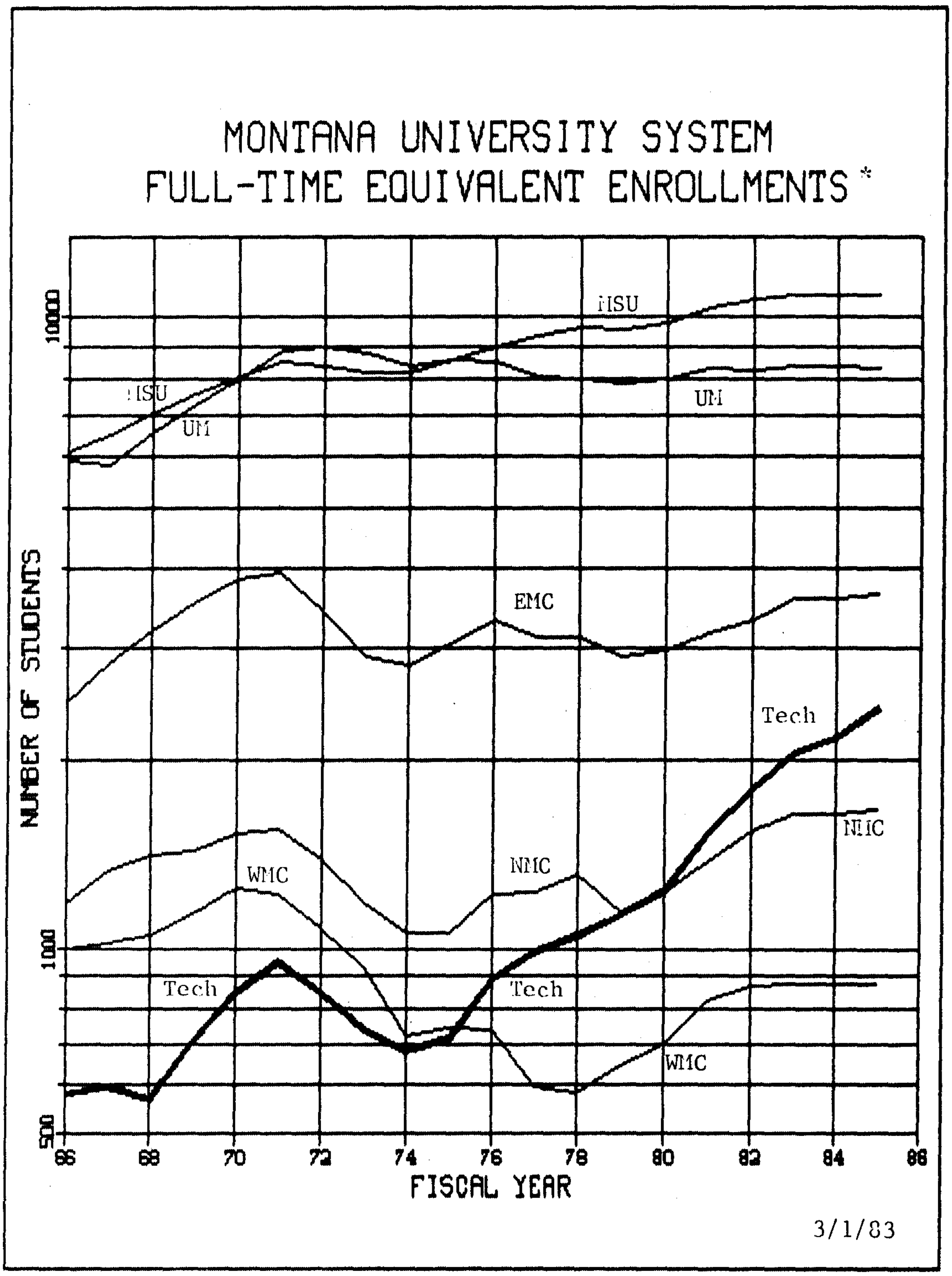
	TECH	CSM	NMT	SDT
Engineering Science	X	-	-	-
Environmental	X	-	-	-
Geological	X	X	X	X
Geophysical	X	X	-	-
Metallurgical	X	X	X	X
Mineral Processing	X	-	-	-
Mining	X	X	X	X
Petroleum	X	X	X	-
Other Engineering	-	2(a)	-	4(b)

(a) Chemical Engineering & Petroleum-Refining, Mineral Engineering Physics

(b) Chemical, Civil, Electrical & Mechanical

FWD:jm

7/26/82



* Dunnam Report: 6/25/82 and Regents' Projection for FY 84 and FY 85

Note rapid rise to record levels at Montana Tech

Figure 15

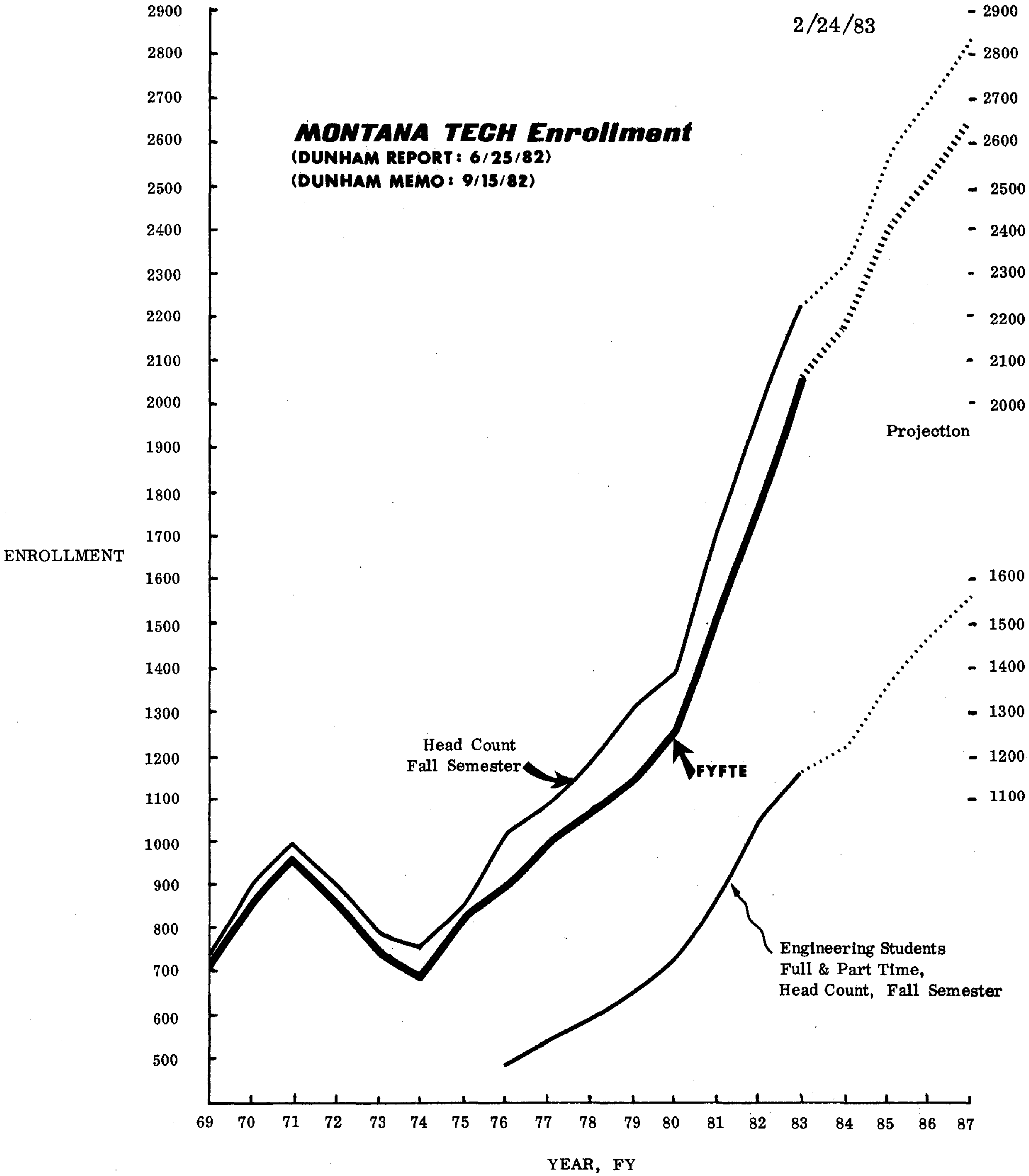

2/24/83
MONTANA TECH Enrollment
(DUNHAM REPORT: 6/25/82)
(DUNHAM MEMO: 9/15/82)
ENROLLMENT
2900
2800
2700
2600
2500
2400
2300
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1100
1000
900
800
700
600
500
Projection
Head Count
Fall Semester
FYFTE
Engineering Students
Full & Part Time,
Head Count, Fall Semester
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
YEAR, FY

Figure 16

Table 3

ENROLLMENT, UNDERGRADUATE & GRADUATE

Full-time and Part-time

FALL HEAD COUNT

YEAR*	GEOPHYSICAL ENGINEERING	METALLURGY & MINERAL PROCESSING ENGINEERING	PETROLEUM ENGINEERING	ALL ENGINEERING
1963	NA	NA	NA	259
1964	NA	NA	NA	253
1965	NA	NA	NA	277
1966	NA	NA	NA	298
1967	NA	NA	NA	288
1968	NA	NA	NA	345
1969	NA	NA	NA	405
1970	NA	NA	NA	415
1971	NA	NA	NA	285
1972	17	31	93	325
1973	13	39	88	309
1974	13	44	89	374
1975	16	57	130	474
1976	30	79	131	535
1977	18	83	155	597
1978	19	78	204	640
1979	27	73	238	712
1980	37	95	286	869
1981	46	113	362	1048
1982	65	123	420	1166

*First Semester date: i.e. 1963 = 1964 FY

NA: Not available

FWD/pl

3/15/83

Table 4

MONTANA TECH

FIRST SEMESTER

	FULL TIME TOTAL HEAD COUNT	FULL TIME ENGINEERING UG & G STUDENTS	% ENGINEERING STUDENTS
1962 FY	380	258	68
1972 FY	843	276	33
1982 FY	1542	997	65
1983 FY	1754	1096	62

FWD/pl
3/1/83

Table 5

ASSIGNABLE SPACE AS OF 1974

Building	WITHOUT ADM. SPACE	WITH ADM. SPACE
Engineering Hall	7,864	8,868
Physics-Petroleum	18,985	18,985
Metallurgy	22,640	23,100
Science-Engineering	1,265	1,265
Museum Building	9,797	11,681
Main Hall	9,180	9,236
Mill Building	993	993
SUB	0	3,401
Totals	70,724	77,529

The above totals do not include storage areas, shop facilities, custodial or circulation areas. Nor does it include Non-Class Lab Space.

Table 6

MONTANA TECH

Academic Space - Square Feet

Summary Table
(as of Fall Semester 1982)

UILDING	Classrooms *	Laboratories *	Faculty Offices *	Administrative Space	Supporting Services *	Graduate Student Space *	TOTAL (incl. Admin. Space)	TOTAL (without Admin. Space) (A.S.F.)
ngineering Hall	5539	0	2492	1465	0	0	9496	8031
Mining-Geology	5557	6842	1952	5732	2939	530	23552	17820
et-Physics	3680	6500	2385	0	3022	278	15865	15865
Metallurgy	3205	8999	3002	0	8915	2668	26789	26789
PER Facility	585	0	1287	0	835	0	2707	2707
cience-Engineering	3139	11513	3880	0	2425	499	21456	21456
Museum Building	0	3409	1898	2167	0	0	7474	5307
n Hall	3418	0	1815	0	640	0	5873	5873
Mill Building	0	1660	0	0	1640	0	3300	3300
.U.B.	0	0	0	650	1403	0	2053	1403
ib./Auditorium	0	23317	0	689	1538	0	25544	24855
OTAL	25123	62240	18711	10703	24346	3975	144109	133406
ab/Classroom Bldg. (proposed)	4740	26520	3080	0	480	1500	36320	36320

*Denotes those categories used to determine Assignable Square Feet (A.S.F.) according to "Facilities Inventory & Classification Manual" Department of Higher Education and Welfare, 1973

Definitions:

Faculty Offices: Includes department secretaries

Supporting Services: Terminal rooms, department libraries, special equipment, storage areas, shop facilities, conference rooms

3/9/83

Table 7

MONTANA TECH

INVENTORY OF ADMINISTRATION OFFICES

Beginning of First Semester, 1982-83

Mining Geology Building	4683 ASF
President, Vice President, Office Staff, Conference Room, Registrar, Business Office, Admissions Office, Assistant Admissions, Counselor, Director of Personnel, Computer Center (Machine Room), Word Processing Center, Computer Center Director, Admissions Work Space, Computer Center System Engr.	
SUB	2053 ASF
CTO & Mail Room, Director of Financial Aid	
Engineering Hall	1314 ASF
Director of Placement, Director of Cooperative Education & Staff	
Museum Building	2665 ASF
Director of Research, Director of Contracts and Grants Administration, Director of Development & Alumni Relations, Switchboard	
Physical Plant Building	920 ASF
Director of Physical Facilities, Assistant Director of Physical Facilities, Drafting Room	
TOTAL	11635 ASF

MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY
BUTTE, MONTANA

March 1, 1983

CLASSROOM UTILIZATION

The standard method to measure classroom utilization is based upon an analysis of Weekly Student Contact Hours (WSCH). Weekly Student Contact Hours are figured by the number of students using a room between 8:00 A.M. and 5:00 P.M. Monday through Friday. Weekly Student Contact Hours depend on scheduled contact hours and is independent of whatever number of credits a student may earn in a course.

A nationally recognized norm for the use of a classroom, which has been adopted by the Montana Commission for Higher Education, is 30 scheduled hours per week (Monday-Friday 8 A.M. - 5 P.M.) at 60% of the room capacity (number of student stations). This can be expressed more simply as 18 hours per week per station.

This level of use is termed OPTIMUM WSCH. It is considered a standard guideline that should be met. However, it is also considered to be a level of use that is difficult to exceed without causing numerous conflicts in students' schedules or without significantly increasing the number of faculty.

ACTUAL WSCH is the term used to identify the Registrar's official record of all student contact hours formally scheduled in each classroom or class laboratory on campus.

When OPTIMUM WSCH is mathematically related to ACTUAL WSCH for a room or set of rooms on campus, a measure of utilization can be computed and related to the optimum level of 100% utilization.

$$\frac{\text{ACTUAL WSCH}}{\text{OPTIMUM WSCH}} = \text{COMPUTED \% UTILIZATION}$$

TABLE 8 provides a complete listing of CLASSROOM UTILIZATION Levels for the Second Semester of the 1982-83 Academic Year from 8:00 A.M. to 5:00 P.M. Monday through Friday.

Table 8

CLASSROOM UTILIZATION LISTING

SECOND SEMESTER, 1982-83

8 A.M. - 5 P.M. MONDAY - FRIDAY

BUILDING NAME	ROOM NO.	NO. OF STATIONS	OPTIMUM WSCH	ACTUAL WSCH	COMPUTED % UTILIZATION
Engineering	101	70	1260	1053	84
Engineering	104	49	881	537	61
Engineering	204	83	1494	1646	111
Engineering	208	36	648	642	99
Main	103	49	882	938	107
Main	106	65	1170	1716	147
Main	112	65	1170	1259	108
Main	115	49	882	907	103
Metallurgy	115	90	1620	687	43
Metallurgy	214	81	1458	811	56
Metallurgy	216	156	2808	2848	102
Petroleum	10	60	1080	1868	173
Petroleum	107	35	630	930	148
Petroleum	108	35	630	474	76
Petroleum	207	29	522	614	118
Petroleum	208	24	432	342	80
HPER	A	30	540	131	25
HPER	B	25	400	52	13
Mining-Geology	107	49	882	817	93
Mining-Geology	108	55	990	890	90
Mining-Geology	206	123	2214	3853	174
Mining-Geology	301	40	720	711	99
Mining-Geology	303	40	720	423	59
Science & Eng.	104	10	180	53	30
Science & Eng.	105	18	324	209	65
Science & Eng.	106	40	720	855	119
Science & Eng.	113	75	1350	1493	111
Science & Eng.	114	15	270	116	43
Science & Eng.	209	30	540	197	37

TABLE II

TOTALS FOR ALL CLASSROOMS

NO. OF CLASSROOMS	NO. OF STATIONS	OPTIMUM WSCH	ACTUAL WSCH	COMPUTED % UTILIZATION
29	1526	27,418	27,072	99%

The preceding figures show that overall, the classrooms, or lecture rooms, on the Montana Tech campus were utilized within one percentage point of 100% capacity (99%). Due to the large classes, especially in physics, math, petroleum, geology, etc., our medium-to-large lecture rooms were utilized quite extensively in order to accommodate them. Again, this semester, we had to add chairs to many of our classrooms to accommodate the students since we did not have enough large rooms on campus in which to place them, and therefore, we had many overcrowded classrooms, which certainly does not make for the best learning conditions.

If our enrollment continues to grow as expected, we will not have enough lecture rooms on campus to handle the increase in enrollment.

The projected FTE for Montana Tech for the 1983-84 academic year is 2179 FTFYE, approximately 6.4% higher than our 1982-83 enrollment. Using the projected numbers, we project 104% utilization of our classroom space for the 1983-84 academic year.

With the statistics on the preceding page, and the projected enrollment growth at Montana Tech, we will be unable to handle the increased influx of students to our campus with the lecture rooms that are now available.

Therefore, it is an absolute must that more classroom space be provided for Montana Tech.

SECTION II

CLASS LAB UTILIZATION

As in the case of classrooms, the standard method of measuring class lab utilization is based upon analysis of WEEKLY STUDENT CONTACT HOURS. The definition for class lab WSCH is the same as for classroom WSCH. However, the method of computing utilization is slightly different.

The nationally recognized norm for class lab use is 20 scheduled hours per week (Monday-Friday, 8 A.M. - 5 P.M.) at 80% of station capacity. Thus, the OPTIMUM WSCH for class labs is 16 hours per week per station.

This standard differs from that of classrooms for two reasons. The capacity guideline of at least 80% is an important goal because the cost of creating specialized laboratory space is much greater than that for classrooms. However, the use of class labs often requires a great deal of preparation and cleanup time for each hour of class. For that reason, the expected number of class lab hours is lower than that for classrooms.

Table 9 provides a complete listing of CLASS LAB UTILIZATION levels for the Second Semester of the 1982-83 academic year from 8:00 A.M. to 5:00 P.M., Monday through Friday.

Table 9

CLASS LAB UTILIZATION

SECOND SEMESTER, 1982-83

8 A.M. - 5 P.M. MONDAY--FRIDAY

BUILDING NAME	ROOM NO.	NO. OF STATIONS	OPTIMUM WSCH	ACTUAL WSCH	COMPUTER % UTILIZATION
Metallurgy	003	3	48	50	105
Metallurgy	005	1	16	40	250
Metallurgy	007	1	16	97	607**
Metallurgy	011	3	48	40	84
Metallurgy	015	15	240	151	63
Metallurgy	018	4	64	134	210
Metallurgy	106	4	64	35	55
Metallurgy	107	1	16	45	282
Metallurgy	108	3	48	28	59
Metallurgy	112	2	32	161	504**
Metallurgy	114	9	144	233	162
Metallurgy	203	46	736	1128	154
Metallurgy	304	18	288	185	65
Petroleum	6	12	192	99	52
Petroleum	8	5	144	181	126
Petroleum	104	2	72	90	125
Petroleum	106	8	128	98	77
Petroleum	109	9	144	147	102
Petroleum	206/211	45	720	534	75
Mining-Geology	6	10	160	213	134
Mining-Geology	100	7	112	164	147
Mining-Geology	103	30	480	240	50
Mining-Geology	200	16	384	250	98
Mining-Geology	203	16	640	285	112
Mining-Geology	204	15	64	51	80
Science & Eng.	108	12	192	22	01*
Science & Eng.	109	16	256	228	89
Science & Eng.	110	16	256	160	63
Science & Eng.	111	16	256	384	150
Science & Eng.	204	24	384	18	05*
Science & Eng.	206	20	320	344	108
Science & Eng.	214	12	192	135	71
Science & Eng.	308	75	1200	1080	90
Museum	210	6	96	117	122
Mill	Welding Lab	6	96	71	74

*These labs are special purpose labs which are used normally only during the first semester

**These labs are labs which have only 1 & 2 student stations in them and they are used extensively by graduate students, as well as having some classes in them.

TABLE IV

TOTALS FOR ALL CLASS LABS

NO. OF CLASS LABS	NO. OF STATIONS	OPTIMUM WSCH	ACTUAL WSCH	COMPUTED % UTILIZATION
35	488	8248	7238	88%

The preceding utilization of class labs shows that Montana Tech has an overall usage of 88% of the labs on campus during the second semester of the 1982-83 academic year. A total of 35 labs is listed on the utilization study this semester. One new lab was added for the Petroleum Engineering Department this year in order to help with the numbers of students taking labs in this Department.

Almost all of the labs used on the Montana Tech campus are special or single purpose labs and can only be used for certain classes, such as the Fluids Lab, Strengths Lab, Physics Labs, Petroleum Engineering, X-ray Diffraction and Electron Microscopy Labs in the Metallurgy and Mineral Processing areas, etc. Therefore, some of the labs have a low usage according to the number of stations and numbers of students enrolled in these courses. However, others have a very high and heavy usage, especially in the service areas.

Also, the quality of space in the labs in our Departments of Physics, Petroleum Engineering and Metallurgy and Mineral Processing Engineering is considered sub-standard. Improvements are definitely needed in these areas.

With the growing enrollment at Montana Tech, many of our labs are very overcrowded, especially those with limited stations, and the percentage of use ranges anywhere from 250% to 607%. Others, of course, fall below this and have a low usage, but many of these labs fall into the category of special or single purpose labs and can only be used for specific courses.

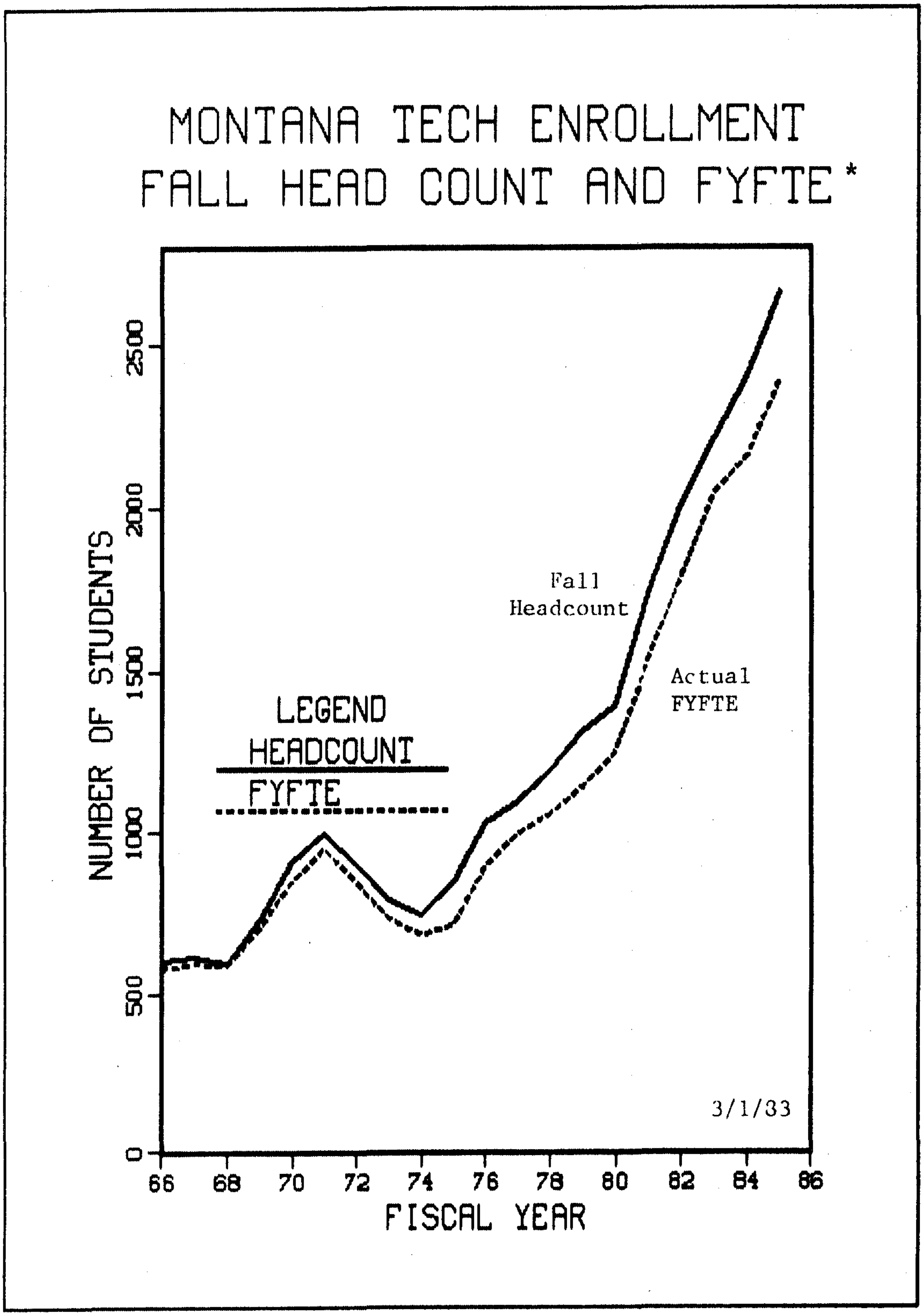
If space standards for lab space were taken into account, we would need a minimum of 20,000 square feet <u>now</u> to handle our current enrollment. With the enrollment growth as projected by the Montana University System's Commissioner of Higher Education, we would need approximately 23,000 square feet more in FY 1983 and should have a total of 64,000 square feet of lab space in FY 1984.

<u>Metallurgy Building</u>

Overall space utilization of the Metallurgy Building, including lecture and laboratory space, is 133%. There are only three lecture rooms in the Metallurgy Building and they are three of the largest lecture rooms on campus. The largest of the three rooms, 156 seating capacity, has a high usage due to large chemistry and math classes. The other two classrooms, 90 and 81 seating capacity, have lower utilizations based upon student stations even though the rooms are scheduled an average of 29 hours per week. With the construction of the new building, smaller classrooms will be available for metallurgy and mineral processing engineering classes freeing the larger lecture rooms in the Metallurgy Building for the larger classes we have on campus.

Laboratory space in the Metallurgy Building is over-utilized because of the small number of stations available in most of the single purpose labs. As a result, many of the labs are in use every hour of every school day. Based on the formula of 16 hours per week per station for optimum weekly student contact hours, we cite the following examples. Students in the mineral processing engineering discipline use Lab 018, which has only 4 stations, 37 hours per week for a total of 134 weekly student contact hours per week and an overall 210% utilization. Students in the metallurgical engineering discipline use labs 005 and 007, which are the Electron Microscopy and X-ray Diffraction Labs respectively. Lab 005 has one station and is used a total of 40 hours per week (40 WSCH) for a 250% utilization. Lab 007, which also has one station, is used 45 hours per week (97 WSCH) for an overall utilization of 627%. Also, the labs are sub-standard and the equipment is old. Updated and modern equipment is needed to bring these labs up to standard. This is a very necessary item in order to retain our engineering accreditation for the Metallurgy and Mineral Processing Engineering disciplines with the Accreditation Board for Engineering and Technology. When these labs were designed and built in 1923, they were built to accommodate a much smaller enrollment than what we are faced with today.

Therefore, the overall utilization of the above rooms show a very definite need for the construction of the new building we have requested, not only to assist the departments located within it, but also to provide expansion room for other departments in the space vacated to accommodate the enrollment growth that Montana Tech has experienced over the last several years and the growth rate that is anticipated for the next several years.



* Dunham Report: 6/25/82 and Regents' Projection for FY 84 and FY 85

Figure 16

Table 10

MONTANA COLLEGE OF MINERAL SCIENCE AND TECHNOLOGY

Space Projections

Enrollment, Faculty FTE and Office Needs Projection

Year	Projected Increase	Student FYFTE	*Calculated Faculty FTE	Current Faculty Offices
1982-83	Actual	2048	88.24	93
1983-84	Appropriated	2148	119	
1984-85	Appropriated	2373	132	
1985-86	6.0	2515	140	
1986-87	4.0	2616	145	
1987-88	4.0	2721	151	
1988-89	3.0	2803	156	
1989-90	3.0	2887	160	
1990-91	3.0	2974	165	
1991-92	4.0	3093	172	

Percent Increase

	FYFTE	
5 Year - 1982-83 to 1986-87	27.7%	(52 offices needed)
10 Year - 1982-83 to 1991-92	51.0%	(79 offices needed)

* Faculty FTE - Calculated at 18/1 Student/Faculty ratio

Weekly student credit hours (WSCH) in lecture, 1982-83 was 27,043 for the first semester. This increased from 23,377 for the comparable period in 1981-82 (15.7%)

RHT/pl

3/9/83

TABLE 11

Projection of Lecture Rooms Needs, Based on Helena Report D

Year	Projected Increase	Projected FYFTE Enrollment	WSCH	Formula Lecture Room Needs	Actual Lecture Space	% Occupancy	Excess or Needed Space At	Excess or Needed Stations
1981-82	Actual	1791	23377	19403 ft^2	25123 ft^2	77%		
1982-83	Actual	2048	27043	22446	24660	91%	+2214 ft^2	+148
1983-84	Approp.	2148	28368	23545	24660	95%	+1115	+ 74
1984-85	Approp.	2373	31347	26018	24660	106%	-1358	- 91
1985-86	6.0%	2515	33228	27579	24660	112%	-2919	-194
1986-87	4.0%	2616	34557	28682	**29210	98%	+ 528	+ 35
1987-88	4.0%	2721	35939	29829	29210	102%	- 619	- 41
1988-89	3.0%	2803	37017	30724	29210	105%	-1514	-101
1989-90	3.0%	2887	38128	31646	29210	108%	-2436	-162
1990-91	3.0%	2974	39272	32596	29210	112%	-3386	-226
1991-92	4.0%	3093	40843	33900	29210	116%	-4690	-313

Assumptions*: 1. Station Size = 15 $\frac{\text{sq. ft.}}{\text{Student}}$ 2. At optimum or 100% utilization each Station is used 30 hours/week @ 60% average from 8 to 5. This means each station is used for 18 WSCH (weekly student contact hour) or each WSCH requires $\frac{15\ ft^2/\text{student}}{18\ \text{WSCH/student}} = 0.83\ ft^2/\text{WSCH}$ for optimum utilization.

*The projections are based on the Board of Regents planning assumptions. At Montana Tech, the actual station size is 16.2 sq. ft./student and the actual space per weekly student credit hour is 0.90 ft^2/WSCH. The percent occupancy based upon student stations is higher than the space formula generates. For example, the second semester of 1982-83 shows a percentage occupancy of 99% rather than 91%. Using the above formula adjustment for station size, the calculations are as follows: 27043 WSCH x 0.90 ft^2/WSCH = 24339 ft^2 ÷ 24660 ft^2 = 99%. In order for our data to coincide with that of other units, we have used the Board of Regents planning assumptions throughout the table. It must be emphasized that by the time a building appropriated by this legislature is ready for occupancy, we would be at 112% occupancy by Board of Regents planning assumptions, but the actual figure would be at 121% occupancy based on actual student stations available at Tech in 1985-86.

**The Laboratory/Classroom Building would be scheduled for occupancy in the fall of 1986. It would add 4550 sq. ft. of lecture room space.

RHT/pl

3/9/83

Table 12

Summary Laboratory Needs, 1982-83, Based on Helena Report D

	Quality of Space	Projected Instructional Space Needs sq. ft.	Projected Research Area Faculty sq. ft.	Projected Graduate Student Area sq. ft.
Engineering Science/ Environmental Engineering	Good	20824	4760	480
Petroleum Engineering	Fair	11239	1700	480
Geological Engineering	Good	11970	2040	960
Physics & Geophysical Engr.	Fair	4072	1370	800
Metallurgical Engineering	Poor	1991	1700	1280
Mining Engineering	Good	3195	1700	1440
Mineral Processing Engr.	Poor	1316	1020	800
Biological Sciences	Good	1439	690	-
Chemistry-Geochemistry	Fair	5562	1610	600

Engineering

340 sq. ft./FTE Faculty
160 sq. ft./FTE Grad. Student
11.25 sq. ft./Grad. WSCH
11.25 sq. ft./Upper Div. WSCH
7.25 sq. ft./Lower Div. WSCH

Science

230 sq. ft./FTE Faculty
120 sq. ft./FTE Grad. Student
5.62 sq. ft./Grad. WSCH
5.62 sq. ft./Upper Div. WSCH
3.75 sq. ft./Lower Div. WSCH

RHT/pl
3/9/83

Table 13

Summary Space Needs Projected to 1986-87 and 1991-92

Office and Lecture Room

	ACTUAL 1982-83	PROJECTION 1986-87	PROJECTION 1991-92
No. of Faculty Offices	93	145	172
Admin. Office Space	9503 sq. ft.	14093 sq. ft.	16393 sq. ft.
Lecture Rooms Area	24660 sq. ft.	28682 sq. ft.	33900 sq. ft.
Lecture Rooms Stations	1526	1912	2260

Laboratory Space - Instructional, Graduate Student, and Faculty

	ACTUAL	PROJECTED BY FORMULA		
	1982-83	1982-83	1986-87	1991-92
	sq. ft.	sq. ft.	sq. ft.	sq. ft.
Engineering Science Environmental Engineering	9330	26064	33904	39300
Petroleum Engineering	3845	13419	17455	20233
Geological Engineering	2047	14970	19473	22572
Physics and Geophysical Engineering	3227	6242	8119	9412
Metallurgical Engr.	4098	4971	6466	7495
Mining Engineering	4825	6335	8240	9552
Mineral Processing Engineering	1457	3135	4078	4727
Biological Sciences	1695	2129	2769	3210
Chemistry-Geochemistry	4454	7772	10110	11719
HSS	365	169	220	255
Totals	35343	85206	110834	128475

RHT/pl

3/15/83

LONG RANGE BUILDING PROGRAM

CAPITAL PROJECT REQUEST

Montana Tech's capital construction project request to the Board of Regents on July 29, 1982 identified the following projects:

Priority	Project Title		Cost (State)
1.	Engineering Lab/Classroom Building		$2,750,000
2.	Computer Center/Admin. Building		2,000,000
3.	Major Maintenance		
	A. Main Hall Roof	$110,000	
	B. Mining-Geology Roof	6,000	
	C. Museum Roof	4,000	
	D. Steam & Condensate Lines	65,000	
	E. Paving Internal Roads	80,000	
	Subtotal		265,000
4.	Major Renovations-Remodeling		
	A. Engineering Hall	$45,000	
	B. Pet. Bldg., Phase I	75,000	
	C. Main Hall, Phase I	175,000	
	D. Museum Bldg., Phase I	800,000	
	Subtotal		1,095,000
5.	Land Acquisition		225,000
6.	Loop Road, Phase I		180,000
	TOTAL		$6,515,000

FWD/pl
3/15/83

Capital Project Request continued...

The Regents approved the following projects, prioritized as follows:

Regents' Priority	Project	Approved For State Funding
1.	Main Hall Roof Repair	$ 110,000
2.	Steam and Condensate Lines Repair	65,000
10.	Engineering Laboratory/Classroom Bldg.	2,750,000*
11.	Land Acquisition	225,000
15.	Petroleum Building Remodel (Phase I)	75,000
16.	Renovation of Engineering Hall	45,000
24.	Museum Building Remodel (Phase I)	800,000
	TOTAL	$4,070,000

*This was later increased to $4,500,000 by a subsequent Board of Regents' action Item #38-502-R0383, at their March 4, 1983 meeting.

The following tables detail the changes to campus space if the priorities 1, 2, and 4 of the Tech request to the Board of Regents had been approved by the Board and subsequent monies appropriated by the 48th Legislature.

FWD/pl

1/15/83

MONTANA TECH

CHANGES IN SPACE INVENTORY RESULTING FROM
COMPLETION OF BUILDING PRIORITIES 1, 2 & 4

INVENTORY ADDED

PRIORITY 1: Engineering Laboratory Classroom Building (1985-86)

Added Classrooms	4740 ASF
Added Laboratories	24720 ASF
Added Faculty Offices (20)	2700 ASF
Added Admin. Space	0 ASF
Added Supporting Services	2360 ASF
Added Grad. Student Space	1800 ASF
Total Added	36320

GROSS INVENTORY: After Completion of Building

Classrooms	29863 ASF
Laboratories	63838 ASF
Faculty Offices (106)	20083 ASF
Admin. Space	9312 ASF
Supporting Services	25168 ASF
Grad. Student Space	6043 ASF
Total	154307 ASF

IMPACT: Frees up 5555 ASF for use by Chemistry & Geochemistry and Engineering Science Departments; and for expanded campus machine shop. Removes laboratory and support services space, 3300 ASF, from Mill Building.

PRIORITY 2: Computer Center - Administration Building (1985-86)

Added Classrooms	900 ASF
Added Laboratories	0 ASF
Added Faculty Offices (4)	480 ASF
Added Admin. Space	12550 ASF
Added Supporting Services	1870 ASF
Added Grad. Student Space	0 ASF
Total	15800

GROSS INVENTORY:

Classrooms	30763 ASF
Laboratories	63838 ASF
Faculty Offices (110)	20563 ASF
Admin. Space	21862 ASF
Supporting Services	27038 ASF
Graduate Student Space	6043
Gross Total	170107

INPACTS: Gives 2850 ASF added space to Computer Center, adds 4 faculty offices, moves Administration offices from 5 buildings across campus and consolidates/integrates their functions, returns to Instructional Program 4760 ASF, thus living up to obligations to A/E Administration of moving Administration out of the M-G Building.

NET INVENTORY, APPROXIMATELY, AFTER COMPLETION PRIORITIES 1 & 2
After restoring M-G space and removal from Mill Building and SUB

M-G Space

Classrooms (+816 ASF)	31579 ASF
Laboratories (+1591 ASF)	65429 ASF
Faculty Offices (115: +5, +884 ASF)	21447 ASF
Admin. Space (-4294 ASF)	17568 ASF
Supporting Services (+233 ASF)	27271 ASF
Grad. Student Space (+1236 ASF)	7279
Subtotal	170573

Mill Building

Classrooms (0)	31579
Laboratories (-1660 ASF)	63769
Faculty Offices (115: 0)	21447
Admin. Space (0)	17568
Supporting Services (-1640 ASF)	25631
Grad. Student Space (0)	7279
Subtotal	167273

SUB

Classroom (0)	31579 ASF
Laboratories (0)	63769
Faculty Offices (115: 0)	21447
Admin. Space (-650 ASF)	17008
Supporting Services (-1403 ASF)	24228
Grad. Student Space (0)	7279
Subtotal NET SPACE	165310 ASF

(Priorities 1 & 2 Completed)

4. RENOVATION PROJECTS (1984-85)

A. Renovation of Engineering Hall

Added Classroom	-720 ASF*
Added Laboratories	0
Added Faculty Offices (6)	720 ASF
Added Admin. Space	0
Added Supporting Services	0
Added Grad. Student Space	0

*Reduction in space will provide a better shaped room for efficient and effective classroom purposes.

B. Petroleum Building Remodeling: Phase I; Remodel Basement

No added or deleted space - converting vacated Engineering Science Lab space into Petroleum Engineering labs.

C. Renovation Main Hall: Phase I

No added or deleted space. Upgrades mechanical and electrical systems in building.

D. Museum Building Remodeling:

First Floor

Added Classroom	1152 ASF
Added Laboratories	0
Added Faculty Offices (8)	1136 ASF
Added Admin. Space	0
Added Supporting Services	0
Added Grad. Student Space	0

D. Museum Building Remodeling (Continued)

Mezzanine Level: After completion of Priority 2

Added Classrooms (4)	1629 ASF
Added Laboratories	0
Added Faculty Offices (2)	559 ASF
Added Admin. Space	(-1838) ASF
Added Supporting Services	(-525) ASF
Added Grad. Student Space	0

Third Floor: After completion of Priority 2

Added Classrooms	646 ASF
Added Laboratories	0
Added Faculty Offices (1)	181 ASF
Added Admin. Space	(-827) ASF
Added Supporting Services	0
Added Grad. Student Services	0

IMPACTS: Adds classroom space, faculty offices, and moves Administration out to new Computer Center - Administration Building.

GRAND TOTAL, NET SPACE, APPROXIMATELY, after completion of Priorities 1, 2 & 4 A, B, C, & D

Classrooms	34286 ASF
Laboratories	63769 ASF
Faculty Offices (132)	24043 ASF
Admin. Space	14343 ASF
Supporting Services	23703 ASF
Grad. Student Services	7279
GRAND TOTAL, APPROX. NET SPACE	167423 ASF

Tabl -1
MONTAN TECH

Butte, Montana

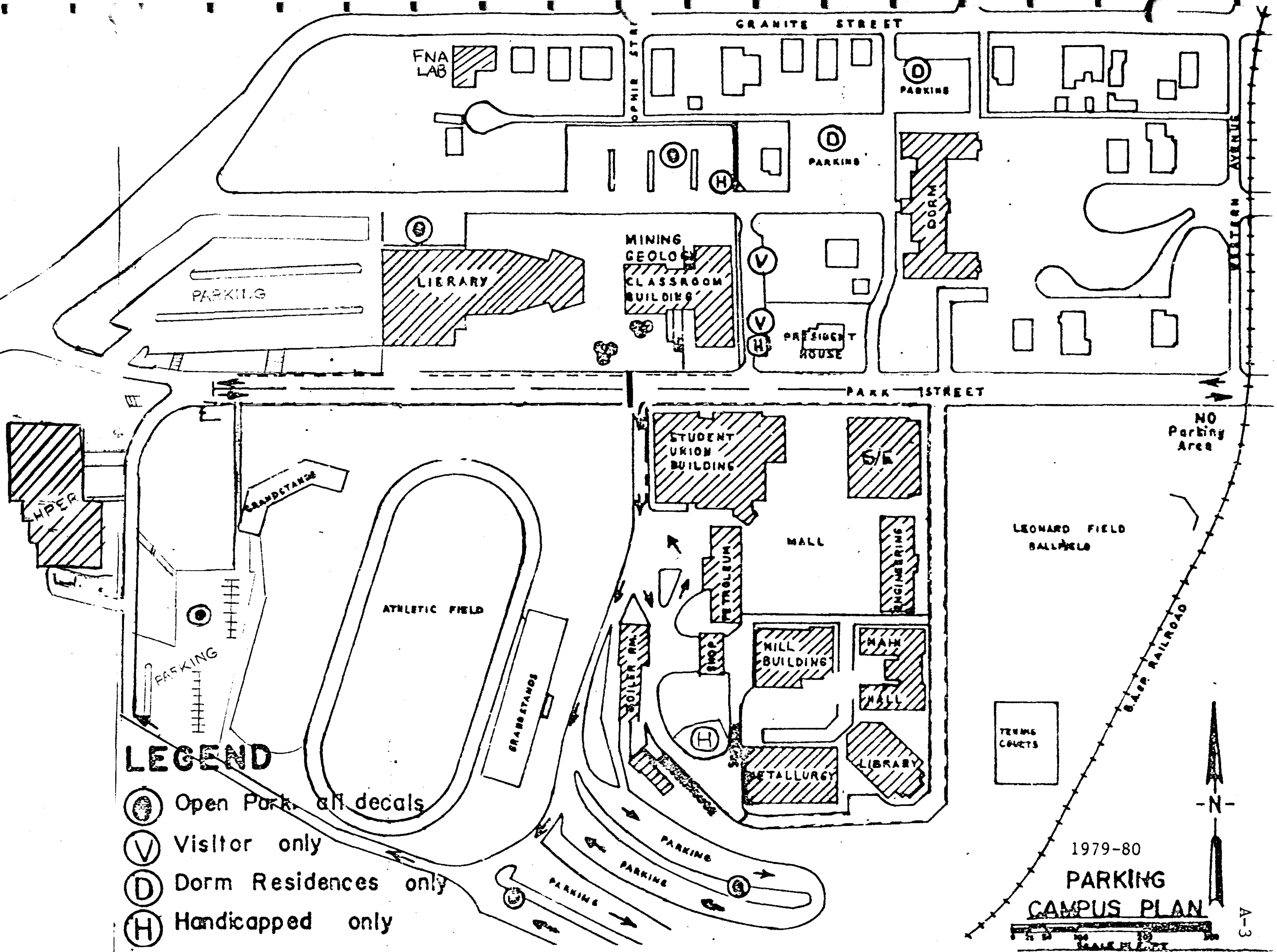
CONSTRUCTION OF BUILDINGS AND OTHER IMPROVEMENTS

NAME OF BUILDING	GROSS SQUARE FEET	NET SQUARE FEET	ACADEMIC A.S.F.	YEAR OF START OF CONSTRUCTION	COST	MEANS OF FINANCING (Tax Funds, Revenue Bonds, etc.
MAIN HALL	37,000	22,113	5,873	1896	$ 219,000	Legislature authorized issue & sale of 30-yr. bonds to the amount of $120,000. Donations
MILL BUILDING	17,456	10,699	3,300	1908	97,300	Legislature appropriated $59,000
METALLURGY BUILDING	31,700	26,865	26,789	1923	447,400	Tax Funds (Univ. Bond Issue)
ENGINEERING BUILDING	12,880	9,496	8,031	1923	85,100	Tax Funds (Univ. Bond Issue)
SCIENCE/ENGINEERING	33,100	21,828	21,456	1925	207,000	Tax Funds (Univ. Bond Issue)
RESIDENCE HALL	46,905			1935	606,100	Revenue Bonds
PRESIDENT'S RESIDENCE	5,805			1936	34,800	Part of P.W.A. Project 812
MUSEUM BUILDING	32,552	20,556	5,307	1940	439,300	Tax Funds (Univ. Bond Issue)
SHOP, GARAGE, PHYSICAL PLANT	5,020			1948	111,500	Tax Funds (Univ. Bond Issue)
PHYSICS-PETROLEUM BLDG.	18,363	15,900	15,865	1953	284,000	Tax Funds (Univ. Bond Issue)
STUDENT UNION BUILDING	47,452	30,633	1,403	1960	250,000	HHRA (Univ. Bond Issue)
ALUMNI COLISEUM				1960	700,000	Private Donations
HEATING PLANT	8,820			1969	89,000	Legislative Appropriations
MINING-GEOLOGY BUILDING	40,774	23,552	17,820	1972	1,500,000	Legislative Appropriations
GREENHOUSE	1,641			1976	27,500	Legislative Appropriations
LIBRARY	32,240	25,544	24,855	1977	1,425,000	Legislative Appropriations
AUDITORIUM	5,213	4,288		1978	600,000	EDA Grant $500,000 college, public gifts
HPER COMPLEX	57,280	43,183	2,707	1980	2,275,000	Bond Issue
	434,171	254,657	133,406			

CONSTRUCTION OF BUILDINGS AND OTHER IMPROVEMENTS

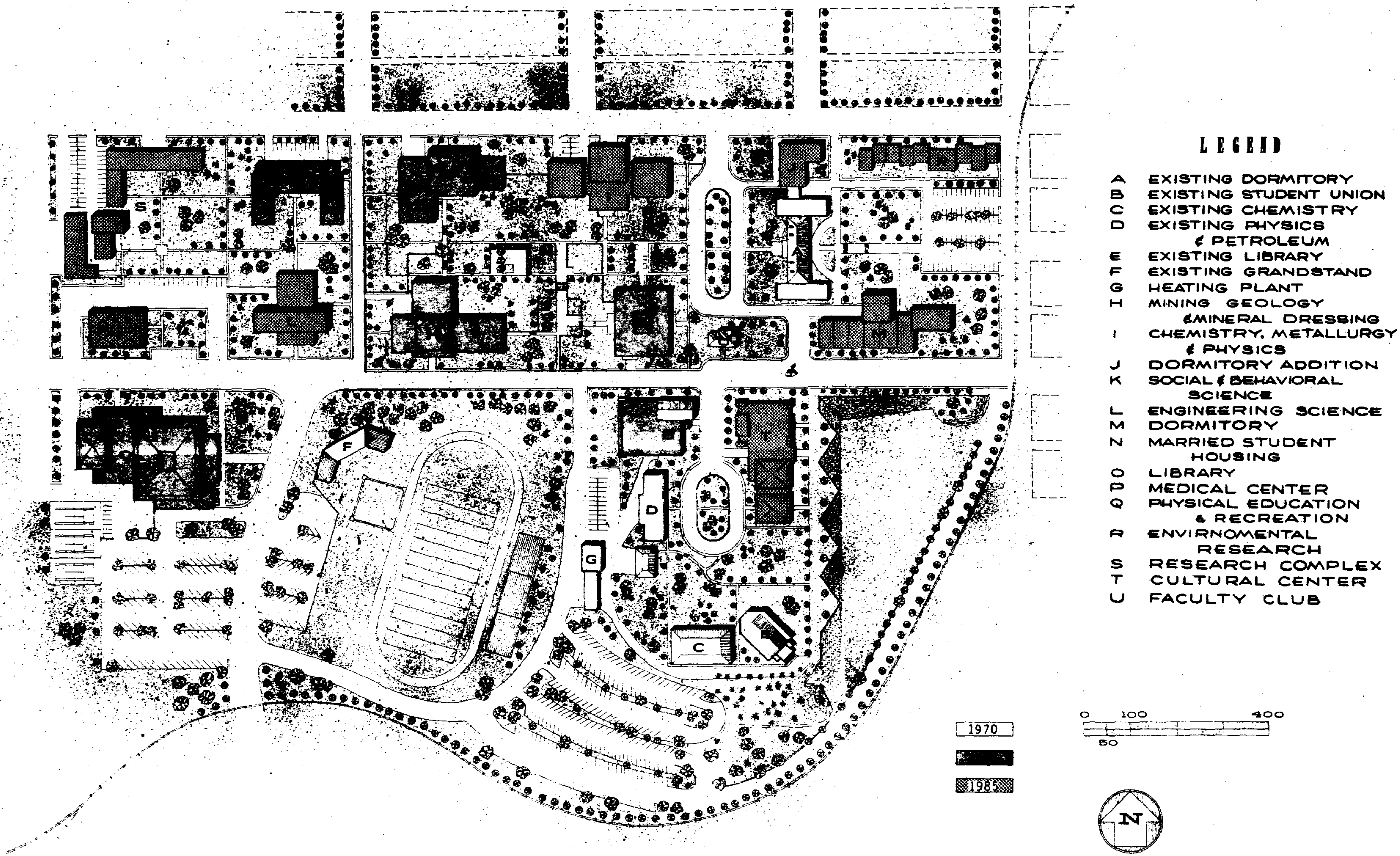
Continued

IMPROVEMENTS			
MAIN HALL			
Basement	1957-58		Footings; repainted, revamped Coed Room, Typing Office
First Floor	1958		Offices
Third Floor	1957		Laboratory, drafting space, office space for MBMG. Cubicles for Graduate Students Dept. of Geology
ENGINEERING HALL	1958		Subdivided to provide classrooms, offices, conference rooms
PHYSICS-PETROLEUM	1958		Completion of Physics Department section
STUDENT UNION BUILDING	1971	$ 700,000	Addition, remodeled
OLD GYMNASIUM	1980	1,600,000	Remodeled to Science Engineering Building
STUDENT UNION BUILDING	1981	112,000	Remodeled food service area for increased capacity



* HPER Building (Gym) is part of the campus facilities and traffic and parking.

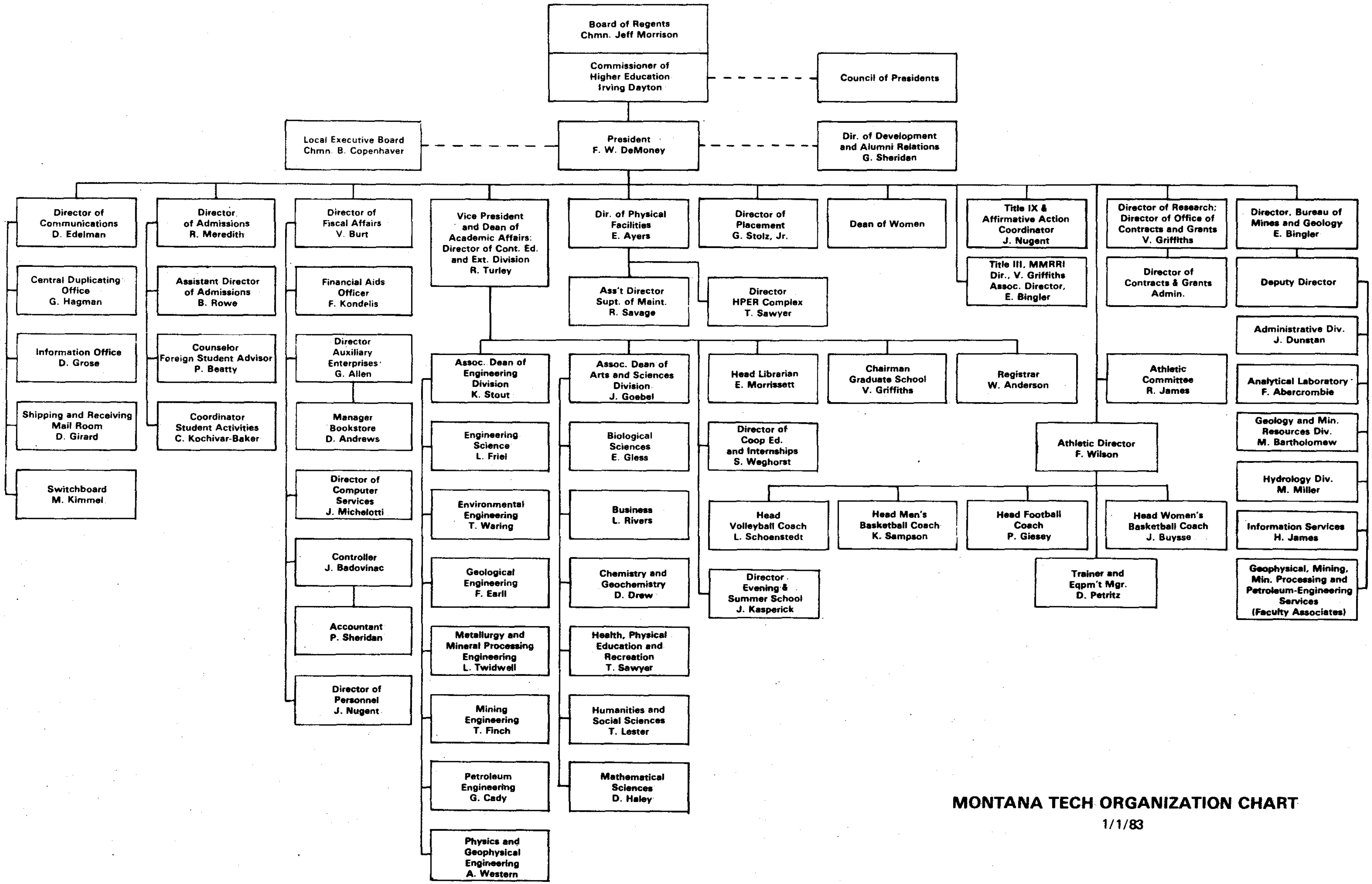
Figure A-1



CAMPUS MASTER PLAN

Montana College of Mineral Science and Technology

Figure A-2



MONTANA TECH ORGANIZATION CHART

1/1/83

Figure A 3

teaching programs. Some of these problem areas:

- Nearly two-thirds of the space used to grow plants lacks artificial lighting nee for winter experiments.
- Almost half the growing area lacks adequate cooling or exhaust systems to prevent damage to plants sensitive to heat and cold.
- Plants cannot be isolated to prevent contamination from other experiments.
- System overloads are causing mechanical failures.

A Paying Proposition

Costs of constructing the Controlled Environment Facility are estimated at about $5.3 million—an amount the facility is expected to start repaying as soon as it's completed. Here are a few examples of the pay back potential·

Teaching

Most of the 1,000 or so students currently enrolled in agriculture will benefit from modern practical learning opportunities offered by the Controlled Environment Facility. This includes undergraduate and graduate students in at least 27 courses covering such subjects as:

- Crop breeding
- Forage and pasture crops
- Plant pathology
- Seed production
- Weed control
- Range ecology and improvement
- Integrated pest management
- Horticulture
- Turf and nursery management
- Soils resources and fertility management

Improved Research

Spring Wheat—By extending the growing season into winter, researchers will be able to reduce the time now needed to breed lines d develop improved varieties.

Winter Wheat—~~A winter~~ growing season will enable breeders to speed development of new varieties. Plus, the controlled-environment will allow them to evaluate such characteristics as winter hardiness and drought resistance without waiting for nature to provide a suitable test.

Barley—Scientists will be able to develop up to three seed generations a year by using this new facility. This will help reduce variety development time.

Forages—The new facility will allow researchers to start rebuilding alfalfa, birdsfoot trefoil and sainfoin breeding programs which experienced a 25 percent loss of greenhouse space in recent years. It will also permit the breeding of forage grasses.

Soil Fertility and Management—The proposed facility will double the amount of soils research now possible with current space. It will also help speed up development more reliable soil fertility tests.

Crop Production Physiology—Precise control of growth conditions will enable scientists to better understand such basic plant functions as photosynthesis, respiration and growth regulation. This information will help breeders and researchers develop more efficient crop varieties and production practices.

Plant Diseases—Researchers will be able to double the number of disease projects they can now work on. For the first time, they will be able to test seedlings for resistance to new plant diseases. The time needed to study disease resistance will be reduced by at least one year compared to relying only on field trials.

Weeds—Research on biological, chemic and cultural control methods of serious weeds which cost Montanans millions of dollars each year.

Range Management—The facility will permit more efficient basic research concerning growth and development of plants on both natural and reclaimed range soils.

Horticulture—The facilty will permit scientists to develop improved vegetables and flowers for garden and indoor use with emphasis on winter-hardiness and other characteristics important to Montana.

Specialty Areas—Research will be improved in such areas as new and alternative crops, specialty crops for small farms, shelterbelt trees and shrubs and home greenhouse management.

Lend Your Support

The demand of Montana's biggest business for innovative ways to manage plants and soils continues to grow. If research and education are to keep pace, students and scientists must have facilities capable of meeting this challenge. The proposed Controlled Environment Facility offers the opportunity to do so. And, to do it well. Your support is needed to turn that opportunity into reality. For more information, contact the Director, Montana Agricultural Experiment Station, 202 Linfield Hall, MSU, Bozeman, Mont. 59717, phone 994-3681.

The
Controlled Environment
Facility

Montana State University. . .

A Growing Need To Grow

College of Agriculture
Montana State University
Bozeman, Montana

Students and scientists at Montana State University's College of Agriculture are like most cost-conscious shoppers. They know a bargain when they see one.

Right now they're looking at plans for a Controlled Environment Facility to replace a structure they've long outgrown.

As these students and scientists see it, the proposed Controlled Environment Facility offers real value for the money. Among its benefits:

Students

Hands-on, practical experience with plants and soils that can't be found in textbooks or in the classroom.

Scientists

More and better research on plants and soils, plus greatly improved research efficiency in a wide variety of plants and soils investigations.

Beyond the Campus

Benefits for those involved with plants and soils, from part-time home gardeners to full-time commercial wheat growers.

The total potential value of this facility is truly large. By serving the needs of agriculture, it will help maintain the economic health of Montana's biggest business. Annual cash receipts from agriculture now total about $1.5 billion. That makes it Montana's biggest single industry.

More Control, Better Results

As its name implies, the Controlled Environment Facility will enable students and scientists to control conditions under which plants grow. That's important when it comes to determining how light or darkness, heat or cold, or too little or too much moisture affect such things as crop yields or disease resistance. It also means plants can be grown year-round. That's extra important considering Montana's short growing season.

True. Some of this work can be done in the present facility. But not nearly as much or anywhere as well.

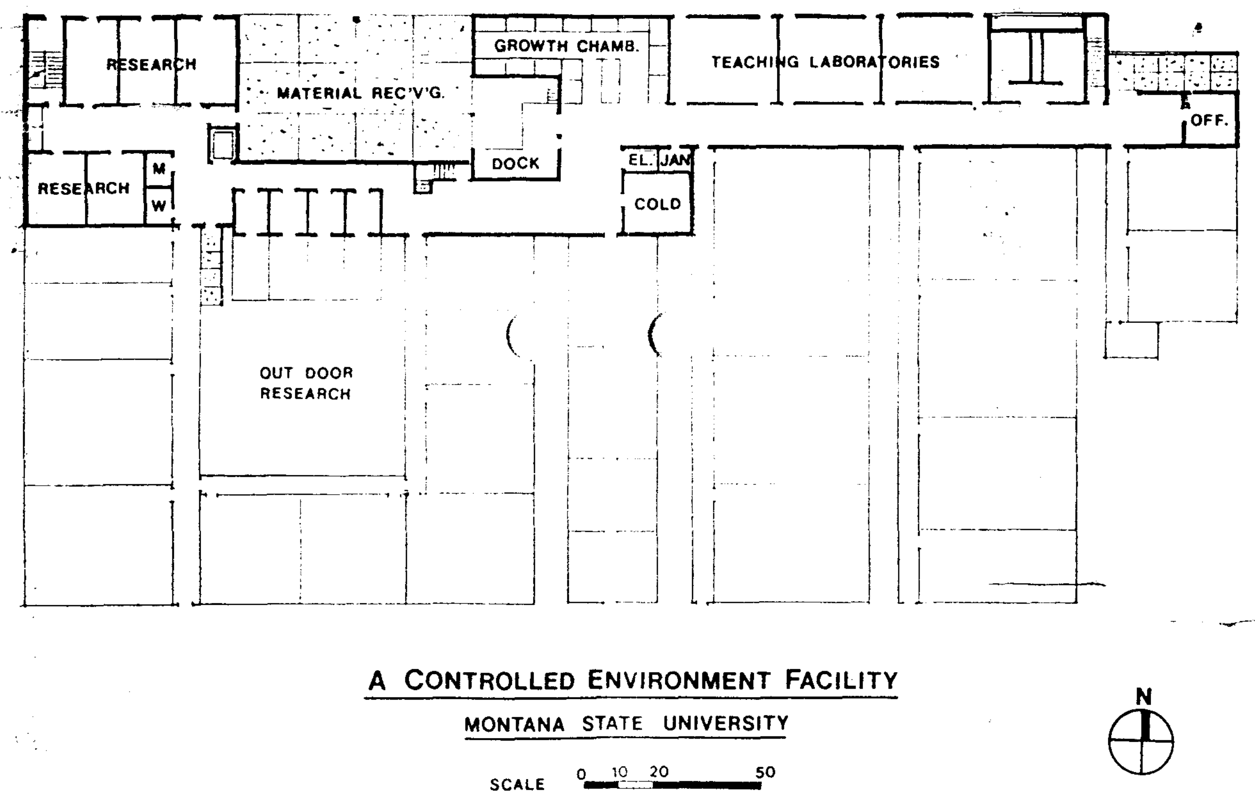
Too Little, Too Late

What's wrong with the present structure? Plenty.

For one thing, it's too small. There are now about 2½ times more students enrolled in the College of Agriculture than when the structure was built in 1952. During the same time, the number of faculty and research projects has tripled.

By comparison, researchers in neighboring states of North Dakota, Wyoming and Idaho have anywhere from three to more than six times as much controlled environment space per scientist as those at MSU.

That's not all. Major functional drawbacks of the current structure limit research and



A CONTROLLED ENVIRONMENT FACILITY

MONTANA STATE UNIVERSITY

Design for Growth

In serving students and scientists, the Controlled Environment Facility will have about three times as much room as is now available. It will also feature state-of-the-art research and teaching laboratories, better security for potentially hazardous research materials and an energy-saving design. The building will consist of two major units.

Teaching-Research Laboratory—the heart of the facility

Size: 17,400 sq. ft.

Features:

- Laboratories specially equipped to handle live biological material
- Rooms to house growth chambers and other environmental control equipment
- Isolation laboratories for diseases and insects
- Cold rooms for research and storage
- Preparation area to handle chemicals, to treat and process plants, to prepare soils and to sterilize equipment
- Potato certification laboratory

Greenhouse—where plants are grown under highly specialized, carefully controlled conditions.

Size: 32,621 sq. ft.

Features:

Controlled Environment

- Artificial lighting to meet special plant requirements
- Shading materials and black cloth for light-dark experiments
- Research-grade thermostats
- Misting systems and water quality control devices
- Isolation areas to prevent contamination from neighboring experiments
- Biological pest control growth areas

Energy-Saving Design

- Recycling systems
- Thermal curtains
- Evaporative coolers
- Electronically-regulated ventilation and exhaust systems

Exhibit 6
#3-31-83

PROPOSAL FOR

CONSTRUCTION OF CONTROLLED ENVIRONMENT FACILITY

FOR

THE COLLEGE OF AGRICULTURE

AND

THE AGRICULTURAL EXPERIMENT STATION

MONTANA STATE UNIVERSITY

1983-85 BIENNIUM

Table of Contents

SUMMARY

Agriculture is Montana's leading industry. Research and education play a vital role in maintaining a healthy agriculture. Montana State University and the Agricultural Experiment Station have the responsibility of developing a sound agricultural teaching and research program for Montana.

Adequate greenhouse facilities are a vital component of agricultural education and research. They provide the necessary facilities to enhance research efficiency and provide students with "hands-on" educational opportunities. The greenhouse facilities at Montana State University are among the lowest in the nation in space per scientist, per teacher, and per student. In addition, the current facilities have deteriorated from old age to the point where they can no longer be efficiently repaired and maintained.

In order to satisfy current research and teaching needs, a new greenhouse complex at a total cost of $5.3 million is being requested. This facility represents an investment in research associated with Montana's largest industry. It also provides teaching facilities appropriate to the needs of Montana's agricultural students.

MONTANA IS AN AGRICULTURAL STATE

Agriculture is our leading industry with annual farm receipts of nearly $1.5 billion. This amount nearly equals the combined income from mining, manufacturing, travel, oil and lumber. As a food producer, Montana ranks second in barley, fifth in wheat and fifteenth in cattle production in the nation.

The State of Montana has invested (on a yearly average) the equivalent of approximately 3.5 cents per $1,000 of its total agricultural income in agricultural research. In contrast, high technology industries invest $30 to $50 per $1,000 of income in research and development. In spite of this relatively low level of investment, the Agricultural Experiment Station and the College of Agriculture have made many contributions that have benefited the education and economy of Montana's agricultural community.

Greenhouse structures are composed of glasshouses (glassed in areas) and headhouses (laboratories, soil preparation rooms, storage, etc.). Greenhouse facilities are the heart of an agricultural teaching and research program. Currently, the Montana Agricultural Experiment Station ranks last in the intermountain region both in total greenhouse facilities and in space per research faculty member (Table 1).

Table 1. Comparison of greenhouse facilities at the Montana Agricultural Experiment Station and Experiment Stations in adjoining states.

	Experiment Station					
Facility	MT	ND	SD	WA	ID	WY
	(-----in 1,000's of square feet-----)					
Greenhouse	9.7	71.2	26.2	30.3	18.0	10.0
Area (sq. ft.) per researcher	162.3	1017.0	423.0	473.0	720.0	500.0

GREENHOUSE IMPACT ON AGRICULTURAL RESEARCH

Greenhouse facilities are a vital dimension for agricultural research and teaching in Montana where the growing season is very short. Researchers and teachers are dependent upon controlled environment facilities for a major part of their work.

The following statements illustrate the importance of agricultural research and teaching to the state. They also highlight the role of greenhouse facilities in these programs.

<u>Barley</u>: Yields have increased by 10 bushels per acre over the past 10 years. Most of this increase results from improved varieties. The total yield increase of 20 million bushels annually is valued at $46.6 million. Montana has recently developed and released varieties such as Purcell, Ershabet, Ridawn, and Clark. These varieties will undoubtedly occupy significant acreages.

Frequent changes in barley varieties are the result of changing needs of industry and producers. Rapid development of new selections requires larger greenhouse facilities. The alternative is relatively expensive winter experiment sites in the southern United States. Proposed greenhouse space would facilitate development of 1) malting barley varieties adapted to Montana with the required industry quality for both two and six rowed types, 2) new waxy and other industrial types, and 3) better feed types adapted to Montana.

<u>Wheat</u>: Spring wheat varieties developed at the Montana Agricultural Experiment Station have made significant contributions to Montana agriculture. Of the record 1981 wheat crop of 173 million bushels, 83 million bushels were spring wheat. Of that total, 36% or 30 million bushels were Montana produced varieties Newana, Fortuna and Lew. Fortuna, Lew and a new line about to be released are resistant to wheat stem sawfly, permitting wheat culture to flourish in sawfly infested areas.

Winter wheat varieties Redwin, Winridge, and Rosebud, released from the MAES, are now in production or will soon be available to Montana producers. Redwin, with high yield, excellent protein content, and shatter and lodging resistance, is expected to occupy 10-20% of the 1982 winter wheat acreage. Winridge, a high yielding, stiff strawed variety, developed for the western part of the state, has TCK smut and stripe rust resistance. Rosebud, named and released in 1981, has good protein, bread-making quality and resistance to stem rust. It performs well under semi-arid conditions and will gain acceptance in the important wheat growing southeastern portion of the state.

Adequate greenhouse facilities allow several generations to be grown each year. This enables the breeder to make crosses and early generation increases during the winter season. Efficient use of research time and talent is then coupled with rapid generation turnover. This provides a much larger number of genetic combinations to be made available for testing. More and better varieties are the ultitmate result of appropriate greenhouse facilities.

<u>Forages</u>: Forage varieties recently released by the Montana Agricultural Experiment Station include "Ladak 65", alfalfa, "Eski" and "Remont" sainfoin, "Lutana" cicer

milkvetch, "Troy" Kentucky bluegrass, and "Tretana" birdsfoot trefoil.

Current forage breeding efforts are directed toward improving dryland alfalfas, increasing disease resistance and nitrogen fixation in irrigated and dryland sainfoins, increasing yield and seedling vigor in birdsfoot trefoil, increasing salt tolerance in tall fescue, and developing a new hybrid intermediate wheatgrass.

Because of our short growing season, most selections for desired traits are made in the greenhouse. Selected plants and their progeny are then tested in the field. The lack of greenhouse space and inadequate control of environmental conditions (primarily light and temperature) in the present facility are a major bottleneck in the forage breeding program. It is extremely difficult to grow adequate populations of plants for selection due to lack of space and poor control of environmental conditions. These factors make it very hard to get good repeatability among selection tests, slow down the breeding process, and result in delayed release of improved varieties.

Soil Fertility and Soil Management: The statewide soil fertility and soil management research program provides the information necessary for Montana farmers and ranchers to update their soil and cropping practices. Improved soil fertility programs are reflected in part by continued growth in fertilizer tonnage sold in Montana. From 1971 to 1980, fertilizer sales increased from 195,611 to 295,958 tons per year. This additional fertilizer has added significantly to crop yields and farmer income.

However, it is imperative to know how to use these fertilizers with maximum effectiveness and efficiency. To do this many studies must be conducted under controlled conditions, some of which will depend upon adequate greenhouse facilities. These studies include 1) determining the relation of soil nutrient status to plant disease, 2) greenhouse evaluation of different nitrogen sources in relation to soil type, 3) studying the relative importance of nitrogen from organic matter compared to fertilizer nitrogen, particularly as it relates to cropping systems research, 4) identifying the effects of soil compaction as it relates to crop nutrition, and 5) determining soil factors which regulate nutrient availability and root uptake.

These types of studies require extensive greenhouse space. They can most efficiently be carried out under controlled conditions which allow the evaluation of complex variables. As basic information becomes available through controlled environment conditions, it is then related to field applications. Lack of greenhouse facilities greatly reduces the efficiency involved in soil fertility and management research.

Plant Disease Research: In 1962, plant pathologists employed by the Montana Agricultural Experiment Station began to estimate losses to Montana farmers caused by plant diseases. Disease losses have decreased dramatically since that time. Crop yield losses were $26 million per year in 1962 and $2.7 million in 1972. This decrease is due, in part, to the development of new crop management information and varieties. Need for continuing efforts is emphasized by events during 1975. Abundant moisture conditions favored development of leaf-spot diseases in susceptible wheat varieties and reduced the value of the 1975 crop by more than $15 million.

Currently, efforts are underway to 1) develop disease resistant barley lines for Montana, the United States, and other similar areas of the world, 2) enhance export markets for wheat by controlling TCK smut, 3) develop leaf-spot and root-rot resistant cereals, 4) detect and identify viruses affecting Montana crop plants and 5) control Canada thistle and leafy spurge by the use of plant disease organisms.Green house facilities are very important to plant disease research. They provide the controlled conditions necessary to identify valuable plant-pathogen relationship research data which can later be extended to field situations.

Range Research: According to the US Forest Service, demands for meat, fiber, water and recreation in the early 21st century cannot be met with current management practices. To avoid these projected shortfalls, a federal interagency ad-hoc committee called for better trained resource managers and intensified research aimed at improving forage production through mechanical treatments, improved forage varieties and more efficient grazing systems.

This type of research requires an interaction between various faculty of the animal and plant areas of the Experiment Station. Much of the basic information required to develop better management and production systems on rangeland can be obtained under greenhouse conditions. Basic research is currently receiving little attention simply because the current greenhouse facilities are inadequate to handle this type of activity.

Land Rehabilitation: Reclamation of coal mines in Montana is defined by law as a return of the disturbed area to native range for livestock grazing and wildlife habitat. It is very difficult to gain regulatory agency approval for alternate uses. Estimates of costs of reclamation for this use are quite variable. However, industry representatives have estimated that average minimum reclamation costs are around $5,000/acre. Total land area mined each year in this state is 500 acres or more. Total reclamation expenditures, therefore, are in excess of $2.5 million per year in Montana. Coal and hard rock mine industry sponsored research with the Reclamation Research Unit at MSU has varied from $200,000 to $350,000 per year with present budget totals around $300,000. An equal or greater financial investment in research is carried out by the companies themselves.

This type of research requires understanding the relationship between plant growth and disturbed soils. In many cases, the soils contain abnormal concentrations of unusual elements. They may also have differing physical characteristics such as water holding capacity. Much of the basic information required to develop appropriate reclamation techniques can be obtained under greenhouse conditions. This allows the efficient utilization of research time and effort during periods of the year when field studies cannot be conducted. At the present time, very little reclamation research is being conducted under greenhouse conditions because facilities are not available.

Entomological Research: A newly organized area of research that will expand in scope during the next decade is that involving insect/plant interactions. Although current levels of involvement are minimal, future research projects in insect pest management will require considerable greenhouse space.

Weed Research: A recent survey showed that weeds are the major production problem for Montana farmers and ranchers. The greenhouse facility is the heart of the weed research program. Weed research projects involve plant life cycles, biological control of weeds with insects and diseases, interplant competition and chemical weed control.

The understanding of the complex relationship between weed and crop growth, control mechanisms, and interaction between weeds and diseases and insects requires extensive basic research. Much of this research could be carried out under greenhouse conditions during the winter. As this information becomes available, it can then be transmitted to field studies for further evaluation. Also, the introduction of diseases and insects for the potential control of weeds requires appropriate protection and handling facilities. It is imperative that only those diseases and insects appropriately cleared be released and distributed. To carry out a properly integrated weed research program, additional greenhouse and quarantine facilities are an absolute requirement.

The weed research program at Montana State University involves three Ph.D. faculty, two technicians, seven graduate students, and 10 to 15 undergraduate employees. We presently have one 8 sq. foot growth chamber and nine 3 x 14 foot greenhouse benches. This minimal space constitutes a major research constraint.

The biological weed control specialist needs isolation capabilities for insect and pathogen rearing. The herbicide specialist also needs isolation from other workers, and our weed physiologist is in need of growth chamber facilities. Regardless of the field of weed science, a specialist must work with weeds at a specific stage of growth. For this reason, the greenhouse and growth chamber represent the heart of a weed research program.

Horticultural Research: According to 1978 statistics provided by the State Statistician's Office, production of horticultural crops represented an income of over $32,000,000 to Montanans. Crops and services included in these figures are vegetables, services, tree fruits, greenhouse and nursery crops, and landscape design. In spite of this Montana production, much of the horticulture consumed in Montana was shipped from other states. Increasing shipping costs have increased the competitive advantage of Montana's producers over the last decade, but there is still potential for increased production of these high value crops in Montana. Greenhouse facilities play a key role in research and evaluation of horticultural crops.

The seed potato industry has played a major role in the improvement of this crop for Montana and the Western Region. The identification of diseases in the potato seed stocks is key to maintaining a viable, healthy industry. Laboratory and greenhouse facilities are needed to maintain this testing and evaluation program.

GREENHOUSE IMPACT ON TEACHING AGRICULTURE

The 1980 USDA report "Graduates of Higher Education in the Food and Agricultural Sciences," made the following statement:

"If the United States is to continue as the lead nation in confronting problems associated with increasing global population and decreasing agricultural and natural resources, it must possess the requisite human capital--individuals with higher education in the food and agricultural sciences.

During the early 1980s, the total average annual demand for college-educated graduates in the United States in the food and agricultural sciences--including agriculture, natural resources, and veterinary medicine--is expected to exceed the available supply by 15 percent.

An especially short supply of individuals having advanced degrees is expected in the food and agricultural sciences during the mid-1980s. The most significant shortages are foreseen in agricultural business management, agricultural engineering, animal sciences, food sciences, plant sciences, soil sciences, forest engineering, forest products utilization, and veterinary medicine specialties such as regulatory medicine and pathology."

The College of Agriculture currently does not have sufficient greenhouse facilities to educate these individuals. Because of increased teaching demands, research projects are forced into cutbacks or delays in order to partially accommodate teaching functions. The number of students and faculty using the greenhouse has increased greatly since the current facilities were constructed. The facility is outdated and inadequate for today's needs. The following statements illustrate the serious effect of greenhouse facilities shortages on teaching capability.

Range Science and Land Rehabilitation

Sixty to seventy percent of the employment opportunities for MSU graduates in both fields are with the federal government. The Civil Service qualifications for Range and Soil Conservationists specify training in rangeland ecology (RAS 306 and RAS 504) and range improvement practices (RAS 404, LREH 401 and 402). Because of these specific requirements, the quality of MSU's Range Science and Land Rehabilitation programs is judged by our students' performance in the field. The level to which MSU graduates will perform is directly related to their educational experience.

Two of the Range Science faculty attended a week-long teaching improvement workshop during September, 1981. Unfortunately, many of the innovative teaching techniques presented during the workshop cannot be fully applied due to the lack of facilities for "hands-on" experience. This reduced learning opportunity is particularly critical for students of Range Science and Land Rehabilitation.

A total of 137 students were enrolled in Range Science and Land Rehabilitation courses Fall and Winter Quarters, 1981-1982. This amounts to 6 percent of the College of Agriculture enrollment being directly affected by lack of greenhouse facilities.

Plant Pathology

Currently there are 27 graduate students, post-doctoral fellows and visiting scientists connected with the Department of Plant Pathology who require greenhouse space for their research activities. If the current level of activity is to be maintained and the department's extensive involvement with international agricultural research is to increase, more greenhouse space will be required.

Plant & Soil Science

Horticulture: Teaching Plant Propagation (P&S 310) cannot be done without greenhouse and associated laboratory facilities. Many horticultural crops are propagated in greenhouses throughout the United States. In Montana, due to cold weather during fall, winter, and spring quarters, and part of the summer quarter, many methods of plant propagation must be conducted inside a greenhouse. Identification of ornamental plants (P&S 305, 406) utilizes the "tropical room" of one greenhouse section, the only section devoted exclusively to teaching. Plant Science in Agriculture (Ag 102) and Horticultural Practices (P&S 205) require a great deal of greenhouse space and connected laboratory to prepare plants for class use. It is in these courses that students receive exposure to a broad range of plant material.

Turf Management (P&S 301) and Nursery Management (P&S 407) also require greenhouse space. These horticultural courses cannot be taught without access to greenhouse facilities.

Agronomy: The greenhouses are used to a limited extent in teaching Forage and Pasture Crops (P&S 320), Seed Production and Processing (P&S 303), Weed Control (P&S 319) and Crop Breeding (P&S 404) to provide valuable firsthand experience illustrating the topics discussed in lecture. More of this type of experience is required to provide an adequate educational experience in agronomy. In the area of pest control, additional greenhouse and laboratory space is needed to effectively teach pest management. This includes insect vectors associated with biological weed control and integrated pest management.

Soils: The greenhouse is a necessary tool providing hands-on experience to students in Soil Resources (P&S 201). "The greenhouse is to these courses what the chemistry lab is to a chemistry course."

Individual Problems: The Individual Problems course (P&S 420) is an integral and required part of every B.S. degree conferred by the Plant and Soil Science Department. This project exposes the students to the scientific method of conducting research to solve specific problems and the application of scientific principles to everyday experiences. The greenhouse is often necessary to simulate field conditions during the winter months when the Agronomy and Horticulture field research laboratories can not be utilized. All disciplines in the Plant and Soil Science Department make extensive use of the greenhouses in 470 projects for the growing of plants, study of herbicides, fertility, propagation, plant growth regulators, and seed quality.

Graduate Student Research (P&S 590) requires concentrated use of the greenhouses. The ability of the Plant and Soil Science Department to educate graduate students is severly limited by current greenhouse facilities.

Crop Protection (Integrated Pest Management): As previously suggested, undergraduate and graduate courses in this new area will require greenhouse support and capabilities.

RESEARCH AND TEACHING EFFICIENCY REDUCED BY INADEQUATE GREENHOUSE FACILITIES

The lack of greenhouse space is affecting the productivity of the Montana State University teaching and Experiment Station research programs. Sixty percent of the agricultural research time (Oct.-May) for many research projects teaching activities should be spent in the greenhouse facility. The greenhouse complex at Montana State University has been increased but little in size since it was built in the early 1950's. On the other hand, faculty and research projects and have increased 300%. Many researchers and teachers are faced with program cutbacks or major delays in productivity due to inadequate greenhouse space. The following are examples of reduced efficiency due to inadequate greenhouse facilities.

RESEARCH

Small Grain Breeding

Spring Wheat Breeding - This project does not have any greenhouse space to make crosses during the winter from plants produced the previous year in the field. Currently it takes two years to produce the same amount of crosses that could be made in one year with adequate greenhouse space.

Winter Wheat Breeding - Space is not available to develop winterkill and drought resistant varieties. Space is only available to make crosses missed or those that are not easily made in the field during the summer. Low temperature vernalization areas are not available to evaluate plant material for winterhardiness. Field experiments are inadequate since several years may pass without adequate differential winterkill. Greenhouse space would allow for making crosses during the winter season. The current operation takes two years in the field but could be completed in one year with expanded greenhouse facilities.

Present and planned research requiring expanded greenhouse facilities is designed to 1) develop new winter-hardy wheats adapted to semi-arid conditions, 2) develop better levels of resistance to TCK smut, 3) improve the protein quality and quantity in winter wheat, and 4) develop long-lasting resistance to several diseases by incorporating genetic diversity into breeding materials. A new research effort to develop elite wheat germplasm lines for use in variety breeding programs is being established as a cooperative effort with the United States Department of Agriculture.

Barley Breeding - Greenhouse space is inadequate to develop high quality, drought-resistant varieties. Space is only available to make crosses missed or those that are not easily made in the field during the summer. The barley research project depends on Arizona State University to make winter crosses since greenhouse facilities are not available in Montana. The barley program is faced with serious cutbacks since Arizona will only be able to assist this program on a temporary basis. With adequate greenhouse and winter nursery facilites, three seed generations per year can be achieved.

Forage Breeding

Greenhouse space reductions in 1979 and 1980 for alfalfa, birdsfoot trefoil and sainfoin breeding have forced a 25% reduction in the forage program. Isolation rooms are not available to make crosses from plant material produced in the field. Space constraints are doubling the time necessary to produce new forage varieties. Many experiments have been damaged due to inadequate light and temperature control.

No research space is available in the Experiment Station greenhouse for breeding work with forage grasses such as western wheatgrass. The current forage grass program is being temporarily housed in the U. S. Forest Service Greenhouse. This program faces serious cutbacks due to lack of permanent greenhouse research space.

Soil Fertility and Management Research

Researchers have to alternate their greenhouse experiments since only half the needed space is available. Several research programs have been forced to rely exclusively on field research. Research determining the effects of soil fertility on plant diseases and the development of new and more reliable soil testing procedures have been delayed due to lack of space. Many soils and land management research projects depend upon expanded greenhouse space.

Plant Disease Research

Space is not available for seedling tests for disease reaction. Pathologists do not have space to work with plant breeders to develop better and more disease resistant varieties. Disease resistance research is restricted to the field due to lack of greenhouse space. This results in at least a one year delay for every year of research productivity.

Decontamination, incubation, and isolation rooms are available for only 50% of the disease control research projects. Researchers are forced to use the space on an alternating basis. This situation has led to many delays and failures in research projects.

Range Research

Research productivity for Range Science personnel is also reduced but is difficult to quantify. Because of the lack of bench space and environmental control, this staff does not seek funding for research projects which would require greenhouse work. The one greenhouse study that is currently underway is being temporarily conducted in the U.S. Forest Service greenhouse because of available space and better temperature and light control. If better facilities were available, an increased effort for acquisition of research funds would be undertaken by Range Science personnel.

Land Rehabilitation Research

A variable segment of the Reclamation Research Unit's studies require protected plant growth areas. At the present time, one staff member and five students are utilizing greenhouse space. Last year, only one student and one staff member were studying plants in controlled environments. Next year, we anticipate that two staff members and more than five students will require greenhouse benches for plant growth trials.

Crop Production Physiology

Greenhouse space is extremely limited for crop management and production research. Additional space would allow plant physiologists to become more involved with crop breeding and soil fertility research. Controlled temperature and light facilities are needed to assist in improving crop quality and yield.

Weed Control Research

Weed researchers estimate that a 50% increase in space would result in a doubling of research productivity. Plant growth facilities are not available to study weed life cycles and chemical spraying techniques. Space restrictions do not allow weed control technology to keep pace with current and new weed infestations. No facilities are available for quarantine and isolation associated with biological weed control work.

Residential Land and Small Rural Farm Research

No greenhouse space is available for research on alternative and new crops. Space for residential and small farm management research is extremely limited. Researchers are forced to use the space on an alternating basis.

TEACHING AND TRAINING

At the time the MAES greenhouses were first put into operation, the College of Agriculture had an enrollment of 400 undergraduate and graduate students. During the 1981 Fall Quarter, there were 1109 students enrolled in the College of Agriculture. Over the years, increasing research demands on the greenhouse facilities have reduced the space which may be devoted to teaching, while the need for teaching space has increased. If the College of Agriculture is to effectively fulfill its responsibility to teach up-to-date principles and techniques of agriculture, its greenhouse facilities must be enlarged and updated. The following are examples of deficiencies in the MSU greenhouse related teaching areas.

Plant & Soil Science Department: One of the major limiting factors in teaching is the lack of space and up-to-date facilities in the greenhouses. The lack of proper lighting for extending day length prevents many students from benefiting from the practical experience which can only be gained in a greenhouse during the winter months. Those courses which currently utilize the greenhouses could be strengthened if space and facilities were not limiting. The strength of these courses depends in large part on the hands-on experience gained in working with living plants. During the winter, this can only be done in the greenhouse.

Plant Pathology: When the present greenhouses were finished, one plant pathologist was conducting research and graduate training. Now, in the same space, thirty-five staff and graduate students from the Department of Plant Pathology are attempting to carry out research. Much of the research in the plant disease area can be conducted during the winter season under greenhouse conditions. To efficiently use the research faculty and graduate student resources, greenhouse facilities must be expanded. Plant virus research includes viruses transmitted by aphids, mites and other insects. The association between host plants and insects and evaluation of pest-resistant plant breeding lives cannot be done without greatly expanded greenhouse facilities. This will significantly impact the stability of Montana grain production.

Animal and Range Sciences Department: Range Science and Land Rehabilitation courses RAS 306, RAS 404, RAS 504, LREH 401, and LREH 402 suffer from the lack of greenhouse space. The opportunity for students to observe and manipulate seed, seedling, and mature plant response to edaphic, temperature, and moisture conditions would make a measurable improvement in their educational experience.

CURRENT GREENHOUSE CONDITIONS

The original greenhouse complex at Montana State University was built in 1952. Additions were made in 1959, 1972, and 1974. The faculty and student body has increased 300% and 400% respectively since 1952. Poor physical condition of existing greenhouse facilities and the lack of additional space are causing many delays or failures in research programs. Major problem areas in the existing facilities are as follows:

1. Sixty-four percent of all space does not have lights. Artificial light is critical for growing plants during the winter months due to cloud cover and short daylight periods.

2. Forty-five percent of the greenhouse space does not have cooling or exhaust systems. Plants overheat on sunny days and experiments are damaged.

3. The wiring system for the greenhouse is completely inadequate. The transformer and wiring are constantly overloaded. All of the lights and other electrical equipment cannot be operated at the same time. Fire potential is serious.

4. Fifteen percent of the benches need to be replaced due to rotten wood.

5. Flooring is rotten and unsafe in some areas.

6. Isolation rooms or partitions are not available to reduce contamination between experiments.

7. Preparation rooms are either inadequate or nonexistent for many research and teaching-related functions described previously.

Current and future research and teaching demands cannot be met without renovation and expansion of greenhouse facilities.

REQUEST FOR NEW GREENHOUSE AND HEADHOUSE FACILITIES

Greenhouse structures are composed of glasshouses (glassed in areas) and headhouses (laboratories, soil preparation rooms, storage, etc.). Montana State University currently has 9,746 sq. ft. of glasshouse and 7,675 sq. ft. of headhouse. Due to structural deterioration in three wooden frame glasshouses, we request that 6,900 sq. ft. be replaced with new glass structures. We further request the addition of 22,875 sq. ft. of new glasshouses. This will bring the total new and existing glasshouses to 32,621 sq. ft.

Of the 7,675 sq. ft. of headhouse currently existing, 5,775 sq. ft. are in a state of deterioration that is uneconomical to repair and must be replaced. We request, in combination with replacing the deteriorated portion of the headhouse, that 9,725 sq. ft. of new headhouse be added to give a total combined new and existing size of 17,400 sq. ft. assignable space. This will make additional space available for support activities such as potting media preparation and storage. It will also allow research and teaching support activities to be carried out within the greenhouse complex, circumventing weather problems when plants are transported between labs and the greenhouse. This will also lessen the chance of an accident in which the public may be exposed to hazardous and caustic materials frequently used in greenhouse research. Facilities will be included to address special research needs such as those associated with biological weed control work. About 2,000 sq. ft. of assignable space has been identified for the potato certification program.

These facilities will allow the teaching of greenhouse related courses which is currently being done at times at the expense of research. They will also be utilized to better familiarize and involve the public with the teaching and research activities of Montana State University. The design we are requesting separates the research and teaching areas of the facility and increases safety and security within the greenhouse.

Glasshouses (Replacement and New Construction)

Objectives and functions.

A. Isolation capacity to prevent interference or contamination by non-compatible research programs.

   1. Negative pressure (isolation) rooms.

   2. Isolation area for biological pest control research.

B. Adequate climate control within each glasshouse to include:

   1. Timers and electric controls for artificial lighting.

   2. Research grade thermostats.

   3. Custom ventilation and exhaust fans to limit contamination problems.

   4. Evaporative coolers.

   5. Shading materials.

   6. Black-cloth and supports for controlled light-dark experiments.

   7. Thermal curtains.

C. Movable benches to reduce wasted space in "aisles". Benches should also be removable to allow the use of "floor beds".

D. Water tempering system in all glasshouses.

E. Mist system and controls in one glasshouse.

F. Energy saving design. Vent heat from growth chambers, soil pasteurization, etc., into glasshouses.

G. Sufficient space to accommodate the Montana Potato Growers disease testing program.

Headhouse

Objectives and functions.

A. Plant processing area.

1. Plant inoculation facilities.

2. Isotope handling.

3. Herbicide handling.

4. Plant grinding.

5. Soil grinding.

6. Plant physiology.

B. Teaching area.

1. Supplemental space for those courses which require plant materials for student use and identification.

a. Courses which will utilize this space on a two-four hour per week basis are:

1. Range Science and Land Rehabilitation 306, 401, 402, 404, 470, and 504.

2. Plant Pathology 301, 402, 470, and 532.

3. Plant and Soil Science 201, 205, 301, 303, 305, 308, 310, 319, 320, 404, 405, 406, 407, 509, 514, and 525.

4. Agriculture 102.

b. Instructional areas should be large enough to accommodate 15 students under laboratory conditions.

2. The teaching areas would be used on a part-time basis to supplement other on-campus teaching laboratories. However, some courses at the present are not utilizing greenhouse grown materials because of lack of space and/or convenience of use. The use of the teaching area by instructors will vary depending on the course. Many instructors will only use the space once or twice a quarter, whereas others will use the same area on a weekly basis. Therefore, a minimum of three class laboratories is needed to limit room scheduling conflicts.

C. Growth chamber rooms.

1. The area designated for growth chambers should be equipped with the proper electrical capacity and plumbing and ventilation for approximately 40 growth chambers. The growth chambers are not included in this proposal.

D. Growth media (soil) preparation.

1. Area is needed on the main floor for media storage, grinding, mixing and sterilization.

E. Container and pot washing.

F. Greenhouse plant preparatory rooms.

1. One for every two greenhouses.

2. This area will be used for planting, applying soil treatments and harvestng plant material.

G. Cold storage rooms for conditioning and storage of plant and seed materials.

1. Temperature controls must be of precision quality, i.e. maintain actual temperature within 1 or 2°C of desired temperature.

2. Sufficient room must be available to accommodate the Montana Potato Growers disease testing program.

H. Storage areas.

1. Sufficient space should be provided for storage of plant containers, fertilizer, chemicals, greenhouse benches, synthetic soil media, research equipment and temporary storage for equipment and supplies of individual researchers.

I. Headhouse should be equipped with:

1. Water still.

2. Fertilizer injector.

3. Air compressor.

4. Freight elevator.

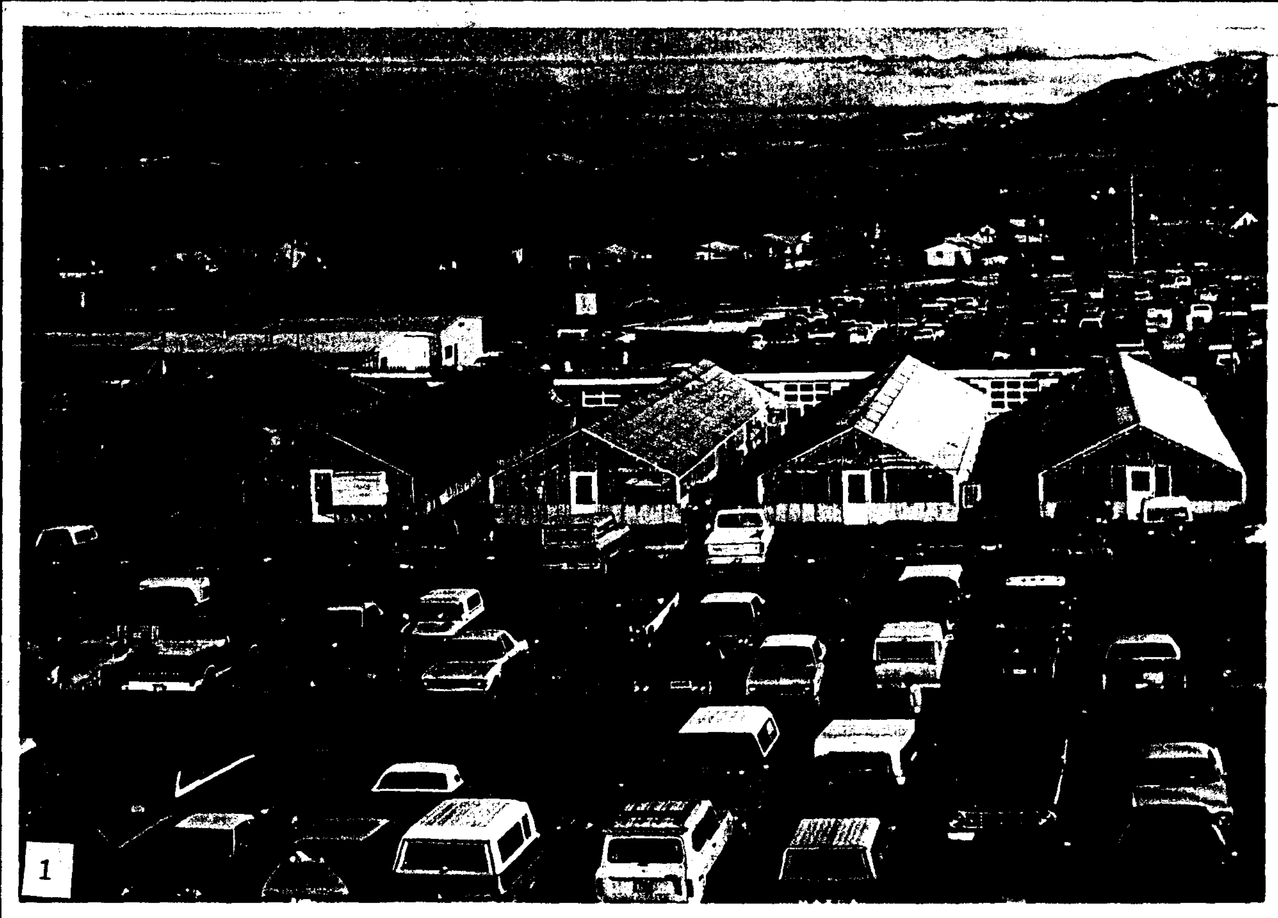
J. Headhouse should have a basement which can be used for storage, mechanical rooms, additional plant processing space and a maintenance shop.

Estimated Cost

Preliminary Expenses	
Site Survey	$ 2,000
Soil Testing	3,000
Other	5,000
Construction Cost	4,285,000
Architectural/Engineering Fees	337,500
Utilities	200,000
Landscaping and Site Development	20,000
Equipment	250,000
Contingencies	200,000
TOTAL	$5,302,500

1. AERIAL VIEW OF PRESENT FACILITY

2. SIDE VIEW OF PRESENT FACILITY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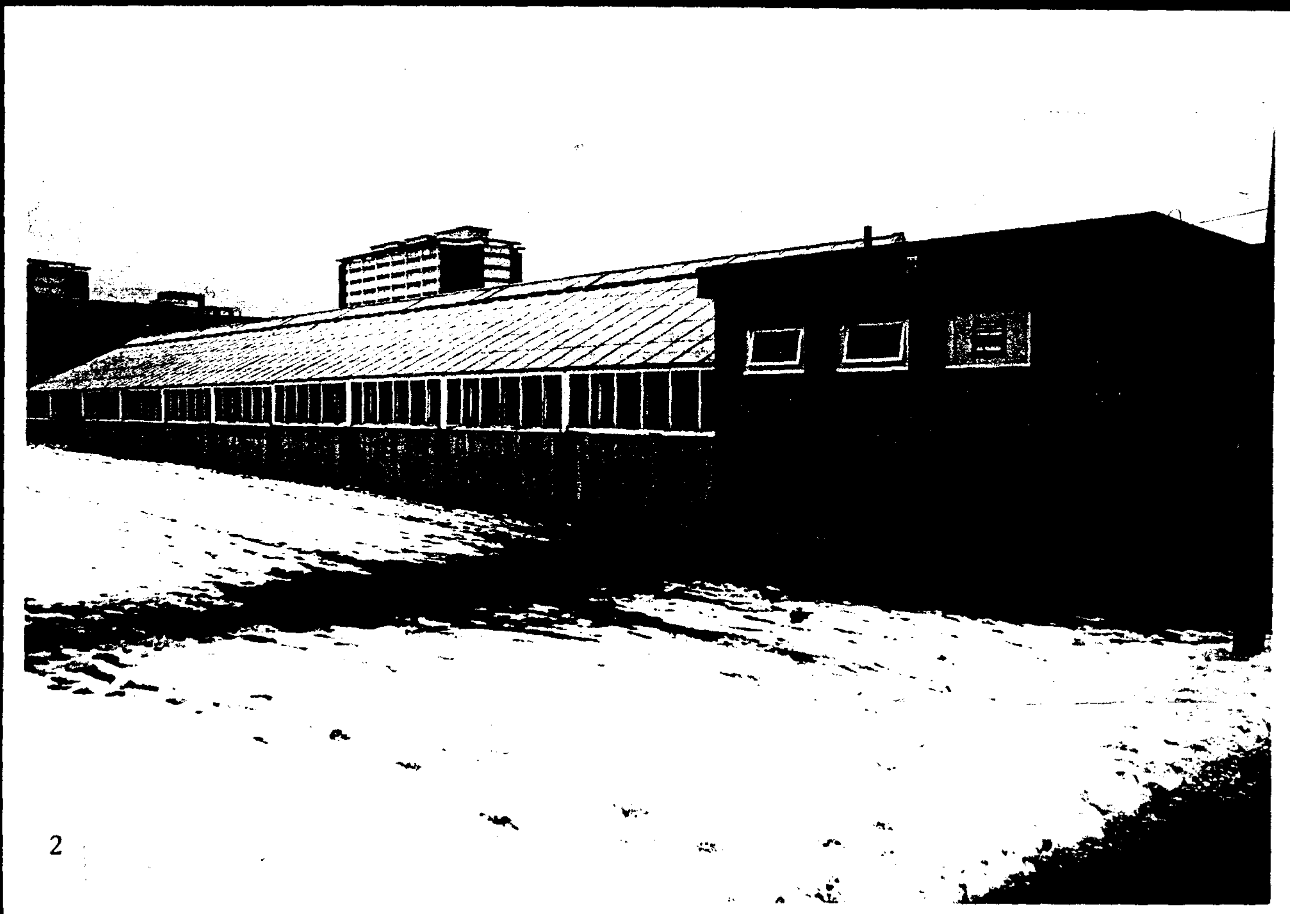
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3. TYPICAL EXTERIOR CONDITION SHOWING WOODEN FRAME DETERIORATION

4. INTERIOR VIEW SHOWING LACK OF ISOLATION AMONG SPECIES

5. ANTIQUATED GROWTH CHAMBERS

6. TOTAL USEABLE SPACE FOR TEACHING AND RESEARCH

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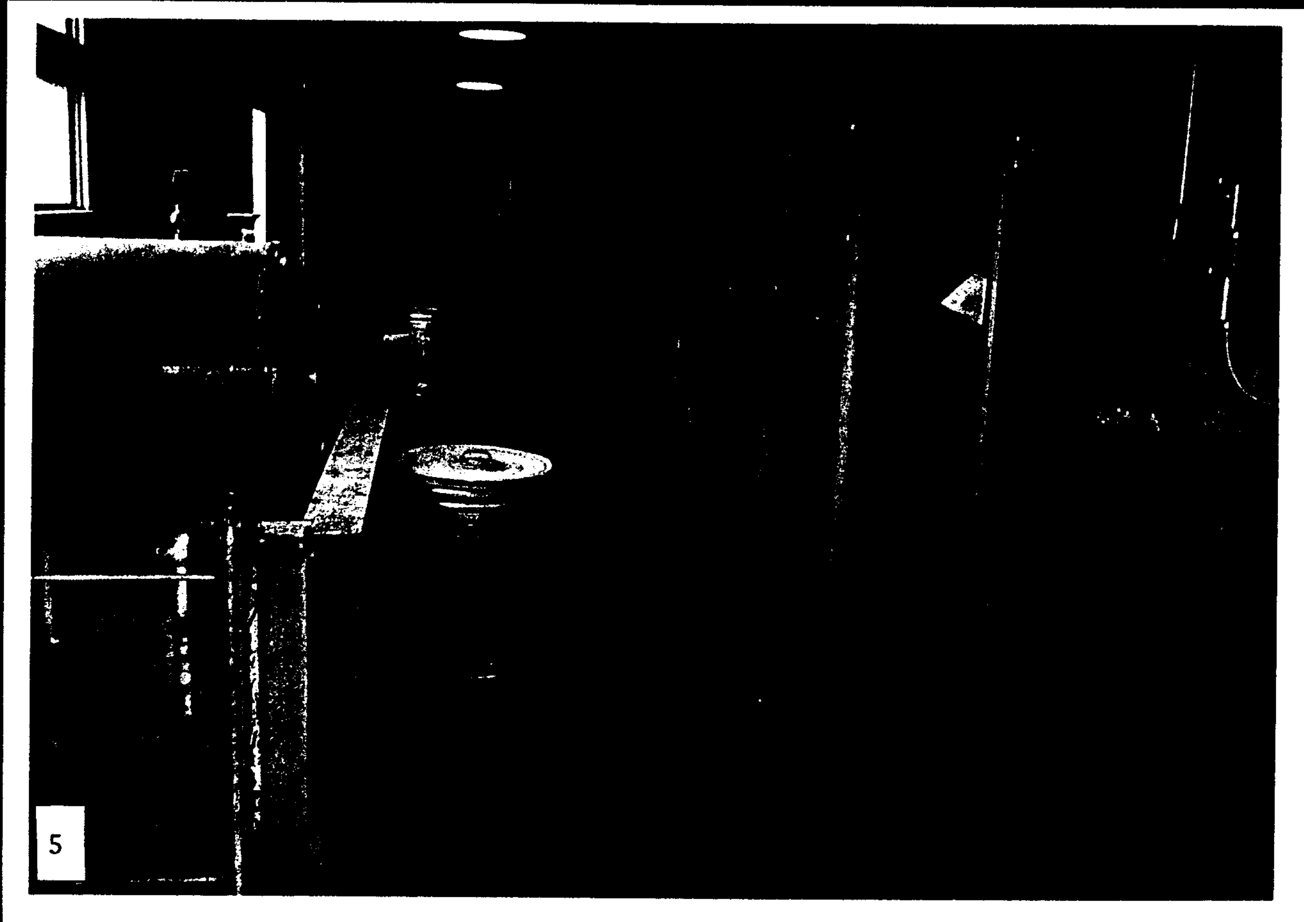

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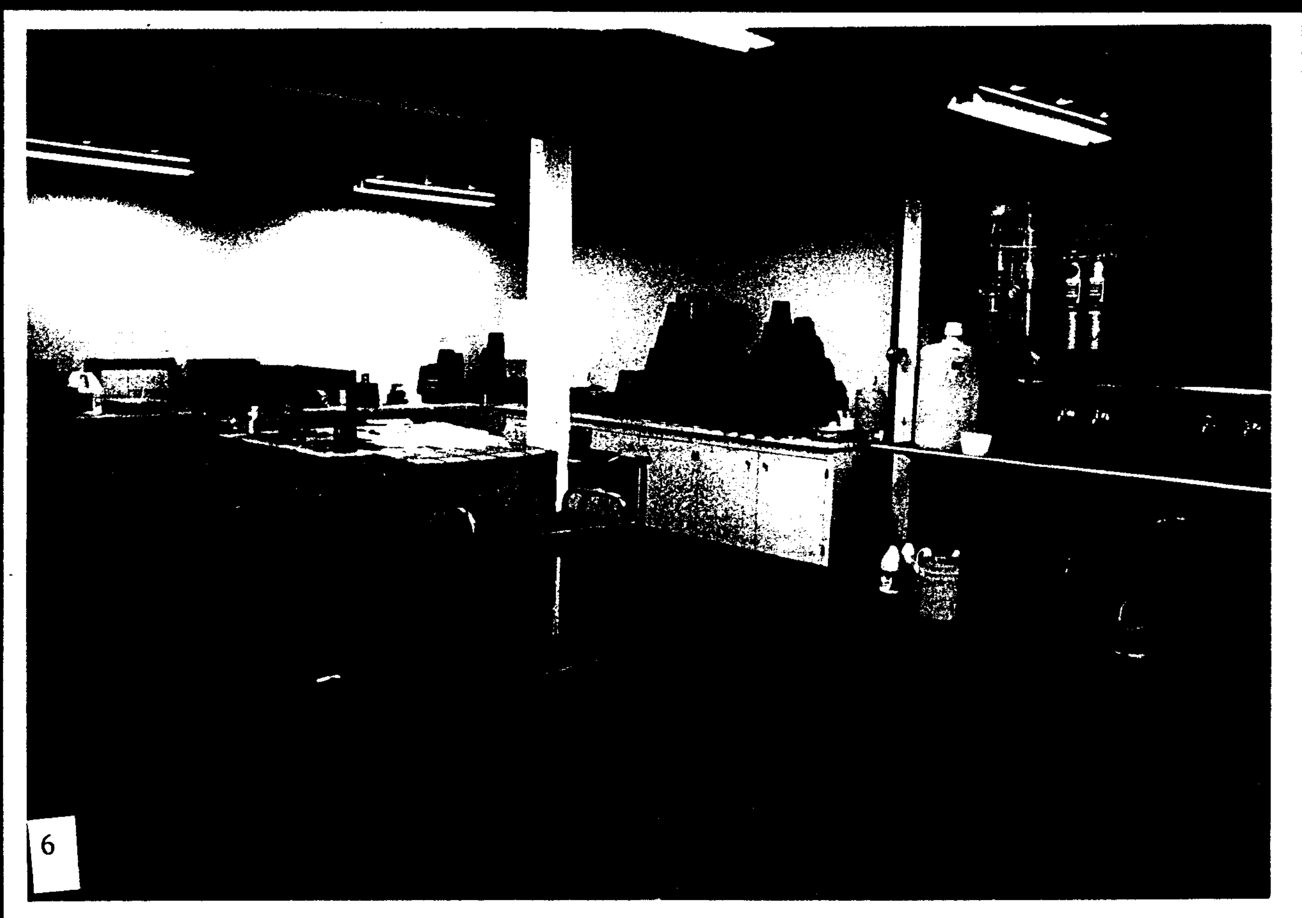

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7. INSTRUMENTATION REQUIRED OF MANY RESEARCH STUDIES. DEMONSTRATES LACK OF ISOLATION AND ENVIRONMENTAL CONTROL.

8. INEFFICIENT UTILIZATION OF HIGH COST AUXILIARY LIGHTING

9. SOIL HANDLING FACILITY FOR CURRENT STRUCTURE

10. EXAMPLE OF INADEQUATE, UNSAFE ELECTRICAL SYSTEM

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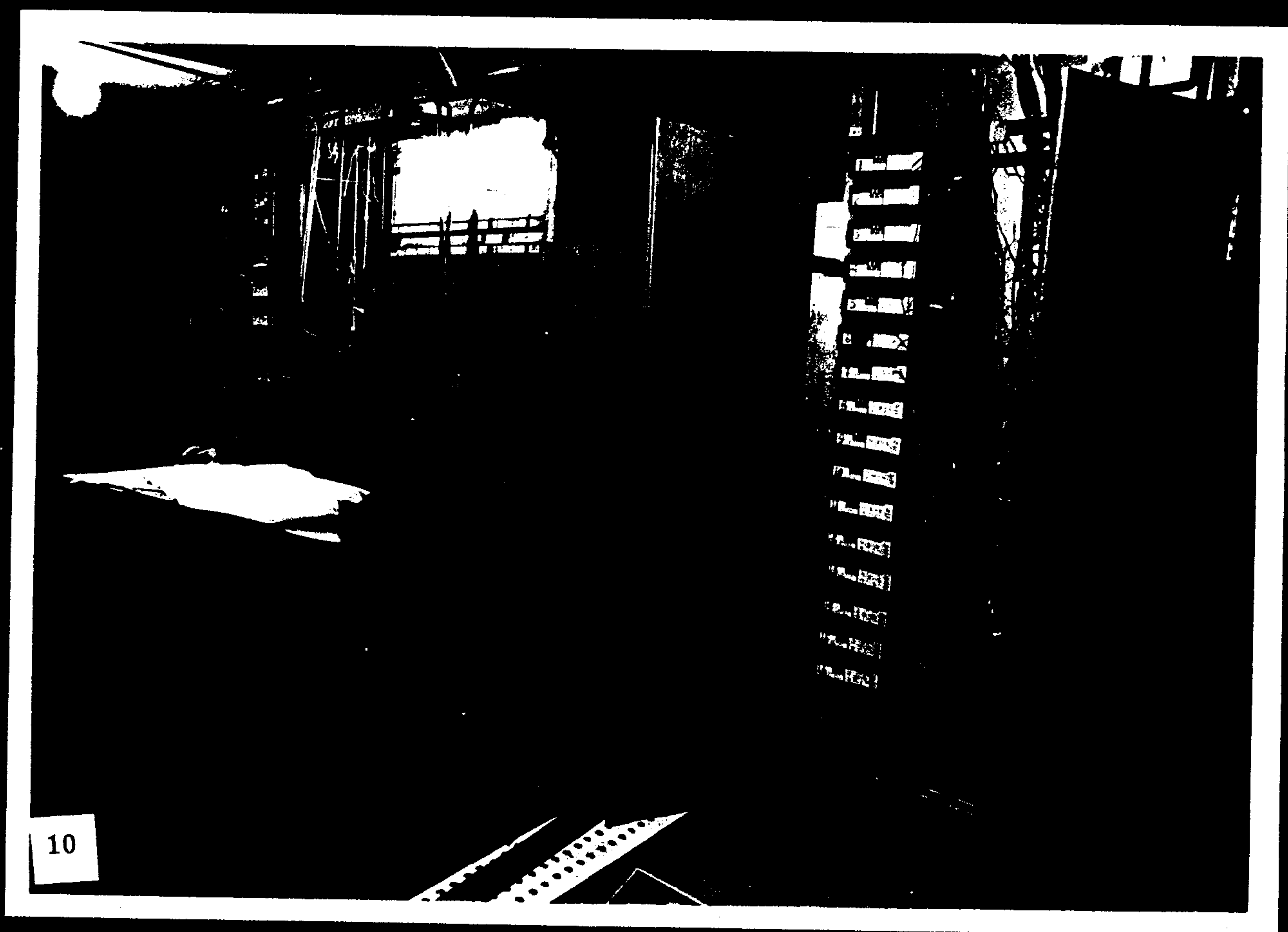

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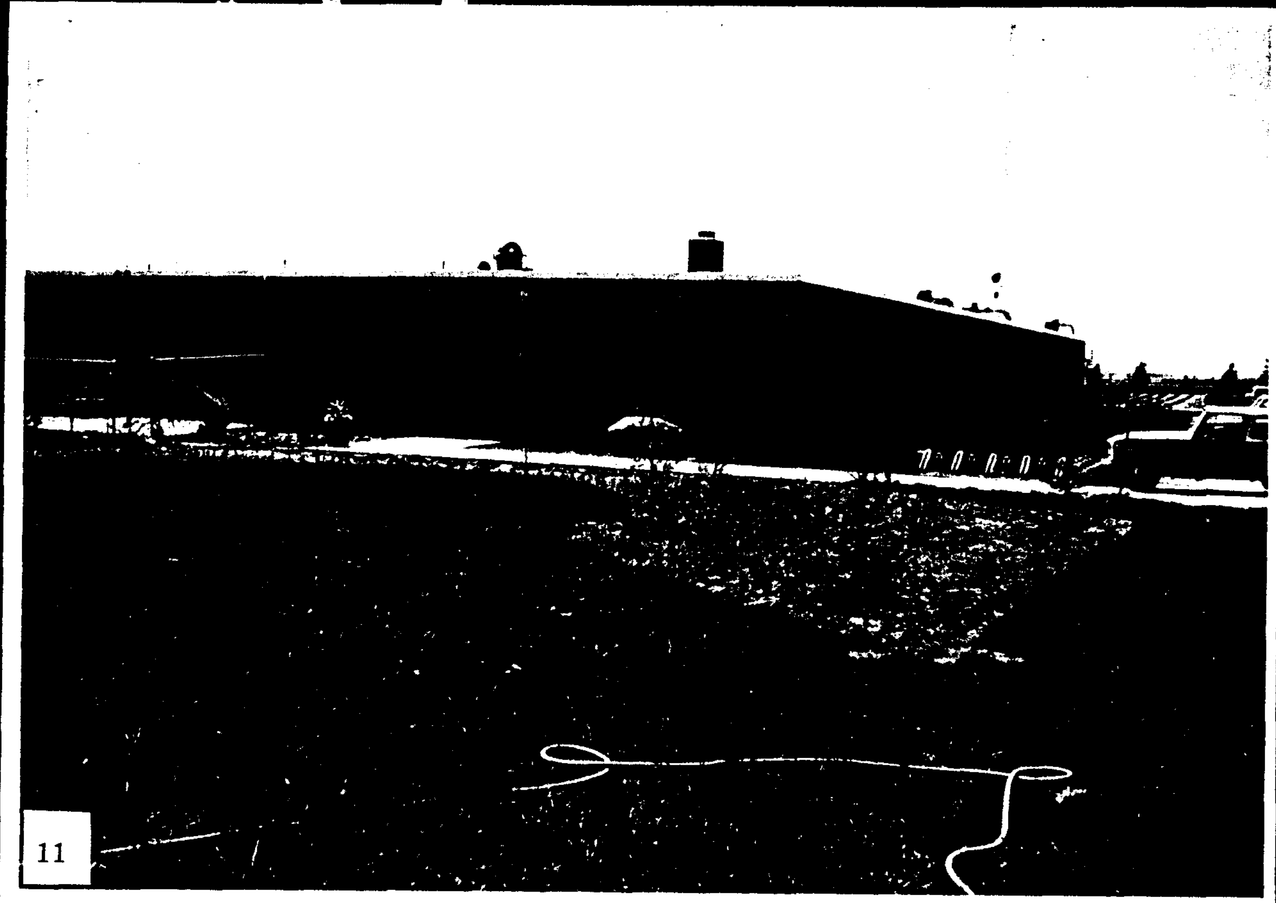

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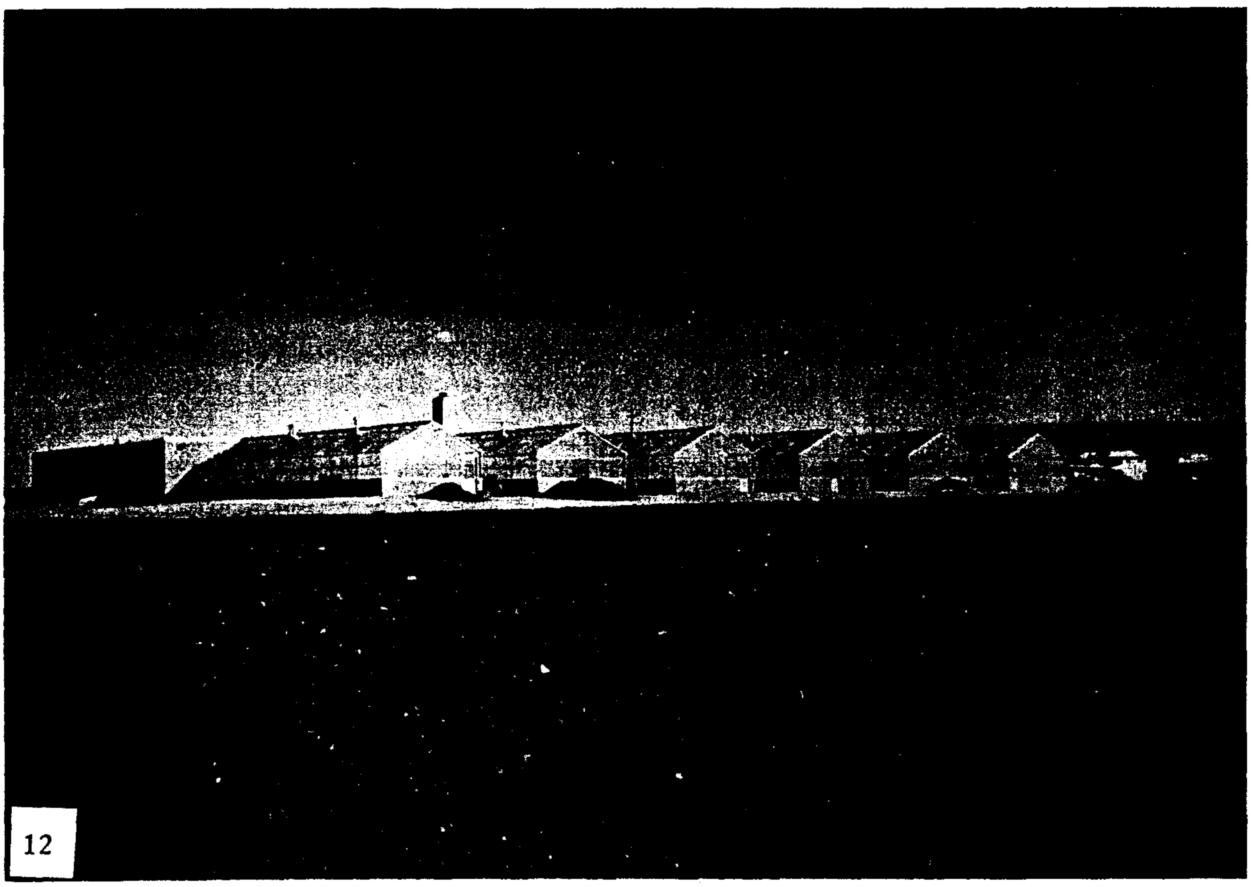

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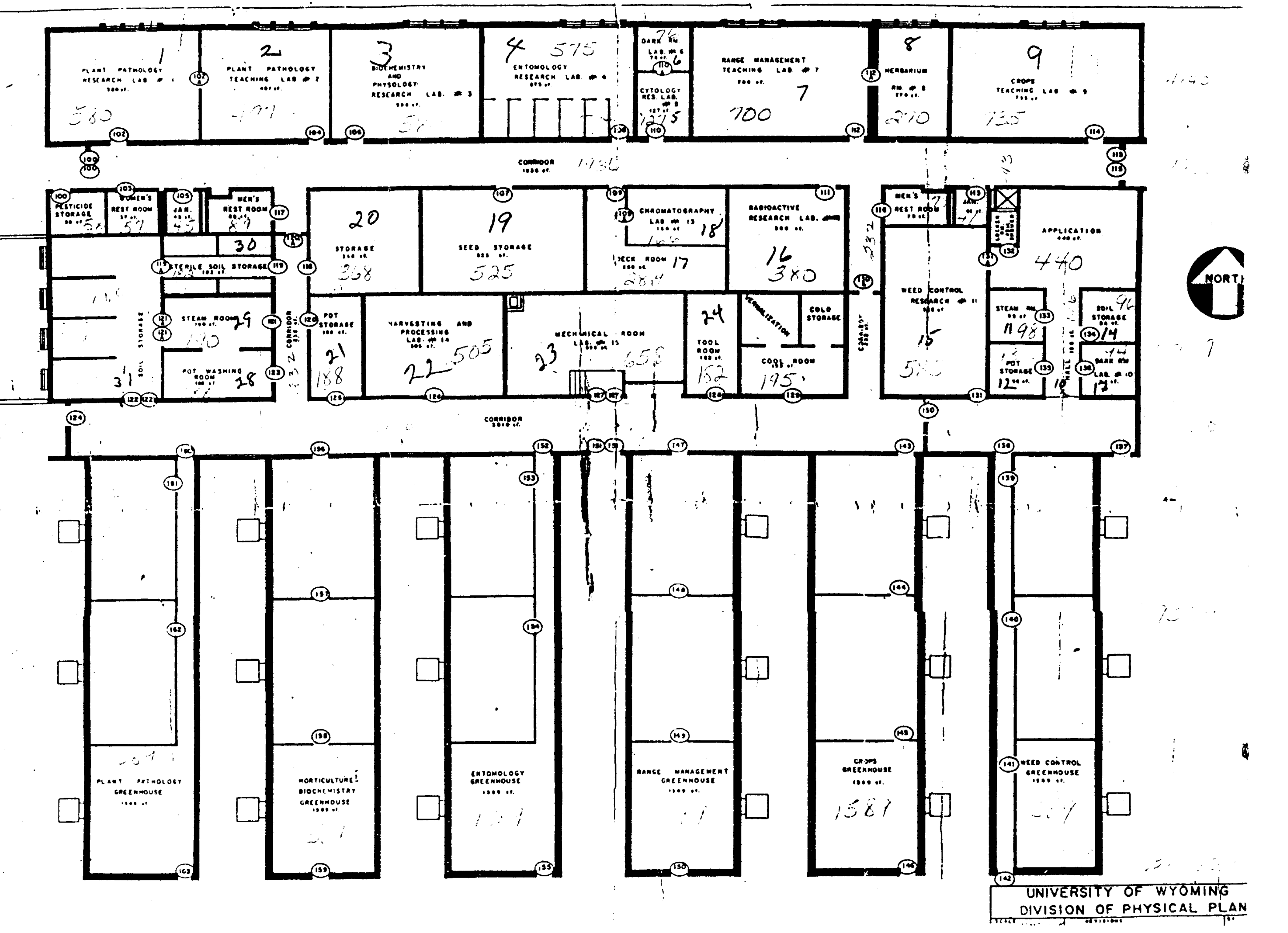
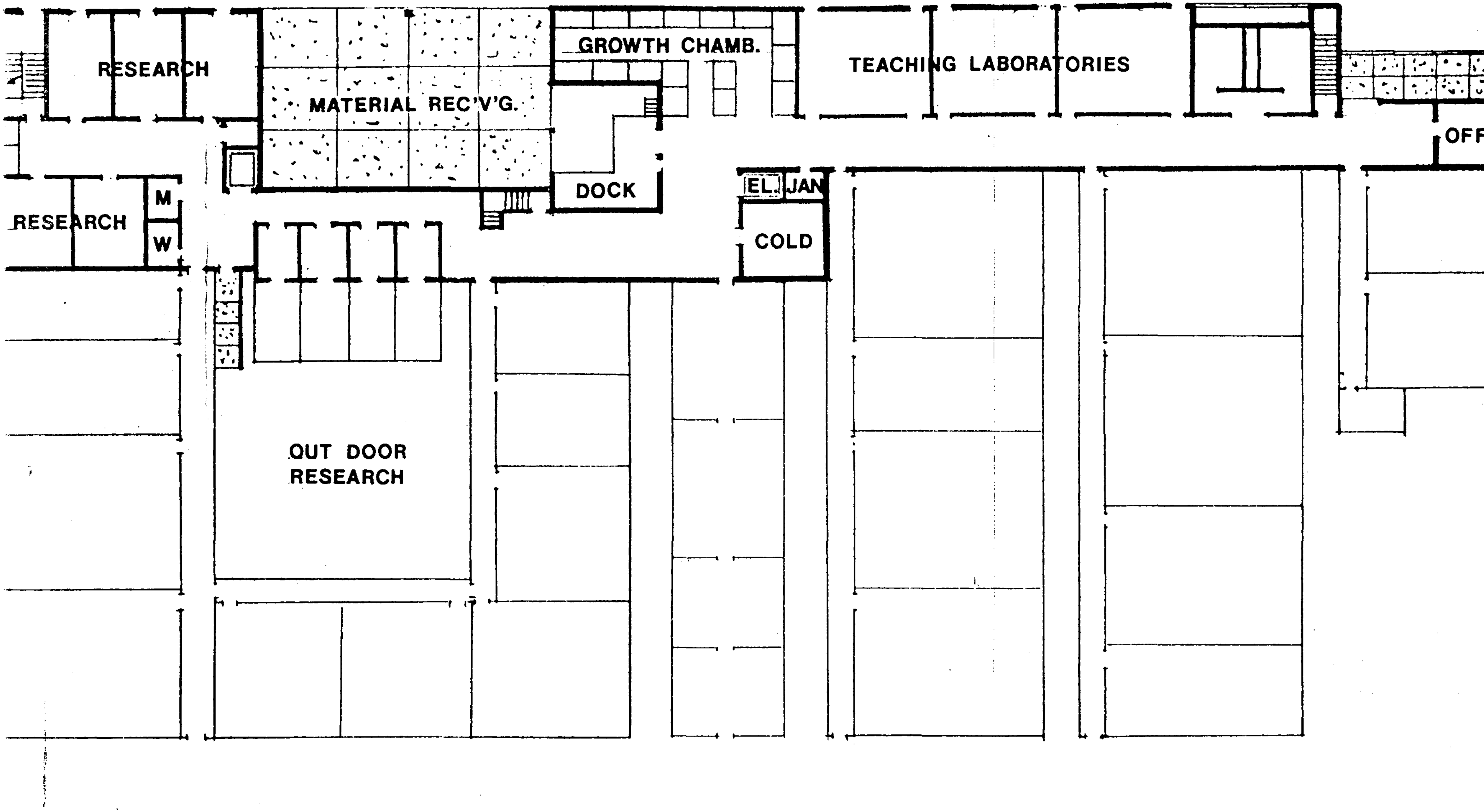
11. CONTROLLED ENVIRONMENT RESEARCH AND TEACHING LABORATORY, UNIVERSITY OF WYOMING

12. CONTROLLED ENVIRONMENT GREENHOUSES, UNIVERSITY OF WYOMING

PLANT SCIENCE LABORATORY—GREENHOUSE COMPLEX





A CONTROLLED ENVIRONMENT FACILITY

MONTANA STATE UNIVERSITY

STATEMENT BY DWANE G. MILLER, 3/31/83

Crop agriculture is one of Montana's leading industries. Income from crops ranges from 40-60 percent of the total agriculture income in the State depending upon yearly factors. Research to support this industry, and education to provide new information and train new people, are important in maintaining a viable crop agriculture for Montana.

Adequate plant growing facilities are a vital component to many departments who must utilize a controlled environmental growing space at Montana State University. We urgently need this facility to extend the "growing season" to a year-round process. As I am sure you are aware, when the University is in session during the winter months, most plants cannot be grown outside. Thus it is important to have facilities of this nature for growing plants to be used by students in their studies.

These facilities are as critical to us in the plant sciences as a chemistry lab is to a chemist, an art studio is to the artist, and a lecture room is to the English professor. The facilities are a vital component of our educational, research and service programs.

The current facility is literally worn out and in most cases has deteriorated to a point where maintenance is no longer possible. For example, four of the five built in growth chambers do not operate and are just used for storage. Many faculty do not use the facility because their specialty needs cannot be met or for fear of losing the experiments because of faculty equipment. Let me cite an example.

Our Biological Weed Control scientist has no place to properly conduct research on plants without fear of the insects being tested infecting other plants in the same growing area. Disease tests offer the same problem. A scientist working with diseases on one bench often can infect plants on another bench where healthy plants were wanted by another researcher.

The facility is very important to our educational programs. The number of people using the current facility has increased some 300 percent since 1952. In the Plant and Soil Science Department alone we have 50-60 graduate students, 10-12 technicians, 26 faculty, 3 USDA scientists, and 9 Extension specialists who use the facility. In addition we have 140 undergraduate majors and approximately 60 part-time student laborers utilizing the facility. There are now approximately eight departments extensively using the plant growth facility compared to two in 1952. When one multiplies the numbers given above for Plant and Soil Science times eight this can give you an idea of its need by people. Sixty to seventy percent of our year's teaching and research is done inside from October through May. There is considerable use of the facility in the summer but this is reduced compared to the winter months.

The majority of our classes in agriculture and other biological sciences still have labs associated with them to give students "hands-on" experience in order to carry out their learning beyond the lecture and textbook. Very limited space is now available for direct use by students to grow plant material for laboratory purposes and no teaching classrooms exist in the current building. In my department alone, we average approximately 12 classes per academic year with some 1,500 students taking labs where learning plant materials is necessary and growing facilities are a must. A new facility with classrooms and plant growth rooms for student use would allow us to do a much better job in teaching the laboratory phases of our classes.

Research is another major activity in a controlled environmental growth facility. In this regard the facility provides controlled growing conditions (temperature, water, soil, and light) enabling scientists to conduct research the year-round. This extension of the growing season is particularly important to allow research in the field to continue during the long winter season. We cannot turn research off and on. It must continue all year for the best efficiency of scientists' time and the fastest return for the dollar invested.

Our plant breeding program in winter wheat currently grows one generation in the field and a second generation in the greenhouse--two generations per year. Many plant breeding firms grow plant material in the northern United States, move that to the southern part of the United States, and then move on into Central and South America in order to grow three to four generations per year. Obviously this process is extremely expensive and our budgets generally prevent this type of activity. However, a plant growth facility similar to the one we are requesting, would have new technology and provide the capability to allow our winter wheat breeding scientist, for example, to grow three generations per year. This greatly speeds up the study and release of new winter wheat varieties which are so vital to the State of Montana.

Because of our diversity in teaching and research programs in the College of Agriculture, and the need for many different studies, a new facility should provide better conditions for doing different activities at the same time. In other words, wheat cannot be grown in the same room as alfalfa. Disease-free material cannot be grown in the same room with diseased material, etc. Remember I commented earlier that we had bugs and diseases moving from one plant bench to another when several different projects are conducted in the same large room. These types of problems can be prevented by a new facility with smaller plant growth rooms, each having its own controlled environment capable of growing different species under differing conditions.

The controlled environmental facility could also house several activities that are of a service nature. Because of inadequate safety standards in the current facility, the Montana Potato Improvement Association has had to relocate their laboratory tissue culture operations to another location on campus. The new facility will provide space for this activity to return to. They need laboratory and growth facilities to grow plant material from tissue cultures under virus-free conditions. This cannot be done outside.

We also grow out a large number of seed potatoes each spring to test for virus infection in seed stock that will be planted in Montana and later marketed as a seed source to the major potatoe growing states of Idaho, Oregon, and Washington.

The new facility that we are seeking with proper energy-efficient design can serve many teaching and research purposes that are simply not available in the current structure. The existing building was constructed in 1952. It does not have any laboratory space or support space to handle the teaching activities that are now needed. The building is in the poorest of physical condition. It is a safety hazard and much of the space cannot be used because of excessive maintenance costs.

Our teachers and researchers are faced with many problems in the current facility and major delays in productivity are commonplace due to the inadequate facilities. We are not asking for a building to just have more space and increase the amount of room we have. I believe the most critical issue here is that the current structure simply cannot accommodate the technology that is now being utilized by the scientists. I am sure there are many opportunities we have missed because of the current structure. Thank you for the opportunity to appear before your committee.

The majority of our most important problem weeds are exotic. That is to say they have been either accidently or otherwise introduced onto the North American continent from other locations. Among these are leafy spurge, spotted knapweed, St. Johnswort, Canada, bull, and musk thistles, dalmation toadflax, and many more. In their native lands, populations of these plants are maintained by natural means at levels considered to be tolerable to man, whereas in the new land, where they are uninhibited by those forces, such as parasites, predators, and diseases which evolved directly with them, these plants are able to reproduce and spread, being limited only by their own requirements, their reproductive potentials, and of course anything unfavorable in the new environment.

The present concept of biological control of exotic weeds suggests that man may be able to recreate much of that balance of nature that is normal in the native land of the exotic weed. To do this, those organisms which are responsible for suppressing the population of the weed must be located, studied, tested, and if possible, introduced and established in the new land.

We receive our biocontrol agents of exotic weeds through either Dr. Peter Harris of Agriculture Canada at Regina, or Dr. Lloyd Andres of the USDA's Beneficial Insect Introduction Laboratory at Albany, California. Through their foreign contacts, these two agencies research and locate potential biocontrol agents of our exotic weeds, determine the host range and specificity of each agent, and obtain some of the life history and habit information as it affects the target weed. Those agents which look promising are shipped to the North American laboratories where they are screened to eliminate parasites and diseases, and tested by exposing the agents to North American plant species related to the target weed, and to plants of economic and aesthetic value. Those agents which pass the tests are then increased in numbers to levels sufficient for field release.

Montana has received some of these biocontrol weed agents in the past. Early releases were just that. They were releases with limited monitoring, and little or no follow-up research to determine why an agent did or did not react as expected.

However, now the state of Montana and the Federal Government are attempting to rectify these problems. The State of Montana has created a permanent position for Dr. Jim Story who is obtaining, doing research on, and releasing biocontrol agents of exotic weeds within Montana. The State of Montana has also hired Dr. Robert Nowierski as program director of the biological control of weeds program of Montana. Dr. Nowierski is also founder and chairman of the Research Coordinating Committee which coordinates biological weed research between Montana weed scientists and those of the Federal Government. Also, several counties, such as Teton County, are also trying to take an active part in the research process.

The Federal Government, responding to suggestions from several Montana officials, is now attempting to establish a research entomologist position to work directly with both the USDA's Beneficial Insect Introduction Laboratory and Montana State weed scientists, a position which would help obtain, process, and make available many of the forthcoming bioweed agents.

But with all of this emphasis, there is still a major problem that confronts us. That is the lack of adequate research facilities within which to conduct much of the needed research. As I have attempted to impress upon you, there is a tremendous amount of work and research which preceeds any clearance for release of these agents, and much more work obtaining life history and habit information, increasing their numbers, and making these agents available before general field release. At present, one of the major bottlenecks to receiving many bioweed agents is in the limited sizes of Albany's quarantine facility, their staff, and their budget. Coupled with this, Montana has much less space and facilities available for bioweed research. In fact, greenhouse space that is available is not suitable for quarantine work, exposure testing, most life history and habit studies, or numbers increase of the agents. In addition, there is no way possible, under the present conditions, to guarantee that some of the insects would not escape and end up on an adjoining bench on someone elses project, or that insecticide spraying for aphids and white flies anywhere within the greenhouse would not eliminate all available biocontrol agents.

Therefore, the bottom line is this. The State of Montana and the Federal Government have worked closely the past years to obtain and release biocontrol agents of exotic weeds. But this has been at a very slow pace. In my conversations with Dr. Lloyd Andres, he stated that if there is space available in a new controlled environmental facility for biocontrol weed research, we could receive biocontrol agents immediately upon their receiving clearance for release within the United States. These agents would be few, and there numbers would have to be increased. In addition to this, Dr. Andres says that if a portion of the controlled environmental facility could be made into a quarantine facility, we could receive these agents much earlier, do much of the screening, the testing, and complete the work needed to lift quarantine and obtain their clearance release, in addition to the work of numbers increase and life history and habit study. This would save much time because of the plant species to be tested growing in Montana, and this work would compliment that of the Albany Laboratory and increase the number of biocontrol agents cleared each year. This combined cooperation can make Montana one of this nation's leading states in biological weed control research.

Testimony given on March 31, 1983, in Room 108, Capitol Building, Helena, Montana, in support of controlled environmental facility.

Norman E. Rees

NORMAN E. REES
Research Entomologist
USDA, ARS
Rangeland Insect Laboratory
Montana State University
Bozeman, Montana 59717

United States Department of Agriculture

Agricultural Research Service

Western Region

Biological Control of
Weeds Laboratory
1050 San Pablo Avenue
Albany, CA 94706

SUBJECT: Albany Biological Control of Weeds Laboratory and Cooperation with State and Federal Programs

TO: Norman E. Rees
Range Insect Control Research
USDA-ARS-WR
Montana State University
Bozeman, MT 59717

The objective of the Albany Laboratory is to enhance the finding, study, clearance, importation and release of weed-feeding insects and weed-infesting plant pathogens. Our main source of materials is the USDA Laboratory in Rome with whom we work closely and the CIBC Laboratory in Delemont. Promising organisms are final tested in our quarantine at Albany and observed to assure their freedom from parasites and disease. Once the beneficial organisms are cleared, we forward them to the states for release and reproduction.

The flow of new natural enemies depends on a balance of qualified personnel, travel and facilities, both federal and state. We are designing and planning to construct an expanded quarantine facility at Albany to service state and regional needs. This expanded facility will be availabe for use by state and federal cooperators alike, working on problems of natural interest. The new quarantine should increase our ability to clear insects and get them to the states.

One of the roadblocks to the smooth flow of organisms is limited ability to find and collect them in large numbers in the native foreign areas. In many cases they are just not abundant. In some instances these limited numbers can be overcome by mass rearing the weed-insects in domestic greenhouse and quarantine facilities. I know, I've discussed this matter with you in the past and have agreed to use Montana as one of the cooperating states to which initial supplies of the insects will be shipped for reproduction and increase, prior to release within Montana and to other states. Since we don't know the growth requirements of each of the insects, it is to Montana's advantage to have a facility designed to duplicate a variety of growth conditions. Greenhouse space will certainly be essential.

Also, a quarantine capability would seem to be advantageous. This would allow Montana to receive material directly from overseas and to clear shipments for (1) proper identification, (2) checking for and elimination of parasites and disease, and (3) limited host specificity screening studies to supplement the overseas work.

We have worked closely with Montana in the past and plan to continue this close relationship in the future. I will want to keep abreast of your program and will try to assist you however I can.

Lloyd

LLOYD A. ANDRES
Research Leader
Biological Control of
Weeds Research Unit

cc:
J. Vetterling
A. I. Morgan, Jr.

Exhibit 7
3-31-93

WIFE Women Involved in Farm Economics

NAME JO BRUNNER BILL NO.

ORGANIZATION WOMEN INVOLVED IN F.E. DATE MARCH 31

ADDRESS 563 3rd St, Helena

SUPPORT X OPPOSE AMEND

COMMENTS:

Mr. Chairman members of the committee, my name is Jo Brunner and I represent the members of the Women Involved in Farm Economics organization and the members of the Montaaa Agriculture Business Association here tonight.

Mr. Chairman, I am sure that you have heard enough facts and figures to convince you, if you are going to be convinced by facts and figures, that we need the greenhouse facility.

I'm not going to give you anymore. I'm going to tell you why I personal , and the organizations I represent here onight feel such a facility w be beneficial to our state in general and to agriculture in particular.

The need for escalation of research into methods of weed control in Montana is of greatest importance and cannot be considered a problem singular to agriculture, simply because we till the soil and pasture the ranges.

If you are not acquainted with the reproduction ability of a weed, you are extremely fortunate. weeds flourish with the barest minimum of moisture and nourishment; in cracks in the sidewalks and in dark alleys behind grocery stores. Railroads and highways help the spread of weeds; streams and rivers, winds--all contribute to our problems. And the overall cost to the state is tremendous---our attempst to kill the infestations, and often doing no more than holding our own, costs farmers and ranchers millions of dollars each year--dollars that could be well spent in other phases of our operations. we loose grazing units-we loose bushels per acre. We purchase very necessary chemical, and stil cannot do the the job to the extent needed to kill the weed. Our industries; the railroads, highway deaartments our public utilities--participate to some extent, but the majority is left up to the agricultural people and the associated programs.

Biological weed control is not a new concept in Montana. It has been around since the 1930's with limited application and success. Just within the last, comparitively few years, have we began to see the

"Hell has no fury like a woman scorned"

WIFE Women Involved In Farm Economics

benefits of bio control. Still we are barely seeing the tip of the iceberg/ We are impor~~ting insects~~, approved by European research centers, and they are ~~being~~ put through the necessary steps in our existing programs before they are put out in the fields. We have thousands of acres that are completey controlled by leafy spurge and potted knapweed. We have fields that we cannot get a, even close[illegible]nt kill of Canadian thistle. Some areas=--either cannot be chemically controlled because of accessability--- or the proximity to other foliage, or simply the tremendous cost and the only feasible way to go is biological control---if and when it is availablee And we do not have readily available a quarantine facility for our needs. We hope, with the new greenhouse facilitiy--toprovide that quaranting center, not only for Montana, but for our sister states.

Farmers and ranchers do spend a great deal of our own money fighting the weed battle and cooperating with chemical companies and research programs in test plots and thevarious methods of chemical application and with tillage control. Experiments in my own County, with the local Extension agent and the county weed board--to combine bio and chemical control are underway, but it is a slow process, and it is not enough! We do not have the financial means, the expertise, nor the climatic control necessary to speed up the process; to do the necessary research that will eventually give us theief from the spreading cancer.

Each season we cannot apply bio-control--and in every increasing applications and programs, we loose ground in the weed war--which means more land lost to noxious weeds, more cost to all of us. And we are already very, very far behind in this war.

The W.I.F.E. organization and the MEA organization request that you do allow the necessary funding for the greenhouse facility.

Thank you.

Exhibit 8
3-31-83

MONTANA FARM BUREAU FEDERATION

502 SOUTH 19th Dial 587-3153 BOZEMAN, MONTANA 59715

DATE ~~[illegible]~~ Mar 31, 83

NAME Pat Underwood BILL NUMBER Greenhouse

SUPPORT ✓ OPPOSE AMMEND

The Montana Farm Bureau is a strong supporter of the appropriation for the M.S.U. College of Agriculture greenhouse. We feel that as we enter into the Hi-Tech age, agriculture must follow suit. Construction of this facility will greatly enhance Montana agriculture's position in remaining a viable leader in our state's major industry. Our farmers and ranchers now on the land, and those to come on to the land, will greatly benefit from the job this facility can do. M.F.B.F. wishes to go on record in firm support of this important facility.

#9 Exhibit 9
3-31-83

OFFICE OF THE ASSOCIATED STUDENTS

ASMSU

03/31/83

To: The Long Range Building Subcommittee

Mr. Chairman, Committee Members,

My name is Dennis Wagner, and I represent the Associated Students of Montana State University. The students at MSU support the much-needed construction of the Controlled Environment Facility.

The existing facility lacks sufficient space for both classroom instruction and classroom research and experimentation. MSU currently has 27 courses which require GreenHouse space, and there simply is not room enough for students enrolled in those courses. Available space is often inadequate for experiments or research that requires variables of temperature, humidity, and lighting.

Speaking from my experience as a student, I would point to a class that I was enrolled in last spring quarter. One of the course requirements for Plant & Soil Science 201 is that each student conduct a research study concerning some aspect of the coursework. It was recommended that a "hands on", "learning by doing", GreenHouse experiment would be the best way to approach the project. However, due to limited space, only about 15% of the students were able to conduct an actual experiment - The other 85% of the class had to rejuvenate old research materials from the Library. There was very little practical and applied research experimentation - in a class designed to initiate just that kind of activity!

Students attending Land Grant Institutions in neighboring states have GreenHouses with two to three times the space available at Montana State University. Construction of the Controlled Environment Facility is a necessary and long-postponed investment in the quality of education, particularily agricultural education available to our students. The future of Montana, its students, and our major industry, agriculture, would benefit from this facility. We encourage your support.

MONTANA STATE UNIVERSITY, BOZEMAN MT, 59717 406-994-2933